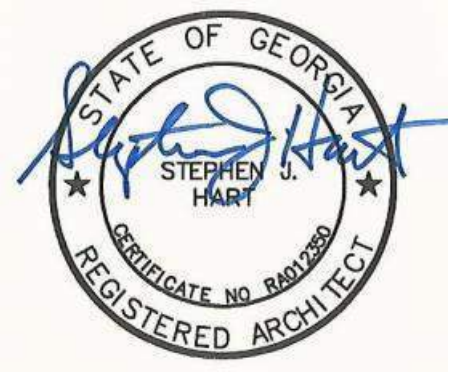
SOUTHERN GEORGIA
REGIONAL COMMISSION

A New Office Building for Southern Georgia Regional Commission

Valdosta, GA

100% Bid Set

February 4, 2019



Technical Specifications Prepared by
Ellis, Ricket and Associates, Architects

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1.1 GENERAL

A. Sealed proposals from qualified Contractors will be received by the Owner, Southern Georgia Regional Commission, in the Meeting Room , located at 327 West Savannah Avenue, Valdosta, Georgia until **2:00 PM** at the time legally prevailing in Valdosta, Georgia on **May 21, 2019** for the "**New Office Building for Southern Georgia Regional Commission"**. At the time and place noted above, the proposals will be publicly opened and read. A statement of bidder's qualifications is required with each proposal.

B. Bids in order to be considered must be accompanied by a bid bond payable to the Owner in an amount not less than 5% of the Base Bid. This bid security shall become payable to the Owner only if the bidder to whom award is made should fail to execute contract with the Owner and furnish bonds in accordance with the terms of his proposal within ten (l0) days after notification of award. No bid may be withdrawn for a period of thirty-five (35) days after date of opening. The contract, if awarded, will be on a lump sum basis. Facsimiles of Bid Bond and Bid Form will not be accepted.

C. The Contractor will deliver to the Owner a Performance Bond and Payment Bond in the amounts equal to l00% of the total contract price. Bonds will be executed by the Contractor, as principal, and a corporate surety authorized to do business in the State of Georgia. See Specifications for format of bonds.

D. Bidders are required to state the number of days required to achieve Substantial Completion of the Work. Consideration will be given to the stated time of completion when reviewing Bids submitted.

E. The Owner reserves the right to reject any or all bids, to waive technicalities and informalities, to retain discretion in adoption of alternates and to re-advertise.

1.2 PRE-BID CONFERENCE

A. There will be a pre-bid conference held on **May 2, 2019 at 10:00 a.m.** in the meeting room of the Owner's current facility, located at 327 West Savannah Avenue, Valdosta, Georgia, 31601. Contractors will have a chance to visit the project immediately after the conference. Attendance at this conference is **MANDATORY** for any Contractor intending to submit a bid on this project. Others may attend if they so desire.

1.3 BIDDING DOCUMENTS

A. Bidding Documents may be examined, by appointment, at the office of Ellis, Ricket and Associates, Architects, 2200 N. Patterson Street, Valdosta, Georgia 31602. Bidders may obtain Bidding Documents from Printlife Printing and Supplies, LLC, located at 1006 Williams Street, Valdosta, Georgia 31601 or by downloading from owner's website at www.sgrc.us/rfps.html.

1.4 EXAMINATION OF SITE

A. An examination of the site will take place immediately after the Pre-Bid Conference. Bidders and sub-bidders who need to revisit the site shall contact the following individual to arrange for examination of the site: **Chris Strom**
327 West Savannah Avenue
Valdosta, Georgia 31601

END OF SECTION

THE PROJECT AND THE PARTIES

2.01 TO:

A. Owner:
   1. Southern Georgia Regional Commission
   2. 327 West Savannah Avenue
   3. Valdosta, GA 31601

2.02 FOR:

A. New Office Building for Southern Georgia Regional Commission.

2.03 DATE: _____.

2.04 SUBMITTED BY:

A. Bidder's Full Name _____.
   1. Address _____.
   2. City, State, Zip_____.

2.05 OFFER

A. Having examined the Place of The Work and all matters referred to in the Instructions to Bidders and the Contract Documents prepared by Ellis, Ricket and Associates for the above mentioned project, we, the undersigned, hereby offer to enter into a Contract to perform the Work for the Sum of:

   1. Base Bid:

      _____dollars

      ($_____), in lawful money of the United States of America.

B. We have included the required security deposit as required by the Instruction to Bidders.

C. All applicable federal taxes are included and State of Georgia taxes are included in the Bid Sum.

2.06 ALTERNATES:

A. The following Alternate prices are hereby established and subject to Owner approval, and may be incorporated into the Contract Price at the time of the award. Said Alternate Prices shall remain firm and in effect for 30 days after Notice to Proceed is issued. The Owner reserves the right to exercise/accept any combination of independent Alternates and adjust the contract price accordingly.

   1. Alternate No. 1: N/A

      Delete the sum of:_____dollars

      $ _____.

2.07 ACCEPTANCE

A. This offer shall be open to acceptance and is irrevocable for thirty days from the bid closing date.

B. If this bid is accepted by Owner within the time period stated above, we will:
   1. Execute the Agreement within seven days of receipt of Notice of Award.
   2. Furnish the required bonds within seven days of receipt of Notice of Award.
   3. Commence work within seven days after written Notice to Proceed of this bid.

C. If this bid is accepted within the time stated, and we fail to commence the Work or we fail to provide the required Bond(s), the security deposit shall be forfeited as damages to Owner by reason of our failure, limited in amount to the lesser of the face value of the security deposit or the difference between this bid and the bid upon which a Contract is signed.

D. In the event our bid is not accepted within the time stated above, the required security deposit shall be returned to the undersigned, in accordance with the provisions of the Instructions to Bidders; unless a mutually satisfactory arrangement is made for its retention and validity for an extended period of time.

2.08 CONTRACT TIME

A. If this Bid is accepted, we will:

B. Complete the Work from Notice to Proceed:

   a. Date of Substantial Completion_____.

2.09 BID FORM SIGNATURE(S)

A. The Corporate Seal of

B. _____

C. (Bidder - print the full name of your firm)

D. was hereunto affixed in the presence of:

E. _____

F. (Authorized signing officer, Title)

G. (Seal)

H. _____

END OF BID FORM

FORM OF GENERAL CONDITIONS

1.01 AIA Document A201, General Conditions of the Contract for Construction, 2017 Edition, is the General Conditions between the Owner and Contractor. A copy of AIA Document A201 may be viewed or obtained at the Architect's office.

1.02 SUPPLEMENTARY CONDITIONS

1.03 These Supplementary Conditions amend and supplement AIA Document A201, General Conditions of the Contract for Construction, 2017 Edition. All provisions which are not so amended or supplemented remain in full force and effect.

1.04 The terms used in these Supplementary Conditions which are defined in the General Conditions have the meanings assigned to them in the General Conditions.

1.05 MODIFICATIONS TO GENERAL CONDITIONS - AIA DOCUMENT A201

1.06 ARTICLE 1.2 - CORRELATION AND INTENT OF THE CONTRACT DOCUMENTS

A. Add the following:
   1. "1.2.4 The following principles shall govern the settlement of disputes which may arise over discrepancies in the contract documents: (a) as between figures given on drawings and the scaled measurements, the figures shall govern; (b) as between large-scale drawings and small-scale drawings, the larger scale shall govern; (c) as between drawings and specifications, the requirements of the specifications shall govern; (d) as between the Form of Agreement and the specifications, the Form of Agreement shall govern. Discrepancies noted shall be reported to the Architect."

1.07 ARTICLE 3.4. LABOR AND MATERIALS

A. Add the following:
   1. “3.4.2 Add the following sentence: “Substitution Requests" prior to bidding are defined in sub-paragraphs 3.4.4 thru 3.4.10.”
   2. “3.4.4 When reference is made in the Contract Documents to trade names, brand names, or to the names of manufacturers, such references are made solely to indicate that products of that description may be furnished and are not intended to restrict competitive bidding. If it is desired to use products of trade or brand names or of manufacturer’s names which are different from those mentioned in the Contract Documents, application for the approval of the use of such products must reach the hands of the Architect at least five (5) days prior to the date set for the opening of bids. Applications shall be made on a Request for Substitutions Form including all changes required to the Contract Documents."
   3. “3.4.5 The latter provision is a restriction which applies only to the party making a submittal. Therefore, the aforesaid restriction does not inhibit the Architect from adding trade names, brand names or names of manufacturers by Addendum.”
   4. “3.4.6 The burden of proving acceptability of a proposed product for use in place of a product or products designated by trade name or names, brand name or names, or by the name or names of manufacturers in the Contract Documents rests on the party submitting the request for approval. The written application for approval of a proposed product must be accompanied by technical data which the party requesting approval desires to submit in support of his application. The Architect will give consideration to reports from reputable independent testing laboratories verified experience records showing the reputation of the proposed product with previous users, evidence of reputation of the manufacturer for prompt delivery, evidence of reputation of the manufacturer for efficiency in servicing its products, or any other written information that is helpful to the Architect.”
   5. “3.4.7 The application to the Architect for approval of a proposed product must be accompanied by a schedule setting forth in which respects the materials or equipment submitted for consideration differ from the materials or equipment designated in the Contract Documents. The degree of proof required for approval of a proposed product as acceptable for use in place of a named product or named products is that amount of proof

necessary to convince a reasonable person beyond all doubt."

6. "3.4.8 To be approved, a proposed product must also meet or exceed all express requirements of the Contract Documents. If the submittal is approved by the Architect an Addendum will be issued to all prospective bidders. Issuance of an Addendum is a representation to all bidders that the Architect in the exercise of his professional discretion established that the product submitted for approval is acceptable and meets or exceeds all express requirements. In the event a submittal shall have been rejected by the Architect and there shall have been a request for a conference as provided in this article pursuant to which conference the said submittal shall have been found to comply with the requirements of this article, a separate Addendum covering the said submittal will be issued prior to the opening of bids. In order for the Architect to prepare an Addendum intelligently, an application for approval of a product must be accompanied by a copy of the published recommendations of the manufacturer for the installation of the product together with a complete schedule of changes in the Contract Documents, if any, which must be made in other Work in order to permit the use and installation of the proposed product in accordance with the recommendations of the manufacturer of the product."
7. "3.4.9 Unless requests for approvals of other products have been received and approvals have been published by Addendum in accordance with the above procedure the successful bidder may furnish no products of any trade names, brand names, or manufacturers' names except those designated on the Contract Documents."
8. "3.4.10 Any party who alleges that rejection of a submittal is the result of bias, prejudice, caprice, or error on the part of the Architect may request a conference with a representative of the Owner, provided: That the request for said conference, submitted in writing, shall have reached the Owner at least five days prior to the date set for the opening of bids, time being of the essence."

1.08 ARTICLE 3.12 - SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

A. "Add requirements of Section 01 3300 Submittals".

1.09 ARTICLE 3.15 - CLEANING UP

A. "Add requirements of Section 01 7400 Final Cleaning."

1.10 ARTICLE 5 - SUBCONTRACTORS

A. Add the following:
   1. "5.1.3 It is the duty of the Contractor to engage Subcontractors who are reputable, skilled, competent in their trades and thoroughly familiar with applicable codes. The failure of a Subcontractor to perform shall not be asserted by the Contractor as an excuse or defense for any reason from or noncompliance with the requirements of the Contract; the Contractor shall not be entitled to an extension of time because of failure of a Subcontractor to perform unless said failure was a result of some cause for which the Contractor shall have requested and received an extension of time under the terms of Article 8 of the General Conditions."

1.11 ARTICLE 7 - CHANGES IN THE WORK

A. Add the following:
   1. " 7.2.2 The Contractor hereby expressly agrees that the Contractor shall have no right to a claim for damages, extended overhead, or extension of time due to cumulative effect of Change Orders because of changes made by the Owner. All such changes shall be performed under the conditions of the original Contract except that any claim for extension of time caused thereby shall be adjusted at the time of signing of the Change Order."

1.12 ARTICLE 7.3 CONSTRUCTION CHANGE DIRECTIVES

A. Delete paragraphs 7.3.3, 7.3.3.1, 7.3.3.2, 7.3.3.3, and 7.3.3.4, and substitute the following:
   1. "7.3.3 The cost to the Owner resulting from a change in the Work shall be determined in one or more of the following ways:

2. 7.3.3.1. By mutual acceptance of a lump sum: The Contractor shall furnish to the Architect, for consideration by the Owner, a proposal in writing, within ten working days of receipt of the Architect's letter of instruction, containing a detailed breakdown of the material and labor to be furnished in connection with such extra Work, together with a detailed estimate of the cost of such material and labor to the Contractor. The proposal shall also contain the lump sum fee for which the Contractor will undertake to perform the extra Work. All backup material and breakdown submitted by the Contractor shall be typewritten, and all items shall be explicitly described. Upon request by the Architect, all backup and material shall be supported by letters from manufacturers, suppliers, fabricators, producers, etc.
3. 7.3.3.2. By Unit Prices stated in the Contract Documents or subsequently agreed upon: Such Unit Prices shall be deemed to cover completed Work in place and shall include all labor, materials, equipment, supervision, taxes, insurance, overhead, fee, and etc. The Contractor shall, within ten working days from the date of receipt of letter of instruction, furnish to the Architect for his approval a comprehensive detailed breakdown of all materials and labor with Unit Prices arranged in a form as approved by the Architect. The quantities against which said Unit Prices are to apply shall be measured by actual quantities, irrespective of trade customs to the contrary, and it is understood that Unit Prices stated in the Contract are so based. Any dispute or question concerning quantities shall be determined by the Architect.
4. 7.3.3.3.As provided in subparagraph 7.3.7."

B. Delete paragraphs 7.3.7, and substitute the following:
   1. "7.3.7 If Owner and Contractor cannot agree on the lump sum proposals or Unit Prices, costs of changes will be based on the actual cost of labor and material to the Contractor, plus overhead and profit, but shall not exceed the lowest sum for which the Contractor offered to perform the extra Work in negotiating for a lump sum agreement under 7.3.3.1 above. Overhead and Profit shall be as follows:
      a. The Contractor's overhead and profit shall not exceed 15% of his net additional allowable expenditures, if any, for changes, when Work is performed with his own forces.
      b. If the Work is to be performed by a Subcontractor, the actual cost of labor and materials to the Contractor shall be measured by the actual cost of labor and materials to the Subcontractor, plus 15% to cover the Subcontractor's overhead and profit, and the Contractor shall be entitled to an additional 5% of the Subcontractor's total sum to cover the Contractor's overhead and profit.
   2. 7.3.7.1 In the event that the Contractor fails to submit a proposal as provided in 7.3.3.1 above, or a breakdown as provided in 7.3.3.2 above, whichever is applicable, within the time period provided therein, then it shall be understood and agreed that the Work to be performed is not deemed by the Contractor to entitle him to extra compensation, and the Contractor shall perform said Work without any extra compensation or time extension.
   3. 7.3.7.2 In the event that the Change Directive by the Owner constitutes a reduction in the Work for which the Owner is entitled to a deduction from the Contract Sum, the value of such deduction to be credited to the Owner shall be determined as follows:
      a. By Unit Prices named in the Contract, if applicable.
      b. By agreement between the Owner and the Contractor for a lump sum.
   4. 7.3.7.3 If Owner and Contractor cannot agree by the determination of the Architect who, in making such a determination, shall estimate the cost of labor and materials saved to the Contractor, plus a reasonable sum to be deducted as an allowance covering overhead and profit.
   5. 7.3.7.4 The actual cost of labor and material shall include items of labor or materials, the use of heavy construction equipment, all such items of cost as public liability and worker's compensation insurance, social security and old age and unemployment insurance, and (in cases where there is an extension of time) pro rata expenditures of time of foremen employed in the direct superintendence of productive labor in execution of changes. No wages of a foreman shall be allowable for a change carried on concurrently with Contract Work unless the claim includes a demand for extension of time caused by the change.

6. 7.3.7.5 All expenditures not specifically included in the paragraphs above shall be considered as Contractor's overhead, including, but not limited to, insurance other than that mentioned above, and premiums, supervision, travels (meals, transportation, and lodging) superintendence (except pro rata time of foremen mentioned above), timekeepers, clerks, watchmen, hand tools, small tools, incidental job burdens, engineering, drafting, and all office expense."

1.13 ARTICLE 8 - TIME

A. Delete paragraph 8.1.2 and substitute the following:
   1. "8.1.2 The date of commencement of the Work is the date established in a Notice to Proceed. The Notice to Proceed will be issued by the Architect after the Contract requirements have been met by the Contractor for submission of bonds and insurance certificates. No physical Work shall be done on the site until the Notice to Proceed has been issued."

1.14 ARTICLE 9.10 - FINAL COMPLETION AND FINAL PAYMENT

A. Add the following:
   1. "9.10.6 Before acceptance of Work, the Contractor will be required to furnish Statutory Affidavits in duplicate in exact form as shown below following this section (Subcontractors likewise submit this affidavit in duplicate). See below.

STATUTORY AFFIDAVIT

STATE OF _____COUNTYOF_____

FROM: _____
(Contractor)

TO: _____
(Owner)

RE: Contract entered into the_____day of_____20_____, between the above mentioned parties for the construction of a

_____ at _____

_____

KNOW ALL MEN BY THESE PRESENTS:

1. The undersigned hereby certifies that all work required under the above contract has been performed in accordance with the terms thereof, that all material men, subcontractors, mechanics, and laborers have been paid and satisfied in full and that there are no outstanding claims of any character arising out of the performance of the contract which have not been paid and satisfied in full.

2. The undersigned further certifies that to the best of his knowledge and belief there are no unsatisfied claims for damages resulting from injury or death to any employees, subcontractors, or the public at large arising out of the performance of the contract, or any suits or claims for any other damage of any kind, nature, or description which might constitute a lien upon the property of the Owner.

3. The undersigned makes this affidavit as provided by law and for the purpose of receiving final payment in full settlement of all claims arising under or by virtue of the contract, and acceptance of such payment is acknowledged as a release of the Owner from any and all claims arising under or by virtue of the contract.

IN WITNESS THEREOF, the undersigned has signed and sealed this instrument this____ day of_____, 20__.

Personally appeared before the undersigned, _____

and_____ who after being duly sworn, depose(s) and say(s)that the facts stated in the above affidavit are true.

_____
(Notary Public)

This_____day of_____ , 20__

My commission expires_____.

1.15 ARTICLE 11.1 – INSURANCE AND BONDS

A. Add the following:
   1. "11.1.5 The following specific insurance shall be carried by the Contractor:
      a. Workmen's Compensation Coverage meeting the requirements of the State in which the work is performed.
      b. Comprehensive General Liability (including automobiles) minimum limits of not less than $1,000,000 combined single limits."
   2. “11.1.6 Performance Bond and Labor and Material Payment Bond each shall be provided by the Contractor for the full amount (100%) of the Contract and shall be delivered to the Architect after the Contract is fully executed and prior to commencement of the Work. Telefax delivery of Bonds is not acceptable. Notice to Proceed will not be issued until the above Bonds have been received." Provide Performance Bond and Material Payment Bond on AIA document A312.

1.16 ARTICLE 11.2 – Owner’s Insurance

A. Change the following:

   1. Change Article title to “**Contractor’s Insurance”**

B. Delete the following:

   1. Delete Paragraphs “11.2.1, 11.2.2, and 11.2.3.”

C. Insert the following:

   1. “11.2.1 The Contractor shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Contractor shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located.

   2. “11.2.2 "The Contractor shall purchase and maintain Property Insurance upon the entire Work at the site to the full insurable value thereof. This insurance shall be the "All Risk" form. Such insurance shall be in a company or companies against which the Owner has no reasonable objection."

   3. “11.2.3 “If property insurance is written with stipulated amounts deductible under the terms of this policy, the Contractor shall pay the difference attributable to deductions in any payments made by the insurance carrier on claims paid by this insurance."

   4. "11.3.4 The Contractor shall file the original and one certified copy of all policies with the Owner and the Architect before exposure to loss may occur. If the Owner is damaged by the failure of the Contractor to maintain such insurance the Contractor shall bear all reasonable costs properly attributable thereto."

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Documentation of changes to Contract Sum and Contract Time.

1.02 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.

1.03 SCHEDULE OF ALTERNATES

1. N/A
2. N/A

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

PART 1 GENERAL

1.01 SUMMARY

A. Section includes:
   1. Administrative and procedural requirements necessary to prepare and process Applications for Payment. Refer to Owner/Contractor Agreement for additional information regarding Payment Procedures.

1.02 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.

   1. Coordinate line items in the schedule of values with other required administrative forms and schedules, including the following:

      a. Application for Payment forms with continuation sheets.
      b. Submittal schedule.
      c. Items required to be indicated as separate activities in Contractor's construction schedule.

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

   1. Identification: Include the following Project identification on the schedule of values:
      a. Project name and location.
      b. Name of Architect.
      c. Architect's project number.
      d. Contractor's name and address.
      e. Date of submittal.

   2. Arrange the schedule of values in tabular form with separate columns to indicate the following for each item listed:
      a. Related Specification Section or Division.
      b. Description of the Work.
      c. Name of subcontractor.
      d. Name of manufacturer or fabricator.
      e. Name of supplier.
      f. Change Orders (numbers) that affect value.
      g. Dollar value of the following, as a percentage of the Contract Sum to nearest one hundredth percent, adjusted to total 100 percent.
         1) Labor.
         2) Materials.
         3) Equipment.

   3. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with Project Manual table of contents. Provide multiple line items for principal subcontract amounts in excess of five percent of the Contract Sum.

   4. Round amounts to nearest whole dollar; total shall equal the Contract Sum.

   5. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.

6. 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.

7. Each item in the schedule of values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.

1.03 APPLICATIONS FOR PAYMENT

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

1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.

B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction work covered by each Application for Payment is the period indicated in the Agreement.

C. Application for Payment Forms: Use forms acceptable to Architect and Owner for Applications for Payment. Submit forms for approval with initial submittal of schedule of values.

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

1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
4. Indicate separate amounts for work being carried out under Owner-requested project acceleration.

E. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed.

1. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
2. Provide summary documentation for stored materials indicating the following:
   a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
   b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
   c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.

F. 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. Products list (preliminary if not final).

5. Schedule of unit prices, if applicable.
6. Submittal schedule (preliminary if not final).
7. List of Contractor's staff assignments.
8. List of Contractor's principal consultants.
9. Copies of building permits.
10. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
11. Initial progress report.
12. Report of preconstruction conference.
13. Certificates of insurance and insurance policies.
14. Performance and payment bonds.
15. Data needed to acquire Owner's insurance.

G. Application for Payment at Substantial Completion: After Architect issues 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 materially complete and a statement showing an accounting of changes to the Contract Sum.
2. This application shall reflect Certificate(s) of Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

H. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:

1. Evidence of completion of Project closeout requirements.
2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
3. Updated final statement, accounting for final changes to the Contract Sum.
4. Evidence that claims have been settled.
5. 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

PART 1 GENERAL

1.01 SUBMITTALS

A. The Contractor shall review, approve and submit to the Architect shop drawings, product data, samples and similar submittals for the specific items required by the technical sections of the specifications with reasonable promptness and in such sequence as to cause no delay in the work on in the activities of the Owner or of separate contractors.
   1. Shop drawings and samples submitted for items for which shop drawings and samples were not specified to be submitted will not be reviewed by the Architect and will not be returned to the Contractor.
   2. Shop drawings and samples shall be accompanied by a transmittal indicating the section number and paragraph, or drawing number, to which the submittal refers.
   3. Submittals received by FAX will not be accepted.

B. Within 50 days after Notice to Proceed, the Contractor shall provide a tabulated list of power wiring requirements for all equipment proposed to be furnished under Divisions 11 through 23 of this Contract. Tabulated list of power requirements shall include horsepower, amperage, voltage, phase of service and KW requirements. Submit list of power wiring requirements to the Architect and to all trades affected.

1.02 SHOP DRAWINGS

A. **Copyrighted Architectural Drawings will not be supplied for the production of Shop Drawings under any circumstances.**

B. Shop drawings include fabrication, erection and setting drawings, manufacturer's standard drawings, diagrams, schedules, descriptive literature, catalogs, brochures, performance and test data, diagrams, cuts, and all other descriptive data.

C. Submit all required shop drawings in PDF format.

   1. Along with PDF shop drawing, provide an additional (1) hard copy (81/2”x11”) of the following sections:

      a. 06 4023 Architectural Woodwork.
      b. 08 1113 Hollow Metal Doors and Frames.
      c. 08 7100 Door Hardware and schedule.

   2. Refer to all mechanical, electrical, plumbing, and fire protection specification sections for required formatting of related shop drawings.

D. The Contractor shall prepare a schedule for submission of shop drawings indicating dates of submissions by the Contractor and the dates approval by the Architect should be received. Dates shall recognize time required for examination and approval (both by the Architect and his consultants for mechanical, and electrical work); resubmission if required; and shall create no delay in ordering, fabrication, and construction. The schedule shall be consistent with the progress schedule. The shop drawing submission schedule may be subject to change upon review by the Architect and Contractor in accordance with the progress of the work.

E. Shop drawing submittals shall indicate the methods and materials by which contract requirements are proposed to be satisfied. Any changes in dimensions, details, materials or other requirements, differing from those shown on the Contract Drawings shall be "flagged" on the shop drawings and such shop drawings accompanied by a written request for authorization and reason for requested change.

F. The Contractor shall review shop drawings prior to submission to the Architect to ensure that the submittal is in compliance with the requirements of the Contract Documents in all aspects. Do not indicate "APPROVED AS NOTED" unless specific change or changes are indicated on

the shop drawings.

G. The Architect will review shop drawings only for conformance with the design concept and for compliance with the information given in the Contract Documents. Action by the Architect will consist of the following:

1. "**No Exceptions Taken**" - No changes required.
2. "**Make Corrections Noted**" - Minor corrections noted; do not resubmit.
3. "**Submit Specified Item**" - Item submitted is not specified; submit item listed in the specifications.
4. "**Revise and Resubmit**" - Multiple corrections required, beyond the responsibility of Architect to note; correct and resubmit.
5. "**Rejected**" - Does not conform to Contract Documents; resubmit.

H. Perform no work for which Shop Drawings are specified unless such drawings are marked "NO EXCEPTIONS TAKEN" or "MAKE CORRECTIONS NOTED".

1.03 SAMPLES

A. Submit samples in duplicate. Each sample shall be labeled with the project name, Contractor's name, and complete identification of the material and accompanied by a letter of transmittal giving full information regarding the sample and the project for which it is submitted. Approved samples will be retained by the Architect. Unapproved samples will be returned to the Contractor upon request.

B. Sample areas or panels at the site shall be prepared, and the Architect given timely notice for inspection. Protect approved field samples and use as standard of quality for the project.

C. Materials used on the project shall match approved samples in all respects. Do not use unapproved materials on the project.

1.04 SUBMITTALS FOR PROJECT CLOSEOUT

A. The General Contractor shall perform his own preliminary and final inspections of the complete project and shall perform the Work required as a result of those inspections prior to requesting the Architect and Owner to perform a final inspection. Two copies of the Contractor's final inspection and the items shall be submitted to the Architect with the written request for the final inspection. The Contractor's written request for final inspection shall be submitted a minimum of seven days prior to the date requested for the final inspection.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. References and standards.

B. Quality assurance submittals.

C. Mock-ups.

D. Control of installation.

E. Tolerances.

F. Manufacturers' field services.

1.02 REFERENCES

A. ASTM C 1021 - Standard Practice for Laboratories Engaged in Testing of Building Sealants; 2001.

B. ASTM C 1077 - Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation; 2005b.

C. ASTM C 1093 - Standard Practice for Accreditation of Testing Agencies for Unit Masonry; 2006.

D. ASTM D 3740 - Standard Practice for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction; 2004a.

E. ASTM E 329 - Standard Specification for Agencies Engaged Construction Inspection and/or Testing; 2005b.

F. ASTM E 543 - Standard Practice for Agencies Performing Nondestructive Testing; 2004.

1.03 SUBMITTALS

A. Testing Agency Qualifications:
   1. Prior to start of Work, Testing Agency will submit agency name, address, and telephone number, and names of full time registered Engineer and responsible officer.
   2. Submit copy of report of laboratory facilities inspection made by testing agency during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection. Testing Agencies include:
      a. NIST Construction Materials Reference Laboratory.
      b. AASHTO Accreditation Program (AAP).
      c. AASHTO R18 or ISO/IEC 1725 accreditation.
      d. American Association for Laboratory Accreditation (A2LA).
      e. International Accreditation Service.
      f. Construction Materials Engineering Council.

B. Design Data: Submit for Architect's knowledge as contract administrator for information for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents.

C. Test Reports: After each test/inspection, promptly submit 5 copies of report to Architect, Structural Engineer, Owner and Contractor.

   1. Include:
      a. Date issued.
      b. Project title and number.
      c. Name of inspector.
      d. Date and time of sampling or inspection.

e. Identification of product and specifications section.
f. Location in the Project.
g. Type of test/inspection.
h. Date of test/inspection.
i. Results of test/inspection.
j. Conformance with Contract Documents.
k. When requested by Architect, provide interpretation of results.

2. Test reports are submitted to Architect for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents.

D. Certificates: When specified in individual specification sections, submit certification by the manufacturer and or installation/application subcontractor to Architect, in quantities specified for Product Data.

1. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
2. Certificates may be recent or previous test results on material or product, but must be acceptable to Architect.

E. 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.

F. Manufacturer's Field Reports: Submit reports for Architect's benefit as contract administrator.

1. Submit report in duplicate within 30 days of observation to Architect for information.
2. Submit for information for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents.

G. Erection Drawings: Submit drawings for Architect's benefit as contract administrator.

1. Submit for information for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents.
2. Data indicating inappropriate or unacceptable Work may be subject to action by Architect or Owner.

1.04 REFERENCES AND STANDARDS

A. For products and workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. Conform to reference standard of date of issue current on date of Contract Documents, except where a specific date is established by applicable code.

C. Obtain copies of standards where required by product specification sections.

D. Maintain copy at project site during submittals, planning, and progress of the specific work, until Material Completion.

E. Should specified reference standards conflict with Contract Documents, request clarification from Architect before proceeding.

F. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of Architect shall be altered from the Contract Documents by mention or inference otherwise in any reference document.

1.05 TESTING AND INSPECTION AGENCIES

A. Laboratories for testing services shall be selected by, engaged by, and responsible to the Architect.

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

C. Employed Agency:

1. Testing agency: Comply with requirements of ASTM E 329, ASTM E 543, ASTM C 1021, ASTM C 1077, and ASTM C 1093.
2. Inspection agency: Comply with requirements of ASTM D3740 and ASTM E329.
3. Laboratory: Authorized to operate in Georgia .
4. Laboratory Staff: Maintain a full time state of Georgia registered Engineer on staff to review services.
5. Testing Equipment: Calibrated at reasonable intervals either by NIST or using an NIST established Measurement Assurance Program, under a laboratory measurement quality assurance program.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 CONTROL OF INSTALLATION

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

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

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

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

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

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

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

3.02 MOCK-UPS

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

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

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

D. Where mock-up has been accepted by Architect and is specified in product specification sections to be removed, remove mock-up and clear area when directed to do so.

3.03 TOLERANCES

A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.

B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Architect before proceeding.

C. Adjust products to appropriate dimensions; position before securing products in place.

3.04 TESTING AND INSPECTION

A. See individual specification sections and the International Building Code for testing and inspection required. Special Inspections required are listed in the attached Schedule of Special Inspection Services.

B. Testing Agency Duties:
   1. Test samples of mixes submitted by the Contractor .
   2. Provide qualified personnel at site. Cooperate with Architect and in performance of services.
   3. Perform specified sampling and testing of products in accordance with specified standards.
   4. Ascertain compliance of materials and mixes with requirements of Contract Documents.
   5. Promptly notify Architect of observed irregularities or non-conformance of Work or products.
   6. Perform additional tests and inspections required by Architect and Owner.
   7. Attend preconstruction meetings and progress meetings.
   8. Submit reports of all tests/inspections specified.

C. 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 Architect or Contractor.
   4. Agency has no authority to stop the Work.

D. Contractor's Responsibilities:
   1. Deliver to agency at designated location, adequate samples of materials proposed to be used which require testing, along with proposed mix designs.
   2. Cooperate with laboratory personnel, and provide access to the Work.
   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 Architect 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 beyond specified requirements.
   6. Arrange with Architect and pay for additional samples, tests, and inspections required beyond specified requirements.

E. Re-testing required because of non-conformance to specified requirements shall be performed by the same agency on instructions by Architect. Payment for re testing will be charged to the Contractor by deducting testing charges from the Contract Sum.

3.05 MANUFACTURERS' FIELD SERVICES

A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust and balance of equipment as applicable, and to initiate instructions when necessary.

B. Submit qualifications of observer to Architect 30 days in advance of required observations.

1. Observer subject to approval of Architect.

C. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

3.06 DEFECT ASSESSMENT

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

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

END OF SECTION

PART 1 GENERAL

1.01 SANITARY FACILITIES

A. Upon commencing work, provide temporary sanitary toilet facilities for use of workmen during progress of Work. Toilet facilities shall be chemical type and shall be maintained on a regular basis. Provide temporary water for sanitation. Keep temporary toilets in a clean condition. Prior to final inspection, remove installation from site.

B. Do not permit use of new toilet facilities at the building by workmen on the site.

1.02 BREAK AREA ON TOBACCO FREE CAMPUS

A. The General Contractor may provide a protected designated break area for eating and drinking at any time during progress of Work. An area, or areas, outside the building will be available for eating and drinking when gypsum wallboard, and related finishes installation, has started inside the building. Signs shall be provided as follows: **NO SMOKING OR USE OF TOBACCO PRODUCTS WILL BE ALLOWED**. The Contractor shall remove any person or persons from the Job Site for non-compliance with these rules.

1.03 JOB PHONE

A. Maintain a telephone service on the premises during the period of construction.

1.04 JOB OFFICES

A. During progress of the work, the Contractor shall maintain one weather- tight temporary office at the site of the work for the use of the Contractor. Offices shall be equipped with a telephone. At least one copy of the following documents shall be kept in the Contractor's temporary office:
   1. Contract Drawings.
   2. Specifications.
   3. Addenda.
   4. Executed Change Orders.
   5. Approved Shop Drawings and Submittals.
   6. Fire Marshal Approved Documents for Fire Marshal use ONLY.

B. The above documents shall be maintained in a legible condition and stored in a systematic fashion. Notation shall be made in red ink on one set of drawings and specifications calling attention to alterations made by addenda and change orders.

1.05 STAGING AREA

A. See drawings (if included) for areas designated for use as a staging area. If additional space is required, the Contractor shall submit a request to the Architect. If staging area drawings are not included, the contractor shall coordinate staging area with construction area to avoid any potential conflicts.

1.06 TEMPORARY FENCING

A. Provide temporary fencing at the perimeter of the Staging area indicated on the drawings, consisting of steel posts 10' o.c., and formed wire fencing not less than 6' high. Install fencing at beginning of construction after preliminary earthwork has been completed, and maintain until beginning of finish grading. Provide gates for access to area where indicated, capable of being padlocked by the Contractor.

B. Do not permit location of temporary offices, operation of equipment, private automobile parking, storage or any functions beyond the limits of the staging area.

C. Remove temporary fencing prior to final grading work on the site.

1.07 FIRE EXTINGUISHERS

A. Provide Type A fire extinguishers at locations in the building of low-potential for either electrical or grease-oil-flammable liquids fires; provide Type ABC dry chemical extinguishers at other locations on the building and site. Locate fire extinguishers where they will be reasonably effective in extinguishing fires during their early stages. Post warning signs and instructions at extinguisher locations.

1.08 TEMPORARY HEAT

A. Provide temporary heat to protect all work and materials from damage due to dampness or cold at no additional cost to the Owner. Fuel, equipment and heating shall not constitute a non-insurable fire hazard to the building. Temporary heating units shall neither prematurely dry any portion of the building nor shall they direct heat continuously onto any surfaces of the structure. The permanent building heating system shall not be used for temporary heating unless specifically authorized by the Architect. Remove temporary heating facilities when no longer required by weather conditions.

1.09 PEST CONTROL

A. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using environmentally safe materials.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

PART 1 GENERAL

1.01 SUMMARY

A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.

1.02 DEFINITIONS

A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.
2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
3. Comparable Product: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

B. Basis-of-Design Product Specification: A specification in which a specific manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specification.

1.03 SUBMITTALS

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

1. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Architect will notify Contractor of approval or rejection of proposed comparable product request within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.

a. Form of Approval: As specified in Section 013300 "Submittal Procedures."
b. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.

B. Basis-of-Design Product Specification Submittal: Comply with requirements in Section 013300 "Submittal Procedures." Show compliance with requirements.

1.04 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.

1.05 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.

B. Delivery and Handling:

1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.

C. Storage:

1. Store products to allow for inspection and measurement of quantity or counting of units.
2. Store materials in a manner that will not endanger Project structure.
3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
6. Protect stored products from damage and liquids from freezing.

1.06 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.

1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
2. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
3. Refer to other Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Section 017700 "Closeout Procedures."

PART 2 PRODUCTS

2.01 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
   1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
   2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
   3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
   4. Where products are accompanied by the term "as selected," Architect will make selection.
   5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.

B. Product Selection Procedures:
   1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
   2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
   3. Products:
      a. Restricted List: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered unless otherwise indicated.
      b. Non-restricted List: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product.
   4. Manufacturers:
      a. Restricted List: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will be considered unless otherwise indicated.
      b. Non-restricted List: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed manufacturer, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed manufacturer's product.
   5. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.

C. Visual Matching Specification: Where Specifications require "match Architect's sample", provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.

1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 012500 "Substitution Procedures" for proposal of product.

D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.02 COMPARABLE PRODUCTS

A. Conditions for Consideration: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:
   1. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
   2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
   3. Evidence that proposed product provides specified warranty.
   4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
   5. Samples, if requested.

PART 3 EXECUTION - NOT USED

END OF SECTION

PART 1 GENERAL

1.01 SUMMARY

A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:

1. Construction layout.
2. Field engineering and surveying.
3. Installation of the Work.
4. Cutting and patching.
5. Coordination of Owner-installed products.
6. Progress cleaning.
7. Starting and adjusting.
8. Protection of installed construction.

1.02 QUALITY ASSURANCE

A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.

B. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.
   1. Structural Elements: When cutting and patching structural elements, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural element during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.
   2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.
   3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.
   4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

PART 2 PRODUCTS

2.01 MATERIALS

A. General: Comply with requirements specified in other Sections.

   1. For projects requiring compliance with sustainable design and construction practices and procedures, use products for patching that comply with sustainable design requirements.

B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

   1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of

in-place materials.

PART 3 EXECUTION

3.01 EXAMINATION

A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, and other construction affecting the Work.

1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services, and other utilities.
2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.02 PREPARATION

A. Existing Utility Information: Furnish information to local utility that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to Architect.

3.03 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect promptly.

B. General: Engage a land surveyor to lay out the Work using accepted surveying practices.

1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
2. Establish limits on use of Project site.
3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
4. Inform installers of lines and levels to which they must comply.
5. Check the location, level and plumb, of every major element as the Work progresses.
6. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
7. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.

C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.

D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.

3.04 FIELD ENGINEERING

A. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.

B. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.

1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.

C. Certified Survey: On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and site work.

D. Final Property Survey: Engage a land surveyor to prepare a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by land surveyor, that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey.

1. Recording: At Substantial Completion, have the final property survey recorded by or with authorities having jurisdiction as the official "property survey."

3.05 INSTALLATION

A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
1. Make vertical work plumb and make horizontal work level.
2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.

F. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.

G. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.
   1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
   2. Allow for building movement, including thermal expansion and contraction.
   3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

I. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

J. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.06 CUTTING AND PATCHING

A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
   1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.

C. Temporary Support: Provide temporary support of work to be cut.

D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

E. Adjacent Occupied Areas: Avoid interference with use of adjoining areas or interruption of free

passage to adjoining areas.

F. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
   1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
   2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
   3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
   4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
   5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
   6. Proceed with patching after construction operations requiring cutting are complete.

G. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.
   1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
   2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.
   3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
   4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
   5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.

H. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.07 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.
   1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
   2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F (27 deg C).
   3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

B. Site: Maintain Project site free of waste materials and debris.

C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.

1. Remove liquid spills promptly.
2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways.

H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

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

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

3.08 STARTING AND ADJUSTING

A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

B. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.

C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Manufacturer's Field Service: Comply with qualification requirements in Section 014000 "Quality Requirements"

3.09 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Comply with manufacturer's written instructions for temperature and relative humidity.

END OF SECTION

PART 1 GENERAL

1.01 CLEANING

A. Remove all tags and non-permanent labels from fixtures and materials. Leave all fixtures clean.

B. Remove excess mastic and trade marks from laminated plastic.

C. Clean grout, paint, marks, packing grease, dirt, and foreign matter from aluminum and hardware.

D. Clean and rinse resilient flooring. After the floor is dry, machine buff to a high gloss.

E. Clean ceramic and quarry tile of all excess grout and foreign matter. Replace discolored grout or tile.

F. Clean glass inside and outside. Remove all foreign matter including water marks.

G. Vacuum carpets and remove soil spots.

H. Dust all interiors, including shelves, face of doors, and areas where dust has accumulated.

I. Clean exterior walks and Portland cement concrete paving of all dirt, mortar, and stains from construction materials.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 CONSTRUCTION DEBRIS

A. Remove construction debris and excess materials from the site.

END OF SECTION

PART 1 GENERAL

1.01 SUMMARY

A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
   1. Substantial Completion procedures.
   2. Final completion procedures.
   3. Warranties.
   4. Final cleaning.
   5. Repair of the Work.

B. Related Requirements:
   1. Section 01 7823 "Operation and Maintenance Data" for operation and maintenance manual requirements.
   2. Section 01 7839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
   3. Section 01 7900 "Demonstration and Training" for requirements for instructing Owner's personnel.

1.02 SUBMITTALS

A. Product Data: For cleaning agents.

B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.

C. Certified List of Incomplete Items: Final submittal at Final Completion.

1.03 CLOSEOUT SUBMITTALS

A. Certificates of Release: From authorities having jurisdiction.

B. Certificate of Insurance: For continuing coverage.

C. Field Report: For pest control inspection.

1.04 MAINTENANCE MATERIAL SUBMITTALS

A. Schedule of Maintenance Material Items: For maintenance material submittal items specified in other Sections.

1.05 SUBSTANTIAL COMPLETION PROCEDURES

A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.

B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

   1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
   2. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.

3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Architect. Label with manufacturer's name and model number where applicable.
   a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Architect’s signature for receipt of submittals.
5. Submit test/adjust/balance records.
6. Submit sustainable design submittals not previously submitted.
7. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.

C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Advise Owner of pending insurance changeover requirements.
2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
3. Complete startup and testing of systems and equipment.
4. Perform preventive maintenance on equipment used prior to Substantial Completion.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 017900 "Demonstration and Training."
6. Advise Owner of changeover in heat and other utilities.
7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
9. Complete final cleaning requirements, including touchup painting.
10. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.

1. Re-inspection: Request re-inspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for final completion.

1.06 FINAL COMPLETION PROCEDURES

A. Preliminary Procedures: Before requesting final inspection for determining final completion, complete the following:

1. Submit a final Application for Payment according to Section 01 2900 "Payment Procedures."
2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed

and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.

3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Submit pest-control final inspection report and warranty.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.

B. Inspection: Submit a written request for final inspection to determine acceptance. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1. Re-inspection: Request re-inspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.07 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

1. Organize list of spaces in sequential order, starting with exterior areas first.
2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
3. Submit list of incomplete items in the following format:
   a. MS Excel electronic file. Architect will return annotated copy.
   b. PDF electronic file. Architect will return annotated copy.
   c. Three paper copies unless otherwise indicated. Architect will return two copies.

1.08 SUBMITTAL OF PROJECT WARRANTIES

A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated, or when delay in submittal of warranties might limit Owner's rights under warranty.

B. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.
1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
4. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

C. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 PRODUCTS

2.01 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

PART 3 EXECUTION

3.01 FINAL CLEANING

A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:
   a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
   b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
   c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
   d. Remove tools, construction equipment, machinery, and surplus material from Project site.
   e. Remove snow and ice to provide safe access to building.
   f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
   g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
   h. Sweep concrete floors broom clean in unoccupied spaces.
   i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
   j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
   k. Remove labels that are not permanent.
   l. Wipe surfaces of mechanical and electrical equipment**,** elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
   m. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
   n. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.

o. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
p. Leave Project clean and ready for occupancy.

C. Pest Control: Comply with pest control requirements in Section 015000 "Temporary Facilities and Controls." Prepare written report.

3.02 REPAIR OF THE WORK

A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.
B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.

1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that that already show evidence of repair or restoration.

a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.

3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION

PART 1 GENERAL

1.01 SUMMARY

A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:

1. Operation and maintenance documentation directory.
2. Emergency manuals.
3. Operation manuals for systems, subsystems, and equipment.
4. Product maintenance manuals.
5. Systems and equipment maintenance manuals.

1.02 CLOSEOUT SUBMITTALS

A. Manual Content: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.

1. Architect will comment on whether content of operations and maintenance submittals are acceptable.
2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

B. Format: Submit operations and maintenance manuals in the following format:

1. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to Architect.
   a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
   b. Enable inserted reviewer comments on draft submittals.
2. Three paper copies. Include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves. Architect will return two copies.

C. Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect will return copy with comments.

1. Correct or revise each manual to comply with Architect's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's comments and prior to commencing demonstration and training.

PART 2 PRODUCTS

2.01 REQUIREMENTS FOR OPERATION AND MAINTENANCE MANUALS

A. Directory: Prepare a single, comprehensive directory of operation, and maintenance data and materials, listing items and their location to facilitate ready access to desired information.

B. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
   1. Title page.
   2. Table of contents.
   3. Manual contents.

C. Title Page: Include the following information:

1. Subject matter included in manual.
2. Name and address of Project.
3. Name and address of Owner.
4. Date of submittal.
5. Name and contact information for Contractor.
6. Name and contact information for Architect.
7. Name and contact information for Commissioning Authority.
8. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
9. Cross-reference to related systems in other operation and maintenance manuals.

D. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.

E. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

F. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.

1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
2. File Names and Bookmarks: Enable bookmarking of individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

G. Manuals, Paper Copy: Submit manuals in the form of hard copy, bound and labeled volumes.

1. Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.

    a. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name and subject matter of contents, and indicate Specification Section. Indicate volume number for multiple volume sets.

2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment.
4. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.

    a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
    b. If drawings are too large to be used as foldouts, fold and place drawings in labeled

envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

2.02 OPERATION MANUALS

A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
   1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
   2. Performance and design criteria if Contractor is delegated design responsibility.
   3. Operating standards.
   4. Operating procedures.
   5. Operating logs.
   6. Wiring diagrams.
   7. Control diagrams.
   8. Piped system diagrams.
   9. Precautions against improper use.
   10. License requirements including inspection and renewal dates.

B. Descriptions: Include the following:
   1. Product name and model number. Use designations for products indicated on Contract Documents.
   2. Manufacturer's name.
   3. Equipment identification with serial number of each component.
   4. Equipment function.
   5. Operating characteristics.
   6. Limiting conditions.
   7. Performance curves.
   8. Engineering data and tests.
   9. Complete nomenclature and number of replacement parts.

C. Operating Procedures: Include the following, as applicable:
   1. Startup procedures.
   2. Equipment or system break-in procedures.
   3. Routine and normal operating instructions.
   4. Regulation and control procedures.
   5. Instructions on stopping.
   6. Normal shutdown instructions.
   7. Seasonal and weekend operating instructions.
   8. Required sequences for electric or electronic systems.
   9. Special operating instructions and procedures.

D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.03 PRODUCT MAINTENANCE MANUALS

A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

B. Source Information: List each product included in manual, identified by product name and

arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.

C. Product Information: Include the following, as applicable:
   1. Product name and model number.
   2. Manufacturer's name.
   3. Color, pattern, and texture.
   4. Material and chemical composition.
   5. Reordering information for specially manufactured products.

D. Maintenance Procedures: Include manufacturer's written recommendations and the following:
   1. Inspection procedures.
   2. Types of cleaning agents to be used and methods of cleaning.
   3. List of cleaning agents and methods of cleaning detrimental to product.
   4. Schedule for routine cleaning and maintenance.
   5. Repair instructions.

E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

2.04 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.

B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.

C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
   1. Standard maintenance instructions and bulletins.
   2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
   3. Identification and nomenclature of parts and components.
   4. List of items recommended to be stocked as spare parts.

D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
   1. Test and inspection instructions.
   2. Troubleshooting guide.
   3. Precautions against improper maintenance.
   4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
   5. Aligning, adjusting, and checking instructions.
   6. Demonstration and training video recording, if available.

E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.

F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

PART 3 EXECUTION

3.01 MANUAL PREPARATION

A. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

B. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.

C. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

D. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.

1. Do not use original project record documents as part of operation and maintenance manuals.

E. Comply with Section 01 7700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION

PART 1 GENERAL

1.01 SUMMARY

A. Section includes administrative and procedural requirements for project record documents, including the following:
   1. Record Drawings.
   2. Record Specifications.
   3. Record Product Data.

B. Related Requirements:
   1. Section 01 7823 "Operation and Maintenance Data" for operation and maintenance manual requirements.

1.02 CLOSEOUT SUBMITTALS

A. Record Drawings: Comply with the following:
   1. Number of Copies: Submit one set of marked-up record prints.
   2. Number of Copies: Submit copies of record Drawings as follows:
      a. Initial Submittal:
         1. Submit one paper-copy set of marked-up record prints.
         2. Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.
      b. Final Submittal:
         1. Submit PDF electronic files of scanned record prints and one set of prints.
         2. Print each drawing, whether or not changes and additional information were recorded.

B. Record Specifications: Submit one paper copy of Project's Specifications, including addenda and contract modifications.

C. Record Product Data: Submit one paper copy of each submittal.

PART 2 PRODUCTS

2.01 RECORD DRAWINGS

A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised Drawings as modifications are issued.

   1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.
      a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
      b. Record data as soon as possible after obtaining it.
      c. Record and check the markup before enclosing concealed installations.
   2. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
   3. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
   4. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Record Digital Data Files: Immediately before inspection for Certificate of Substantial

Completion, review marked-up record prints with Architect. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:

1. Format: Annotated PDF electronic file with comment function enabled.
2. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
3. Refer instances of uncertainty to Architect for resolution.
4. Architect will furnish Contractor one set of digital data files of the Contract Drawings for use in recording information.

C. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.

1. Record Prints: Organize record prints and newly prepared record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
2. Format: Annotated PDF electronic file with comment function enabled.
3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
4. Identification: As follows:
   a. Project name.
   b. Date.
   c. Designation "PROJECT RECORD DRAWINGS."
   d. Name of Architect.
   e. Name of Contractor.

2.02 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
4. Note related Change Orders and record Drawings where applicable.

B. Format: Submit record Specifications as scanned PDF electronic file(s) of marked-up paper copy of Specifications.

2.03 RECORD PRODUCT DATA

A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
3. Note related Change Orders and record Drawings where applicable.

B. Format: Submit record Product Data as scanned PDF electronic file(s) of marked-up paper copy of Product Data.

2.04 MISCELLANEOUS RECORD SUBMITTALS

A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

B. Format: Submit miscellaneous record submittals as scanned PDF electronic file(s) of marked-up miscellaneous record submittals.

PART 3 EXECUTION

3.01 RECORDING AND MAINTENANCE

A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.

B. Maintenance of Record Documents and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Architect's reference during normal working hours.

END OF SECTION

PART 1 - GENERAL

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

1.2 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.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:

    a. Contractor's superintendent.
    b. Independent testing agency responsible for concrete design mixtures.
    c. Ready-mix concrete manufacturer.
    d. Concrete Subcontractor.

2. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, forms and form removal limitations, vapor-retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, methods for achieving specified floor and slab flatness and levelness floor and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.

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.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Welding certificates.

C. 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. Fiber reinforcement.
6. Curing compounds.
7. Floor and slab treatments.
8. Bonding agents.
9. Adhesives.
10. Vapor retarders.
11. Joint-filler strips.
12. Repair materials.

D. Material Test Reports: For the following, from a qualified testing agency:

1. Aggregates.

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

F. Field quality-control reports.

G. Minutes of preinstallation conference.

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, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician, Grade I. Testing agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician, Grade II.

D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4/D 1.4M.

E. Mockups: Cast concrete slab-on-grade panels to demonstrate typical joints, surface finish, texture, tolerances, floor treatments, and standard of workmanship.

1. Build panel approximately 200 sq. ft. (18.6 sq. m) for slab-on-grade in the location indicated or, if not indicated, as directed by Architect.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on concrete mixtures.

1.8 DELIVERY, STORAGE, AND HANDLING

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

1.9 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 (4.4 deg C) for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301 (ACI 301M).
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 (ACI 301M) and as follows:

1. Maintain concrete temperature below 90 deg F (32 deg C) 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 (ACI 301M).
2. ACI 117 (ACI 117M).

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.
2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:

    a. High-density overlay, Class 1 or better.
    b. Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.
    c. Structural 1, B-B or better; mill oiled and edge sealed.
    d. B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed.

3. Overlaid Finnish birch plywood.

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. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch (19 by 19 mm), minimum.

D. 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.

1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

E. 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.

1. Furnish units that leave no corrodible metal closer than 1 inch (25 mm) to the plane of exposed concrete surface.
2. Furnish ties that, when removed, leave holes no larger than 1 inch (25 mm) in diameter in concrete surface.
3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.3 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.

B. Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, deformed.

C. 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 (Grade 420), plain-steel bars, cut true to length with ends square and free of burrs.

B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:

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

2.5 CONCRETE MATERIALS

A. 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:

1. Portland Cement: ASTM C 150/C 150M, Type I, gray.
2. Fly Ash: ASTM C 618, Class F.
3. Slag Cement: ASTM C 989/C 989M, Grade 100 or 120.
4. Blended Hydraulic Cement: ASTM C 595/C 595M, Type IS, portland blast-furnace slag cement.
5. Silica Fume: ASTM C 1240, amorphous silica.

C. Normal-Weight Aggregates: ASTM C 33/C 33M, Class 3M coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.

1. Maximum Coarse-Aggregate Size: 1-1/2 inches (38 mm) for footings and other formed concrete and 3/4 inch (19 mm) for slabs, nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

D. Lightweight Aggregate: ASTM C 330/C 330M, 3/4-inch (19-mm) nominal maximum aggregate size.

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

F. 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. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

G. Color Pigment: ASTM C 979/C 979M, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable,[free of carbon black,] nonfading, and resistant to lime and other alkalis.

1. Available Manufacturers:
   a. Bayer Corporation.
   b. ChemMasters.
   c. Davis Colors.
   d. Hoover Color Corporation.
   e. Lambert Corporation.
   f. Scofield, L. M. Company.
   g. Solomon Colors.
2. Color: As selected by Architect from manufacturer's full range.

H. Water: ASTM C 94/C 94M and potable.

2.6 FIBER REINFORCEMENT

A. Synthetic Micro-Fiber: Fibrillated polypropylene micro-fibers engineered and designed for use in concrete, complying with ASTM C 1116/C 1116M, Type III, 1/2 to 1-1/2 inches (13 to 38 mm) long.
1. Available Products:
   a. Axim Concrete Technologies; Fibrasol IIP
   b. Euclid Chemical Company (The); Fiberstrand 100.
   c. FORTA Corporation; Forta Mono.
   d. Grace Construction Products, W. R. Grace & Co.; Grace MicroFiber.
   e. Metalcrete Industries; Polystrand 1000.
   f. SI Concrete Systems; Fibermix Stealth.

B. Synthetic Macro-Fiber: Polyolefin macro-fibers engineered and designed for use in concrete, complying with ASTM C 1116/C 1116M, Type III, 1 to 2-1/4 inches (25 to 57 mm) long.
1. Available Products:
   a. Axim Concrete Technologies; Fibrasol F.
   b. Euclid Chemical Company (The); Fiberstrand F.
   c. FORTA Corporation; Forta.
   d. Grace Construction Products, W. R. Grace & Co.; Grace Fibers.
   e. SI Concrete Systems; Fibermesh.

2.7 VAPOR RETARDERS

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

1. Available Products:

   a. Fortifiber Corporation; Moistop Ultra, 10 mils, min.
   b. Raven Industries Inc.; Vapor Block 10.
   c. Stego Industries, LLC; Stego Wrap, 15 mils.

B. Sheet Vapor Retarder: Polyethylene sheet, ASTM D 4397, not less than 10 mils (0.25 mm) thick.

2.8 CURING MATERIALS

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

1. Available Products:

a. Axim Concrete Technologies; Cimfilm.
b. Burke by Edoco; BurkeFilm.
c. ChemMasters; Spray-Film.
d. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Aquafilm.
e. Dayton Superior Corporation; Sure Film.
f. Euclid Chemical Company (The); Eucobar.
g. Kaufman Products, Inc.; Vapor Aid.
h. Lambert Corporation; Lambco Skin.
i. L&M Construction Chemicals, Inc.; E-Con.
j. MBT Protection and Repair, Div. of ChemRex; Confilm.
k. Meadows, W. R., Inc.; Sealtight Evapre.
l. Metalcrete Industries; Waterhold.
m. Nox-Crete Products Group, Kinsman Corporation; Monofilm.
n. Sika Corporation, Inc.; SikaFilm.
o. Symons Corporation, a Dayton Superior Company; Finishing Aid.
p. Unitex; Pro-Film.
q. US Mix Products Company; US Spec Monofilm ER.
r. Vexcon Chemicals, Inc.; Certi-Vex EnvioAssist.

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) when dry.

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

D. Water: Potable.

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

1. Available Products:

a. Anti-Hydro International, Inc.; AH Clear Cure WB.
b. Burke by Edoco; Spartan Cote WB II.
c. ChemMasters; Safe-Cure & Seal 20.
d. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Cure and Seal WB.
e. Dayton Superior Corporation; Safe Cure and Seal (J-18).
f. Euclid Chemical Company (The); Aqua Cure VOX.
g. Kaufman Products, Inc.; Cure & Seal 309 Emulsion.
h. Lambert Corporation; Glazecote Sealer-20.
i. L&M Construction Chemicals, Inc.; Dress & Seal WB.

j. Meadows, W. R., Inc.; Vocomp-20.
k. Metalcrete Industries; Metcure.
l. Nox-Crete Products Group, Kinsman Corporation; Cure & Seal 150E.
m. Symons Corporation, a Dayton Superior Company; Cure & Seal 18 Percent E.
n. Tamms Industries, Inc.; Clearseal WB 150.
o. Unitex; Hydro Seal.
p. US Mix Products Company; US Spec Hydrasheen 15 percent Vexcon Chemicals, Inc.; Starseal 309.Verify with manufacturer that retained products have been tested against interference with bonding of floor covering.

2.9 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork.

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.

2.10 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch (3.2 mm) and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C 150/C 150M, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3.2 to 6 mm) or coarse sand as recommended by underlayment manufacturer.
4. Compressive Strength: Not less than 4100 psi (29 MPa) at 28 days when tested according to ASTM C 109/C 109M.

B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch (6.4 mm) and that can be filled in over a scarified surface to match adjacent floor elevations.

1. Cement Binder: ASTM C 150/C 150M, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3.2 to 6 mm) or coarse sand as recommended by topping manufacturer.
4. Compressive Strength: Not less than 5000 psi (34.5 MPa) at 28 days when tested according to ASTM C 109/C 109M.

2.11 CONCRETE MIXTURES, GENERAL

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

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

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

1. Fly Ash: 25 percent.
2. Combined Fly Ash and Pozzolan: 25 percent.

C. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

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

1. Use water-reducing 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.
4. Use corrosion-inhibiting admixture in concrete mixtures where indicated.

E. Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.

2.12 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Footings: Normal-weight concrete.

1. Minimum Compressive Strength: 3000 psi (20.7 MPa) at 28 days.
2. Maximum W/C Ratio: 0.45.
3. Slump Limit: 4 inches (100 mm), plus or minus 1 inch (25 mm).
4. Air Content: 5.5 percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch (38-mm) nominal maximum aggregate size.

B. Foundation Walls: Normal-weight concrete.

1. Minimum Compressive Strength: 3000 psi (20.7 MPa) at 28 days.
2. Maximum W/C Ratio: 0.45.
3. Slump Limit: 4 inches (100 mm), plus or minus 1 inch (25 mm).
4. Air Content: 5.5 percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch (38-mm) nominal maximum aggregate size.

C. Slabs-on-Grade: Normal-weight concrete.

1. Minimum Compressive Strength: 4000 psi (27.6 MPa) at 28 days.
2. Maximum W/C Ratio: 0.45.
3. Minimum Cementitious Materials Content: 520 lb/cu. yd. (309 kg/cu. m).

4. Slump Limit: 4 inches (100 mm), plus or minus 1 inch (25 mm).
5. Air Content: 1.5 percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch (38-mm) nominal maximum aggregate size.
6. Air Content: 1.5 percent, plus or minus 1.5 percent at point of delivery.
7. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.
8. Synthetic Micro-Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than a rate of 1.5 lb/cu. yd. (0.90 kg/cu. M).

D. Concrete Toppings: Normal-weight or semi (sand) lightweight concrete, as indicated.

1. Minimum Compressive Strength: 4000 psi (27.6 MPa) at 28 days.
2. Minimum Cementitious Materials Content: 520 lb/cu. yd. (309 kg/cu. M).
3. Slump Limit: 4 inches (100 mm), plus or minus 1 inch (25 mm).
4. Air Content: 1.5 percent, plus or minus 1.5 percent at point of delivery.
5. Air Content: Do not allow air content of trowel-finished toppings to exceed 3 percent.
6. Welded Wire Reinforcement: As indicated on drawings.

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 (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), 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 (ACI 301M), 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 (ACI 117M).

C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:

1. Class A, 1/8 inch (3.2 mm) for smooth-formed finished surfaces.
2. Class B, 1/4 inch (6 mm) 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 (10 deg C) 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 (ACI 318M) and ACI 301 (ACI 301M) for design, installation, and removal of shoring and reshoring.

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

B. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

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 (150 mm) and seal with manufacturer's recommended tape.

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.

1. Weld reinforcing bars according to AWS D1.4/D 1.4M, where indicated.

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. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches (38 mm) into concrete.
3. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

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

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch (3.2 mm). Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3.2-mm-) wide joints into concrete when cutting action 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. Terminate full-width joint-filler strips not less than 1/2 inch (13 mm) or more than 1 inch (25 mm) below finished concrete surface where joint sealants, specified in Section 079200 "Joint Sealants," are indicated.
3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.8 CONCRETE PLACEMENT

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

B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.

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

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

D. 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 (ACI 301M).
3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches (150 mm) into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

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

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

3.9 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, or to be covered with a coating or covering material applied directly to concrete.

C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.10 FINISHING FLOORS AND SLABS

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

B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch (6 mm) in one direction.

1. Apply scratch finish to surfaces indicated and to receive mortar setting beds for bonded cementitious floor finishes.

C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.

1. Apply float finish to surfaces to receive trowel finish.

D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

1. Apply a trowel finish to surfaces indicated, exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
2. Finish surfaces to the following tolerances, according to ASTM E 1155 (ASTM E 1155M), for a randomly trafficked floor surface:
   a. Specified overall values of flatness, F(F) 35; and of levelness, F(L) 25; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 17; for slabs-on-grade.
   b. Specified overall values of flatness, F(F) 30; and of levelness, F(L) 20; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 15; for suspended slabs.

3. Finish and measure surface, so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.- (3.05-m-) long straightedge resting on two high spots and placed anywhere on the surface does not exceed 3/16 inch (4.8 mm). This criteria should only be applicable and used in areas where significant plumbing or other floor conditions make it difficult to achieve proper ASTM E 1155 evaluation.

E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces where ceramic or quarry tile is to be installed by either thickset or thinset method. While concrete is still plastic, slightly scarify surface with a fine broom.

1. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.

F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Design Professional before application.

3.11 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 4 inches ((100 mm) high unless otherwise indicated, and extend base not less than 6 inches (150 mm) in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated or unless required for seismic anchor support.
3. Minimum Compressive Strength: 4000 psi (27.6 MPa) at 28 days.
4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete substrate.
6. Prior to pouring concrete, place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
7. Cast anchor-bolt insert into bases. Install anchor bolts to elevations required for proper attachment to supported equipment.

3.12 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 (ACI 301M) for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for 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 (300-mm) lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period, using cover material and waterproof tape.

    a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
    b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
    c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies 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.

3.13 JOINT FILLING

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.

    1. Defer joint filling until concrete has aged at least [one] [six] month(s). Do not fill joints until construction traffic has permanently ceased.

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

C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches (50 mm) deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.14 CONCRETE SURFACE REPAIRS

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

B. Patching Mortar: Mix dry-pack patching mortar, consisting of 1 part portland cement to 2-1/2 parts fine aggregate passing a No. 16 (1.18-mm) sieve, using only enough water for handling and placing.

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

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch (13 mm) in any dimension to solid concrete. Limit cut depth to 3/4 inch (19 mm). Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar 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 (0.25 mm) wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
2. After concrete has cured at least 14 days, correct high areas by grinding.
3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch (6 mm) to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
6. Repair defective areas, except random cracks and single holes 1 inch (25 mm) or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch (19-mm) clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
7. Repair random cracks and single holes 1 inch (25 mm) or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

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

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

3.15 FIELD QUALITY CONTROL

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

B. Inspections:

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

C. 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 one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd. (4 cu. m), but less than 25 cu. yd. (19 cu. m), plus one set for each additional 50 cu. yd. (38 cu. m) or fraction thereof.
2. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. (76 cu. m) 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.

3. 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.
4. 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.
5. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F (4.4 deg C) and below or 80 deg F (27 deg C) and above, and one test for each composite sample.
6. Unit Weight: ASTM C 567/C 567M, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
7. Compression Test Specimens: ASTM C 31/C 31M.

    a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.

8. 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.

9. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
10. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa).
11. 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.
12. 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.
13. 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.
14. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
15. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

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

END OF SECTION 033000

PART 1 GENERAL

1.01 SUMMARY

A. Section includes:
   1. Face Brick

1.02 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples: For each type of product indicated.

1.03 QUALITY ASSURANCE

A. Masonry Standard: Comply with ACI 530.1/ASCE 6/TMS 602 unless modified by requirements in the Contract Documents.

B. Sample Panels: Build sample panels to verify selections made under sample submittals and to demonstrate aesthetic effects. Comply with requirements in Section 014000 "Quality Requirements" for mockups.

   1. Build sample panels for each type of exposed unit masonry construction incorporated into exterior wall mockup shown on Drawings.

1.04 PROJECT CONDITIONS

A. 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.

B. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

PART 2 PRODUCTS

2.01 MASONRY UNITS - GENERAL

A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects will be exposed in the completed Work.

2.02 BRICK

A. Regional Materials: Brick shall be manufactured within 500 miles (800 km) of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles (800 km) of Project site.

B. General: Provide shapes indicated and as follows.
   1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.

2. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.

C. Face Brick: Modular size facing brick complying with ASTM C 216.

1. Grade: MW or SW.
2. Type: FBS.
3. Initial Rate of Absorption: Less than 30 g/30 sq. in. (30 g/194 sq. cm) per minute when tested per ASTM C 67.
4. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."
5. Size (Actual Dimensions): 3-5/8 inches (92 mm) wide by 2-1/4 inches (57 mm) high by 7-5/8 inches (194 mm) long].
6. Color and Texture: To be selected by Architect from manufacturer's full line.

2.03 MORTAR AND GROUT MATERIALS

A. Mortar for masonry shall be composed of one part masonry cement, one-half part Portland cement, and three parts sand. Mortar shall comply with the requirements of ASTM C 270, type S with not less than 1800 psi compressive strength. Color of mortar for concrete masonry units and face brick shall be selected from manufacturer's standard colors.

B. The quantities of cementitious materials shall be adjusted as approved to maintain the specified strength.

C. Portland cement shall conform to ASTM C150, Type II.

D. Sand for masonry work shall conform to ASTM C 144 color shall match sample described in "2.03, A." above.

E. Grout shall comply with ASTM C476.

F. Grout compressive strength shall comply with ASTM C1019.

G. Use fine grout for walls where spaces are 2" or less. Use coarse grout where spaces are greater than 2".

H. Grout or concrete fill shall be batch mixed, and delivered as per ASTM C 94. Transit-mix grout shall be rotated continuously from the time the water is added until placement. Discard grout not placed within 1-1/2 hours after water is first added to the batch.

I. Water shall be fresh, of quality suitable for domestic consumption, and shall be clean and free from injurious amounts of oil, acids, alkalis, organic materials, or other deleterious materials.

2.04 REINFORCEMENT AND ANCHORAGE

A. Reinforcing Steel: ASTM A 615/A 615M Grade 60 (420) deformed billet bars; uncoated.

B. Single Wythe Joint Reinforcement: Truss type; ASTM A 82/A 82M steel wire, hot dip galvanized after fabrication to ASTM A 153/A 153M, Class B; 0.1483 inch side rods with 0.1483 inch cross rods; width as required to provide not more than 1 inch and not less than 1/2 inch of mortar coverage on each exposure.

C. Adjustable Multiple Wythe Joint Reinforcement: Ladder type with adjustable ties spaced at 16 in on center and fabricated with moisture drip; ASTM A 82/A 82M steel wire, hot dip galvanized after fabrication to ASTM A 153/153M, Class B; 0.1875 inch side rods with 0.1483 inch cross rods and adjustable components of 0.1875 inch wire; width of components as required to provide not more than 1 inch and not less than 1/2 inch of mortar coverage from each masonry

face.
1. Vertical adjustment: Not less than 2 inches.

D. Strap Anchors: Bent steel shapes configured as required for specific situations, 1-1/4 in width, 0.125 in thick, lengths as required to provide not more than 1 inch and not less than 1/2 inch of mortar coverage from masonry face, corrugated for embedment in masonry joint, hot dip galvanized to ASTM A 153/A 153M, Class B.

E. Flexible Anchors: 2-piece anchors that permit differential movement between masonry and building frame, sized to provide not more than 1 inch and not less than 1/2 inch of mortar coverage from masonry face.

F. Two-Piece Wall Ties: Formed steel wire, 0.1875 inch thick, adjustable, eye and pintle type, hot dip galvanized to ASTM A 153/A 153M, Class B, sized to provide not more than 1 inch and not less than 1/2 inch of mortar coverage from masonry face and to allow vertical adjustment of up to 1-1/4 in.

G. Vertical reinforcement is indicated in the structural requirements.

2.05 EMBEDDED FLASHING MATERIALS

A. Metal Flashing: Provide metal flashing complying with Section 076200 "Sheet Metal Flashing and Trim" and as follows:

1. Fabricate metal drip edges from stainless steel. Extend at least 3 inches (76 mm) into wall and 1/2 inch (13 mm) out from wall, with outer edge bent down 30 degrees and hemmed.
2. Fabricate metal sealant stops from stainless steel. Extend at least 3 inches (76 mm) into wall and out to exterior face of wall. At exterior face of wall, bend metal back on itself for 3/4 inch (19 mm) and down into joint 1/4 inch (6 mm) to form a stop for retaining sealant backer rod.
3. Fabricate metal expansion-joint strips from stainless steel to shapes indicated.

B. Flexible Flashing: Use the following unless otherwise indicated:

1. Copper-Laminated Flashing: 7-oz./sq. ft. (2-kg/sq. m) copper sheet bonded between two layers of glass-fiber cloth. Use only where flashing is fully concealed in masonry.

C. Solder and Sealants for Sheet Metal Flashings: As specified in Section 076200 "Sheet Metal Flashing and Trim."

D. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

2.06 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene urethane or PVC.

B. Bond-Breaker Strips: Asphalt-saturated felt complying with ASTM D 226/D 226M, Type I (No. 15 asphalt felt).

C. Weep/Cavity Vent Products: Use the following unless otherwise indicated:

1. Cellular Plastic Weep/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height and width of head joint and depth 1/8 inch (3 mm) less than depth of outer wythe, in color selected from manufacturer's standard.

D. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.

1. Configuration: Provide one of the following:
   a. Strips, full depth of cavity and 10 inches (250 mm) high, with dovetail shaped notches 7 inches (175 mm) deep that prevent clogging with mortar droppings.

2.07 MASONRY CLEANERS

A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.

2.08 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.

1. Do not use calcium chloride in mortar or grout.
2. Use portland cement-lime mortar unless otherwise indicated.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Unit Masonry: Comply with ASTM C 270. Provide the following types of mortar for applications stated unless another type is indicated.

1. For masonry below grade or in contact with earth, use Type M.
2. For exterior, above-grade, load-bearing and nonload-bearing walls and parapet walls; for interior load-bearing walls; for interior nonload-bearing partitions; and for other applications where another type is not indicated, use Type N.

PART 3 EXECUTION

3.01 INSTALLATION - GENERAL

A. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

B. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures. Mix units from several pallets or cubes as they are placed.

C. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. (30 g/194 sq. cm) per minute when tested according to ASTM C 67. Allow units to absorb water so they are damp but not wet at time of laying.

3.02 TOLERANCES

A. Dimensions and Locations of Elements:
1. For dimensions in cross section or elevation, do not vary by more than plus 1/2 inch (12 mm) or minus 1/4 inch (6 mm).
2. For location of elements in plan, do not vary from that indicated by more than plus or minus

1/2 inch (12 mm).
3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch (6 mm) in a story height or 1/2 inch (12 mm) total.

B. Lines and Levels:
1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 feet (6 mm in 3 m), or 1/2-inch (12-mm) maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2-inch (12-mm) maximum.
3. For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (9 mm in 6 m), or 1/2-inch (12-mm) maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2-inch (12-mm) maximum.
5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (9 mm in 6 m), or 1/2-inch (12-mm) maximum.

C. Joints:
1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm), with a maximum thickness limited to 1/2 inch (12 mm).
2. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch (9 mm) or minus 1/4 inch (6 mm).
3. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm).

3.03 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less-than-nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.

C. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

3.04 MORTAR BEDDING AND JOINTING

A. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

B. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

C. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.

3.05 ANCHORED MASONRY VENEERS

A. Anchor masonry veneers to wall framing with masonry-veneer anchors to comply with the following requirements:

1. Fasten screw-attached anchors through sheathing to wall framing with metal fasteners of

type indicated. Use two fasteners unless anchor design only uses one fastener.
2. Embed connector sections and continuous wire in masonry joints.
3. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
4. Space anchors as indicated, but not more than 16 inches (406 mm) o.c. vertically and 25 inches (635 mm) o.c. horizontally. Install additional anchors within 12 inches (305 mm) of openings and at intervals, not exceeding 36 inches (914 mm), around perimeter.

3.06 FLASHING, WEEP HOLES, AND CAVITY VENTS

A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.

B. Install flashing as follows unless otherwise indicated:
1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
2. At 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.
3. 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.
4. Install metal flashing termination 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 flashing termination.

C. Install weep holes in exterior wythes and veneers in head joints of first course of masonry immediately above embedded flashing.
1. Use specified weep/cavity vent products to form weep holes.
2. Space weep holes 24 inches (600 mm) o.c. unless otherwise indicated.

D. Place cavity drainage material in airspace behind veneers to comply with configuration requirements for cavity drainage material in "Miscellaneous Masonry Accessories" Article.

3.07 PARGING

A. Parge exterior faces of below-grade masonry walls, where indicated, in two uniform coats to a total thickness of 3/4 inch (19 mm). Dampen wall before applying first coat, and scarify first coat to ensure full bond to subsequent coat.

B. Use a steel-trowel finish to produce a smooth, flat, dense surface with a maximum surface variation of 1/8 inch per foot (3 mm per 300 mm). Form a wash at top of parging and a cove at bottom.

C. Damp-cure parging for at least 24 hours and protect parging until cured.

3.08 REPAIRING, POINTING, AND CLEANING

A. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

B. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes.
3. Protect adjacent surfaces from contact with cleaner.
4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
5. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
6. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Reinforcing for unit masonry.

1.2 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product data for each different masonry unit, accessory, and other manufactured product specified.

C. Shop drawings for reinforcing detailing fabrication, bending, and placement of unit masonry reinforcing bars. Comply with ACI 315 "Details and Detailing of Concrete Reinforcement" showing bar schedules, stirrup spacing, diagrams of bent bars, and arrangement of masonry reinforcement.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:

1. Joint Reinforcement, Ties, and Anchors:

a AA Wire Products Co.
b Dur-O-Wal, Inc.
c Heckman Building Products, Inc.
d Hohmann & Barnard, Inc.
e Masonry Reinforcing Corp. of America.
f National Wire Products Industries.
g Southern Construction Products.

2.2 REINFORCING STEEL

A. Steel Reinforcing Bars: Material and grade as follows:

1. Billet steel complying with ASTM A 615 (ASTM A 615M).

B. Deformed Reinforcing Wire: ASTM A 496, with ASTM A 153, Class B-2 zinc coating.

C. Welded-Wire Fabric: ASTM A 185.

2.3 JOINT REINFORCEMENT

A. General: Provide joint reinforcement formed from the following:

1. Galvanized carbon-steel wire, coating class as follows:

    g. ASTM A 641 (ASTM A 641M), Class 1, for interior walls; and ASTM A 153, Class B-2, for exterior walls.

B. Description: Welded-wire units prefabricated with deformed continuous side rods and plain cross rods into straight lengths of not less than 10 feet (3 m), with prefabricated corner and tee units, and complying with requirements indicated below:

1. Wire Diameter for Side Rods: 0.1483 inch (3.8 mm).
2. Wire Diameter for Cross Rods: 0.1483 inch (3.8 mm).

C. For single-wythe masonry, provide type as follows with single pair of side rods:

1. Ladder design with perpendicular cross rods spaced not more than 16 inches (407 mm) o.c.

2.4 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.

1. Do not use calcium chloride in mortar or grout.
2. Add cold-weather admixture (if used) at the same rate for all mortar, regardless of weather conditions, in order to ensure that mortar color is consistent.

B. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification, for types of mortar indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of unit masonry. Do not proceed with installation until unsatisfactory conditions have been corrected.

1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of unit masonry.

B. Examine rough-in and built-in construction to verify actual locations of piping connections prior to installation.

3.2 HORIZONTAL-JOINT REINFORCEMENT

A. General: Provide continuous horizontal-joint reinforcement as indicated. Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch (16 mm) on exterior side of walls, 1/2 inch (13 mm) elsewhere. Lap reinforcing a minimum of 6 inches (150 mm).

1. Space reinforcement not more than 16 inches (406 mm) o.c.
2. Space reinforcement not more than 8 inches (203 mm) o.c. in foundation walls and parapet walls.
3. Provide reinforcement in mortar joint 1 block course above and below wall openings and extending 12 inches (305 mm) beyond opening.

    a. Reinforcement above is in addition to continuous reinforcement.

B. Cut or interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.

C. Provide continuity at corners and wall intersections by using prefabricated "L" and "T" sections. Cut and bend reinforcement units as directed by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.3 INSTALLATION OF REINFORCED UNIT MASONRY

A. Temporary Formwork and Shores: Construct formwork and shores to support reinforced masonry elements during construction.

3. Construct formwork to conform to shape, line, and dimensions shown. Make sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
4. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other temporary loads that may be placed on them during construction.

B. Grouting: Do not place grout until entire height of masonry to be grouted has attained sufficient strength to resist grout pressure.

1. Do not exceed the following pour heights for fine grout:

a. For minimum widths of grout spaces of 3/4 inch (19 mm) or for minimum grout space of hollow unit cells of 1-1/2 by 2 inches (38 by 51 mm), pour height of 12 inches (305 mm).
b. For minimum widths of grout spaces of 2 inches (51 mm) or for minimum grout space of hollow unit cells of 2 by 3 inches (51 by 76 mm), pour height of 60 inches (1524 mm).
c. For minimum widths of grout spaces of 2-1/2 inches (63 mm) or for minimum grout space of hollow unit cells of 2-1/2 by 3 inches (63 by 76 mm), pour height of 12 feet (3.6 m).
d. For minimum widths of grout spaces of 3 inches (76 mm) or for minimum grout space of hollow unit cells of 3 by 3 inches (76 by 76 mm), pour height of 24 feet (7.3 m).

2. Do not exceed the following pour heights for coarse grout:

a. For minimum widths of grout spaces of 1-1/2 inches (38 mm) or for minimum grout space of hollow unit cells of 1-1/2 by 3 inches (38 by 76 mm), pour height of 12 inches (305 mm).
b. For minimum widths of grout spaces of 2 inches (51 mm) or for minimum grout space of hollow unit cells of 2-1/2 by 3 inches (63 by 76 mm), pour height of 60 inches (1524 mm).
c. For minimum widths of grout spaces of 2-1/2 inches (63 mm) or for minimum grout space of hollow unit cells of 3 by 3 inches (76 by 76 mm), pour height of 12 feet (3.6 m).
d. For minimum widths of grout spaces of 3 inches (76 mm) or for minimum grout space of hollow unit cells of 3 by 4 inches (76 by 101 mm), pour height of 24 feet (7.3 m).

3. Provide cleanout holes at least 3 inches (76 mm) in least dimension for grout pours over 60 inches (1524 mm) in height.

a. Provide cleanout holes at each vertical reinforcing bar.
b. At solid grouted masonry, provide cleanout holes at not more than 32 inches (813 mm) o.c.

3.4 FIELD QUALITY CONTROL

A. The Owner will engage and pay for the services of an independent testing agency or special inspector to perform the following testing for field quality control. Payment for these services will be made from the Inspection and Testing Allowance, as authorized by Change Orders. Retesting of

materials failing to meet specified requirements shall be done at Contractor's expense.

B. Testing Frequency: Tests and Evaluations listed in this Article will be performed during construction for each 5000 sq. ft. (460 sq. m) of wall area or portion thereof.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Structural steel.
2. Grout.

1.2 DEFINITIONS

A. Structural Steel: Elements of structural-steel frame, as classified by AISC's "Code of Standard Practice for Steel Buildings and Bridges," that support design loads.

1.3 PERFORMANCE REQUIREMENTS

A. Connections: Provide details of simple shear connections required by the Contract Documents to be selected or completed by structural-steel fabricator. If an reduced connection is desired it shall be designed by the structural steel fabricator’s engineer to withstand ASD-service loads based on the maximum uniform load moment capacity of the beam.

1. Select and complete connections using schematic details indicated and AISC's "Manual of Steel Construction, Allowable Stress Design," Part 4.
2. Engineering Responsibility: Fabricator's responsibilities include using a qualified professional engineer to prepare structural analysis data for structural-steel connections designs provided or modified by the fabricator.

B. Construction: Type 1, rigid frame and 2, simple framing, as indicated.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show fabrication of structural-steel components.

1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
2. Include embedment drawings.
3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld.
4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections.
5. For structural-steel connections indicated to comply with design loads, include structural analysis data by the qualified professional engineer responsible for their preparation.

C. Welding certificates.

D. Mill Test Reports: Signed by manufacturers certifying that the following products comply with requirements:

1. Structural steel including chemical and physical properties.
2. Bolts, nuts, and washers including mechanical properties and chemical analysis.
3. Direct-tension indicators.
4. Tension-control, high-strength bolt-nut-washer assemblies.
5. Shear stud connectors.
6. Shop primers.
7. Nonshrink grout.

E. Source quality-control test reports.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category CSE, or an qualified installer with not less than ten (10) years of experience installing structural steel for similar and larger projects.

B. Fabricator Qualifications: A qualified fabricator who participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category Sbd, or an qualified fabricator with not less than ten (10) years of experience fabricating structural steel for similar and larger projects.

C. Shop-Painting Applicators: Qualified according to AISC's Sophisticated Paint Endorsement P1 or SSPC-QP 3, "Standard Procedure for Evaluating Qualifications of Shop Painting Applicators."

D. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel."

E. Comply with applicable provisions of the following specifications and documents:

1. AISC's "Code of Standard Practice for Steel Buildings and Bridges."
2. AISC's "Seismic Provisions for Structural Steel Buildings" and "Supplement No. 2."
3. AISC's "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design."
4. AISC's "Specification for the Design of Steel Hollow Structural Sections."
5. AISC's "Specification for Allowable Stress Design of Single-Angle Members."
6. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

F. Preinstallation Conference: Conduct conference at Project site.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from erosion and deterioration.

1. Store fasteners in a protected place. Clean and relubricate bolts and nuts that become dry or rusty before use.
2. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

1.7 COORDINATION

A. Furnish anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

A. W-Shapes: ASTM A 992/A 992M.

B. Channels, Angles: ASTM A 36/A 36M.

C. Plate and Bar: ASTM A 36/A 36M.

D. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B, structural tubing.

E. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade B.

1. Weight Class: as indicated.
2. Finish: Black.

F. Welding Electrodes: Comply with AWS requirements.

2.2 BOLTS, CONNECTORS, AND ANCHORS

A. High-Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, heavy hex steel structural bolts; ASTM A 563 (ASTM A 563M) heavy hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M) hardened carbon-steel washers.

1. Finish: Plain.
2. Direct-Tension Indicators: ASTM F 959, Type 325 (ASTM F 959M, Type 8.8,) compressible-washer type.

    a. Finish: Plain.

B. Unheaded Anchor Rods: ASTM F 1554, Grade 36.

1. Configuration: Hooked.
2. Nuts: ASTM A 563 (ASTM A 563M) hex carbon steel.
3. Plate Washers: ASTM A 36/A 36M carbon steel.
4. Washers: ASTM F 436 (ASTM F 436M) hardened carbon steel.
5. Finish: Plain.

C. Headed Anchor Rods: ASTM F 1554, Grade 36, straight.

1. Nuts: ASTM A 563 (ASTM A 563M) hex carbon steel.
2. Plate Washers: ASTM A 36/A 36M carbon steel.
3. Washers: ASTM F 436 (ASTM F 436M) hardened carbon steel.
4. Finish: Plain.

D. Eye Bolts and Nuts: ASTM A 108, Grade 1030, cold-finished carbon steel.

E. Sleeve Nuts: ASTM A 108, Grade 1018, cold-finished carbon steel.

2.3 PRIMER

A. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer.

2.4 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.5 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC's "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design."

1. Camber structural-steel members where indicated.
2. Identify high-strength structural steel according to ASTM A 6/ A 6M and maintain markings until structural steel has been erected.
3. Mark and match-mark materials for field assembly.
4. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.

B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.

1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1.

C. Bolt Holes: Cut, drill, mechanically thermal cut, or punch standard bolt holes perpendicular to metal surfaces.

D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 1, "Solvent Cleaning."

F. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's written instructions.

G. Holes: Provide holes required for securing other work to structural steel and for passage of other work through steel framing members.

1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
2. Base-Plate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.6 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

1. Joint Type: Pretensioned.

B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.

1. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
2. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.
3. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent weld show-through on exposed steel surfaces.

    a. Grind butt welds flush.
    b. Grind or fill exposed fillet welds to smooth profile. Dress exposed welds.

2.7 SHOP PRIMING

A. Shop prime steel surfaces except the following:

1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches (50 mm).
2. Surfaces to be field welded.
3. Surfaces to be high-strength bolted with slip-critical connections.
4. Surfaces to receive sprayed fire-resistive materials.
5. Galvanized surfaces.

B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:

1. SSPC-SP 2, "Hand Tool Cleaning."
2. SSPC-SP 3, "Power Tool Cleaning."

C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a dry film thickness of not less than 1.5 mils (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
2. Apply two coats of shop paint to inaccessible surfaces after assembly or erection. Change color of second coat to distinguish it from first.

D. Painting: Apply a 1-coat, nonasphaltic primer complying with SSPC-PS Guide 7.00, "Painting System Guide 7.00: Guide for Selecting One-Coat Shop Painting Systems," to provide a dry film thickness of not less than 1.5 mils (0.038 mm).

2.8 SOURCE QUALITY CONTROL

A. Owner will engage an independent testing and inspecting agency to perform shop tests and inspections and prepare test reports.

1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.

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

C. Bolted Connections: Shop-bolted connections will be[tested and] inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

D. Welded Connections: In addition to visual inspection, shop-welded connections will be tested and inspected according to AWS D1.1 and the following inspection procedures, at testing agency's option:

1. Liquid Penetrant Inspection: ASTM E 165.
2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
3. Ultrasonic Inspection: ASTM E 164.
4. Radiographic Inspection: ASTM E 94.

E. In addition to visual inspection, shop-welded shear connectors will be tested and inspected according to requirements in AWS D1.1 for stud welding and as follows:

1. Bend tests will be performed if visual inspections reveal either a less-than- continuous 360-degree flash or welding repairs to any shear connector.
2. Tests will be conducted on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments, with steel erector present, for compliance with requirements.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place, unless otherwise indicated.

1. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

3.3 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design."

B. Base and Bearing Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting base and bearing plates. Clean bottom surface of base and bearing plates.

1. Set base and bearing plates for structural members on wedges, shims, or setting nuts as required.
2. Weld plate washers to top of base plate.
3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of base or bearing plate before packing with grout.
4. Promptly pack grout solidly between bearing surfaces and base or bearing plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

C. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

D. Align and adjust various members forming part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure.
2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.

E. Splice members only where indicated.

F. Remove erection bolts on welded, architecturally exposed structural steel; fill holes with plug welds; and grind smooth at exposed surfaces.

G. Do not use thermal cutting during erection unless approved by Architect. Finish thermally cut sections within smoothness limits in AWS D1.1.

H. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

3.4 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened or Slip critical as indicated.

B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.

1. Comply with AISC's "Code of Standard Practice for Steel Buildings and Bridges" and "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design" for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
2. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
3. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.
4. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent weld show-through on exposed steel surfaces.

    a. Grind butt welds flush.
    b. Grind or fill exposed fillet welds to smooth profile. Dress exposed welds.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds and high-strength bolted connections.

B. Bolted Connections: Shop-bolted connections will be inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

C. Welded Connections: Field welds will be visually inspected according to AWS D1.1.

1. In addition to visual inspection, field welds will be tested according to AWS D1.1 and the following inspection procedures, at testing agency's option:

    a. Liquid Penetrant Inspection: ASTM E 165.
    b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
    c. Ultrasonic Inspection: ASTM E 164.
    d. Radiographic Inspection: ASTM E 94.

D. In addition to visual inspection, test and inspect field-welded shear connectors according to requirements in AWS D1.1 for stud welding and as follows:

1. Perform bend tests if visual inspections reveal either a less-than- continuous 360-degree flash or welding repairs to any shear connector.
2. Conduct tests on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1.

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

3.6 REPAIRS AND PROTECTION

A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Touchup Painting: After installation, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists and accessories, bearing plates, and abutting structural steel.

1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.
2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.

C. Touchup Painting: Cleaning and touchup painting are specified in painting Sections.

END OF SECTION 051200

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Roof deck.
2. Composite floor deck.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of deck, accessory, and product indicated.

B. Shop Drawings:

1. Include layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

1.3 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Product Certificates: For each type of steel deck.

C. Product Test Reports: For tests performed by a qualified testing agency, indicating that each of the following complies with requirements:

1. Power-actuated mechanical fasteners.

D. Evaluation Reports: For steel deck, from ICC-ES.

E. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

C. FM Global Listing: Provide steel roof deck evaluated by FM Global and listed in its "Approval Guide, Building Materials" for Class 1 fire rating and Class 1-90 windstorm ratings.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."

B. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.2 ROOF DECK

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

1. Steel Deck:

a. ASC Profiles, Inc.
b. Canam Steel Corp.;The Canam Manac Group.
c. Consolidated Systems, Inc.
d. DACS, Inc.
e. D-Mac Industries Inc.
f. Epic Metals Corporation.
g. Marlyn Steel Decks, Inc.
h. New Millennium Building Systems, LLC.
i. Nucor Corp.; Vulcraft Division.
j. Roof Deck, Inc.
k. United Steel Deck, Inc.
l. Valley Joist; Division of EBSCO Industries, Inc.
m. Verco Manufacturing Co.
n. Wheeling Corrugating Company; Div. of Wheeling-Pittsburgh Steel Corporation.

B. Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 31, and with the following:

1. Galvanized-Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33 (230), G60 (Z180) zinc coating.
2. Deck Profile: As indicated.
3. Profile Depth: As indicated.
4. Design Uncoated-Steel Thickness: As indicated.
5. Span Condition: Double or Triple span or more].
6. Side Laps: Overlapped or interlocking seam at Contractor's option.

2.3 COMPOSITE FLOOR DECK

A. Composite Floor Deck: Fabricate panels, with integrally embossed or raised pattern ribs and interlocking side laps, to comply with "SDI Specifications and Commentary for Composite Steel Floor Deck," in SDI Publication No. 31, with the minimum section properties indicated, and with the following:
   1. Galvanized-Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33 (230), G60 (Z180) zinc coating.
   2. Profile Depth: As indicated.
   3. Design Uncoated-Steel Thickness: As indicated.
   4. Span Condition: Double or Triple span or more].

2.4 ACCESSORIES

A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.

B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.

C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 (4.8-mm) minimum diameter.

D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.

E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi (230 MPa), not less than 0.0359-inch (0.91-mm) design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.

F. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi (230 MPa), of same material and finish as deck, and of thickness and profile recommended by SDI Publication No. 31 for overhang and slab depth.

G. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck unless otherwise indicated.

H. Piercing Hanger Tabs: Piercing steel sheet hanger attachment devices for use with floor deck.

I. Weld Washers: Uncoated steel sheet, shaped to fit deck rib, [0.0598 inch (1.52 mm)] [0.0747 inch (1.90 mm)] thick, with factory-punched hole of 3/8-inch (9.5-mm) minimum diameter.

J. Flat Sump Plates: Single-piece steel sheet, 0.0747 inch (1.90 mm) thick, of same material and finish as deck. For drains, cut holes in the field.

K. Recessed Sump Pans: Single-piece steel sheet, 0.0747 inch (1.90 mm) thick, of same material and finish as deck, with 3-inch- (76-mm-) wide flanges and [level] [sloped] recessed pans of 1-1/2-inch (38-mm) minimum depth. For drains, cut holes in the field.

L. Galvanizing Repair Paint: ASTM A 780/A 780M.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 31, manufacturer's written instructions, and requirements in this Section.

B. Install temporary shoring before placing deck panels if required to meet deflection limitations.

C. Locate deck bundles to prevent overloading of supporting members.

D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.

E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.

F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.

G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.

H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

I. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

3.3 ROOF-DECK INSTALLATION

A. Fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that is not less than 1-1/2 inches (38 mm) long, and as follows:

1. Weld Diameter: 5/8 inch (16 mm), nominal.
2. Weld Spacing: Weld edge and interior ribs of deck units with a minimum of two welds per deck unit at each support. Space welds 6 inches (150 mm) apart in the field of roof and 6 inches (150 mm) apart in roof corners and perimeter, based on roof-area definitions in FMG Loss Prevention Data Sheet 1-28 but not less than indicated.
3. Weld Washers: Install weld washers at each weld location.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of one-half of the span or 18 inches (457 mm), and as follows:

1. Mechanically fasten with self-drilling, No. 10 (4.8-mm-) diameter or larger, carbon-steel screws.
2. Mechanically clinch or button punch.
3. Fasten with a minimum of 1-1/2-inch- (38-mm-) long welds.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches (38 mm), with end joints as follows:

1. End Joints: Lapped 2 inches (51 mm) minimum or butted at Contractor's option.

D. Roof Sump Pans and Sump Plates: Install over openings provided in roof deck and weld or mechanically fasten flanges to top of deck. Space welds or mechanical fasteners not more than 12 inches (305 mm) apart with at least one attachment at each corner.

E. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Weld or mechanically fasten to substrate to provide a complete deck installation.

1. Weld cover plates at changes in direction of roof-deck panels unless otherwise indicated.

F. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive according to manufacturer's written instructions to ensure complete closure.

3.4 FLOOR-DECK INSTALLATION

A. Fasten floor-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated and as follows:

1. Weld Diameter: 5/8 inch (16 mm), nominal.
2. Weld Spacing: Weld edge ribs of panels at each support. Space additional welds an average of 12 inches (305 mm) apart, but not more than 18 inches (457 mm) apart.
3. Weld Spacing: Space and locate welds as indicated.
4. Weld Washers: Install weld washers at each weld location.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of one-half of the span or 36 inches (914 mm), and as follows:

1. Mechanically fasten with self-drilling, No. 10 (4.8-mm-) diameter or larger, carbon-steel screws.
2. Mechanically clinch or button punch.
3. Fasten with a minimum of 1-1/2-inch- (38-mm-) long welds.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 2 inches (56 mm), with end joints as follows:

1. End Joints: Lapped or butted at Contractor's option.

D. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations unless otherwise indicated.

E. Floor-Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck, according to SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of deck.

F. Install piercing hanger tabs at spacing indicated or required for architectural ceiling and soffit support.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Field welds subject to inspection.

C. Prepare test and inspection reports.

3.6 PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780/A 780M and manufacturer's written instructions.

END OF SECTION 053100

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Interior & exterior load-bearing wall framing.
   2. Roof trusses.
   3. Roof rafter framing.
   4. Ceiling joist framing.

1.2 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide cold-formed metal framing capable of withstanding design loads within limits and under conditions indicated.

   1. Design Loads: As indicated.

   2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:
      a. Interior Load-Bearing Wall Framing: Horizontal deflection of 1/360 of the wall height under a horizontal load of 5 lbf/sq. ft. (239 Pa).
      b. Roof Trusses: Vertical deflection of 1/360 of the span.
      c. Roof Rafter Framing: Horizontal deflection of 1/360 of the horizontally projected span.
      d. Ceiling Joist Framing: Vertical deflection of 1/360 of the span.

   3. Design framing systems to provide for movement of framing members without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F (67 deg C).

B. Cold-Formed Steel Framing, General: Design according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions."

   1. Headers: Design according to AISI's "Standard for Cold-Formed Steel Framing - Header Design."
   2. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.
   3. Roof Trusses: Design according to AISI's "Standard for Cold-Formed Steel Framing - Truss Design."

1.3 SUBMITTALS

A. Product Data: For each type of cold-formed metal framing product and accessory indicated.

B. Shop Drawings: Show layout, spacing(s), sizes, thicknesses, and types of cold-formed metal framing; fabrication; and fastening and anchorage details, including mechanical fasteners. Show reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.

1. For cold-formed metal framing indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Welding certificates.

D. Qualification Data: For professional engineer.

E. Product Test Reports: From a qualified testing agency, unless otherwise stated, indicating that each of the following complies with requirements, based on evaluation of comprehensive tests for current products:

1. Steel sheet.
2. Expansion anchors.
3. Power-actuated anchors.
4. Mechanical fasteners.
5. Vertical deflection clips.
6. Horizontal drift deflection clips
7. Miscellaneous structural clips and accessories.

F. Research/Evaluation Reports: For cold-formed metal framing.

1.4 QUALITY ASSURANCE

A. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a qualified professional engineer.

B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of cold-formed metal framing that are similar to those indicated for this Project in material, design, and extent.

C. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM E 329 to conduct the testing indicated.

D. Product Tests: Mill certificates or data from a qualified independent testing agency, or in-house testing with calibrated test equipment indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements,[ductility,] and metallic-coating thickness.

E. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."

F. AISI Specifications and Standards: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" and its "Standard for Cold-Formed Steel Framing - General Provisions."

1. Comply with AISI's "Standard for Cold-Formed Steel Framing - Truss Design."
2. Comply with AISI's "Standard for Cold-Formed Steel Framing - Header Design."

G. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Store cold-formed metal framing, protect with a waterproof covering, and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering cold-formed metal framing that may be incorporated into the Work include, but are not limited to, the following:

1. Allied Studco.
2. AllSteel Products, Inc.
3. California Expanded Metal Products Company.
4. Clark Steel Framing.
5. Consolidated Fabricators Corp.; Building Products Division.
6. Craco Metals Manufacturing, LLC.
7. Custom Stud, Inc.
8. Dale/Incor.
9. Design Shapes in Steel.
10. Dietrich Metal Framing; a Worthington Industries Company.
11. Formetal Co. Inc. (The).
12. Innovative Steel Systems.
13. MarinoWare; a division of Ware Industries.
14. Quail Run Building Materials, Inc.
15. SCAFCO Corporation.
16. Southeastern Stud & Components, Inc.
17. Steel Construction Systems.
18. Steeler, Inc.
19. Super Stud Building Products, Inc.
20. United Metal Products, Inc.

2.2 MATERIALS

A. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:

1. Grade: ST33H (ST230H), minimum or As required by structural performance.
2. Coating: G60 (Z180), A60 (ZF180), AZ50 (AZ150), or GF30 (ZGF90)].

2.3 LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0428 inch (1.09 mm).

2. Flange Width: 1-5/8 inches (41 mm).
3. Section Properties: As required for structural performance.

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with straight flanges, and as follows:

1. Minimum Base-Metal Thickness: Matching steel studs.
2. Flange Width: 1-1/4 inches (32 mm).

C. Steel Box or Back-to-Back Headers: Manufacturer's standard C-shapes used to form header beams, of web depths indicated, punched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0428 inch (1.09 mm).
2. Flange Width: 1-5/8 inches (41 mm).

2.4 ROOF TRUSSES

A. Roof Truss Members: Manufacturer's standard-shape steel sections.

1. Minimum Base-Metal Thickness: 0.0428 inch (1.09 mm).
2. Flange Width: 1-5/8 inches (41 mm), minimum.
3. Section Properties: As required by structural design and performance.

2.5 ROOF-RAFTER FRAMING

A. Steel Rafters: Manufacturer's standard C-shaped steel sections, of web depths indicated, unpunched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0428 inch (1.09 mm).
2. Flange Width: 1-5/8 inches (41 mm), minimum.
3. Section Properties: As required by structural design and performance.

B. Built-up Members: Built-up members of manufacturer's standard C-shaped steel section, with stiffened flanges, nested into a U-shaped steel section joist track, with unstiffened flanges; unpunched; of web depths indicated; and as follows:

1. Minimum Base-Metal Thickness: Matching steel rafters.
2. Flange Width: 1-5/8 inches (41 mm), minimum.

2.6 CEILING JOIST FRAMING

A. Steel Ceiling Joists: Manufacturer's standard C-shaped steel sections, of web depths indicated, unpunched, or punched with enlarged service holes, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0428 inch (1.09 mm).
2. Flange Width: 1-5/8 inches (41 mm), minimum.
3. Section Properties: As required by structural design and performance.

2.7 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.

B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:

1. Supplementary framing.
2. Bracing, bridging, and solid blocking.
3. Web stiffeners.
4. Anchor clips.
5. End clips.
6. Foundation clips.
7. Gusset plates.
8. Stud kickers, knee braces, and girts.
9. Joist hangers and end closures.
10. Hole reinforcing plates.
11. Backer plates.

2.8 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123/A 123M.

B. Anchor Bolts: ASTM F 1554, Grade 36, threaded carbon-steel hex-headed bolts and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153/A 153M, Class C or mechanically deposition according to ASTM B 695, Class 50.

C. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

D. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as determined by testing per ASTM E 1190 conducted by a qualified independent testing agency.

E. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping steel drill screws.

1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.

F. Welding Electrodes: Comply with AWS standards.

2.9 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: ASTM A 780.

B. Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.

C. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C 1107, with fluid consistency and 30-minute working time.

D. Shims: Load bearing, high-density multimonomer plastic, nonleaching.

E. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch (6.4 mm) thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

2.10 FABRICATION

A. Fabricate cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.

1. Fabricate framing assemblies using jigs or templates.
2. Cut framing members by sawing or shearing; do not torch cut.
3. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.

    a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
    b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by not less than three exposed screw threads.

4. Fasten other materials to cold-formed metal framing by welding, bolting, or screw fastening, according to Shop Drawings.

B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.

C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960) and as follows:

1. Spacing: Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
2. Squareness: Fabricate each cold-formed metal framing assembly to a maximum out-of-square tolerance of 1/8 inch (3 mm).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Install load bearing shims or grout between the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations to ensure a uniform bearing surface on supporting concrete or masonry construction.

B. Install sealer gaskets to isolate the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations.

3.3 INSTALLATION, GENERAL

A. Cold-formed metal framing may be shop or field fabricated for installation, or it may be field assembled.

B. Install cold-formed metal framing according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions" and to manufacturer's written instructions unless more stringent requirements are indicated.

C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.

1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch (1.6 mm).

D. Install cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened.

1. Cut framing members by sawing or shearing; do not torch cut.
2. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.

    a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
    b. Locate mechanical fasteners and install according to Shop Drawings, and complying with requirements for spacing, edge distances, and screw penetration.

E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.

F. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

G. Do not bridge building expansion and control joints with cold-formed metal framing. Independently frame both sides of joints.

H. Install insulation, specified in Division 07 Section "Thermal Insulation," in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.

I. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's standard punched openings.

J. Erection Tolerances: Install cold-formed metal framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960) and as follows:

1. Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.4 LOAD-BEARING WALL INSTALLATION

A. Install continuous top and bottom tracks sized to match studs. Align tracks accurately and securely anchor at corners and ends, and at spacings as follows:

1. Anchor Spacing: To match stud spacing.

B. Squarely seat studs against top and bottom tracks with gap not exceeding of 1/8 inch (3 mm) between the end of wall framing member and the web of track. Fasten both flanges of studs to top and bottom tracks. Space studs as follows:

1. Stud Spacing: 16 inches (406 mm).

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar configurations.

D. Align studs vertically where floor framing interrupts wall-framing continuity. Where studs cannot be aligned, continuously reinforce track to transfer loads.

E. Align floor and roof framing over studs. Where framing cannot be aligned, continuously reinforce track to transfer loads.

F. Anchor studs abutting structural columns or walls, including masonry walls, to supporting structure as indicated.

G. Install headers over wall openings wider than stud spacing. Locate headers above openings as indicated. Fabricate headers of compound shapes indicated or required to transfer load to supporting studs, complete with clip-angle connectors, web stiffeners, or gusset plates.

1. Frame wall openings with not less than a double stud at each jamb of frame as indicated on Shop Drawings. Fasten jamb members together to uniformly distribute loads.
2. Install runner tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with clip angles or by welding, and space jack studs same as full-height wall studs.

H. Install supplementary framing, blocking, and bracing in stud framing indicated to support fixtures, equipment, services, casework, heavy trim, furnishings, and similar work requiring attachment to framing.

1. If type of supplementary support is not indicated, comply with stud manufacturer's written recommendations and industry standards in each case, considering weight or load resulting from item supported.

I. Install horizontal bridging in stud system, spaced as indicated on Shop Drawings. Fasten at each stud intersection.

1. Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs with a minimum of 2 screws into each flange of the clip angle for framing members up to 6 inches (150 mm) deep.
2. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
3. Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.

J. Install steel sheet diagonal bracing straps to both stud flanges, terminate at and fasten to reinforced top and bottom tracks. Fasten clip-angle connectors to multiple studs at ends of bracing and anchor to structure.

K. Install miscellaneous framing and connections, including supplementary framing, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.5 JOIST INSTALLATION

A. Install perimeter joist track sized to match joists. Align and securely anchor or fasten track to supporting structure at corners, ends, and spacings indicated on Shop Drawings.

B. Install joists bearing on supporting frame, level, straight, and plumb; adjust to final position, brace, and reinforce. Fasten joists to both flanges of joist track.

1. Install joists over supporting frame with a minimum end bearing of 1-1/2 inches (38 mm).
2. Reinforce ends and bearing points of joists with web stiffeners, end clips, joist hangers, steel clip angles, or steel-stud sections as indicated on Shop Drawings.

C. Space joists not more than 2 inches (51 mm) from abutting walls, and as follows:

1. Joist Spacing: 16 inches (406 mm).

D. Frame openings with built-up joist headers consisting of joist and joist track, nesting joists, or another combination of connected joists if indicated.

E. Install joist reinforcement at interior supports with single, short length of joist section located directly over interior support, with lapped joists of equal length to joist reinforcement, or as indicated on Shop Drawings.

1. Install web stiffeners to transfer axial loads of walls above.

F. Install bridging at intervals indicated on Shop Drawings. Fasten bridging at each joist intersection as follows:

1. Bridging: Joist-track solid blocking of width and thickness indicated, secured to joist webs.
2. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and joist-track solid blocking of width and thickness indicated. Fasten flat straps to bottom flange of joists and secure solid blocking to joist webs.

G. Secure joists to load-bearing interior walls to prevent lateral movement of bottom flange.

H. Install miscellaneous joist framing and connections, including web stiffeners, closure pieces, clip angles, continuous angles, hold-down angles, anchors, and fasteners, to provide a complete and stable joist-framing assembly.

3.6 TRUSS INSTALLATION

A. Install, bridge, and brace trusses according to Shop Drawings and requirements in this Section.

B. Truss Spacing: As indicated.

C. Do not alter, cut, or remove framing members or connections of trusses.

D. Erect trusses with plane of truss webs plumb and parallel to each other, align, and accurately position at spacings indicated.

E. Erect trusses without damaging framing members or connections.

F. Align webs of bottom chords and load-bearing studs or continuously reinforce track to transfer loads to structure. Anchor trusses securely at all bearing points.

G. Install continuous bridging and permanently brace trusses as indicated on Shop Drawings and designed according to LGSEA's Technical Note 551e, "Design Guide for Permanent Bracing of Cold-Formed Steel Trusses."

3.7 FIELD QUALITY CONTROL

A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Field and shop welds will be subject to testing and inspecting.

C. Testing agency will report test results promptly and in writing to Contractor and Architect.

D. Remove and replace work where test results indicate that it does not comply with specified requirements.

E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.8 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed metal framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 054000

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
1. Steel framing and supports for countertops.
2. Steel framing and supports for mechanical and electrical equipment.
3. Steel framing and supports for applications where framing and supports are not specified in other Sections.
4. Shelf angles.
5. Loose bearing and leveling plates.
6. Steel weld plates and angles for casting into concrete not specified in other Sections.
7. Cast metal nosings at exterior concrete steps.

B. Products furnished, but not installed, under this Section include the following:

1. Loose steel lintels.
2. Anchor bolts, steel pipe sleeves, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.

1.2 PERFORMANCE REQUIREMENTS

A. Thermal Movements: Provide exterior metal fabrications that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

1.3 SUBMITTALS

A. Product Data: For the following:
1. Paint products.
2. Grout.

B. Shop Drawings: Show fabrication and installation details for metal fabrications.

1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
2. Provide templates for anchors and bolts specified for installation under other Sections.
3. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Samples for Verification: For each type and finish of extruded nosing.

D. Mill Certificates: Signed by manufacturers of stainless-steel sheet certifying that products furnished comply with requirements.

E. Welding certificates.

F. Qualification Data: For professional engineer.

1.4 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."
2. AWS D1.2, "Structural Welding Code--Aluminum."
3. AWS D1.3, "Structural Welding Code--Sheet Steel."
4. AWS D1.6, "Structural Welding Code--Stainless Steel."

1.5 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating metal fabrications without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond to established dimensions.
2. Provide allowance for trimming and fitting at site.

1.6 COORDINATION

A. Coordinate installation of anchorages for metal fabrications. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

B. Coordinate installation of steel weld plates and angles for casting into concrete that are specified in this Section but required for work of another Section. Deliver such items to project site in time for installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
2. Products: Subject to compliance with requirements, provide one of the products specified.
3. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

4. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces, unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

2.3 FERROUS METALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 304.

C. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304.

D. Steel Tubing: ASTM A 500, cold-formed steel tubing.

E. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.

F. Cast Iron: ASTM A 48/A 48M, Class 30, unless another class is indicated or required by structural loads.

2.4 NONFERROUS METALS

A. Aluminum Plate and Sheet: ASTM B 209 (ASTM B 209M), Alloy 6061-T6.

B. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063-T6.

C. Aluminum-Alloy Rolled Tread Plate: ASTM B 632/B 632M, Alloy 6061-T6.

D. Aluminum Castings: ASTM B 26/B 26M, Alloy 443.0-F.

2.5 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, at exterior walls. Provide stainless-steel fasteners for fastening aluminum. Select fasteners for type, grade, and class required.

B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with hex nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.

C. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, nuts and, where indicated, flat washers; ASTM F 593 (ASTM F 738M) for bolts and ASTM F 594 (ASTM F 836M) for nuts, Alloy Group [1 (A1)] [2 (A4)].

D. Anchor Bolts: ASTM F 1554, Grade 36.

1. Provide hot-dip or mechanically deposited, zinc-coated anchor bolts where item being fastened is indicated to be galvanized.

E. Eyebolts: ASTM A 489.

F. Machine Screws: ASME B18.6.3 (ASME B18.6.7M).

G. Lag Bolts: ASME B18.2.1 (ASME B18.2.3.8M).

H. Wood Screws: Flat head, ASME B18.6.1.

I. Plain Washers: Round, ASME B18.22.1 (ASME B18.22M).

J. Lock Washers: Helical, spring type, ASME B18.21.1 (ASME B18.21.2M).

K. Cast-in-Place Anchors in Concrete: Anchors capable of sustaining, without failure, a load equal to four times the load imposed, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.

1. Threaded or wedge type; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, hot-dip galvanized per ASTM A 153/A 153M.

L. Expansion Anchors: Anchor bolt and sleeve assembly with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.

1. Material for Anchors in Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5.
2. Material for Anchors in Exterior Locations: Alloy Group [1 (A1)] [2 (A4)] stainless-steel bolts complying with ASTM F 593 (ASTM F 738M) and nuts complying with ASTM F 594 (ASTM F 836M).

2.6 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79.

1. Use primer with a VOC content of 420 g/L (3.5 lb/gal.) or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

C. Zinc-Rich Primer: Complying with SSPC-Paint 20 or SSPC-Paint 29 and compatible with topcoat.

1. Use primer with a VOC content of 420 g/L (3.5 lb/gal.) or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Available Products:

a. Benjamin Moore & Co.; Epoxy Zinc-Rich Primer CM18/19.

b. Carboline Company; Carbozinc 621.
c. ICI Devoe Coatings; Catha-Coat 313.
d. International Coatings Limited; Interzinc 315 Epoxy Zinc-Rich Primer.
e. PPG Architectural Finishes, Inc.; Aquapon Zinc-Rich Primer 97-670.
f. Sherwin-Williams Company (The); Corothane I GalvaPac Zinc Primer.
g. Tnemec Company, Inc.; Tneme-Zinc 90-97.

D. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

F. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

G. Concrete Materials and Properties: Comply with requirements in Division 03 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi (20 MPa), unless otherwise indicated.

2.7 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm), unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work true to line and level with accurate angles and surfaces and straight edges.

E. Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts, unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

1. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches (3.2 by 38 mm), with a minimum 6-inch (150-mm) embedment and 2-inch (50-mm) hook, not less than 8 inches (200 mm) from ends and corners of units and 24 inches (600 mm) o.c., unless otherwise indicated.

2.8 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.

1. Fabricate units from slotted channel framing where indicated.
2. Furnish inserts if units are installed after concrete is placed.

C. Fabricate supports for operable partitions from continuous steel beams of sizes indicated with attached bearing plates, anchors, and braces as indicated. Drill bottom flanges of beams to receive partition track hanger rods; locate holes where indicated on operable partition Shop Drawings.

D. Fabricate steel girders for wood frame construction from continuous steel shapes of sizes indicated.

1. Provide bearing plates welded to beams where indicated.
2. Drill girders and plates for field-bolted connections where indicated.
3. Where wood nailers are attached to girders with bolts or lag screws, drill holes at 24 inches (600 mm) o.c.

E. Galvanize miscellaneous framing and supports where indicated.

F. Prime miscellaneous framing and supports with zinc-rich primer where indicated.

2.9 LOOSE STEEL LINTELS

A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Weld adjoining members together to form a single unit where indicated.

B. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span but not less than 8 inches (200 mm), unless otherwise indicated.

C. Galvanize loose steel lintels located in exterior walls.

2.10 LOOSE BEARING AND LEVELING PLATES

A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

B. Prime plates with zinc-rich primer.

2.11 STEEL WELD PLATES AND ANGLES

A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with not less than two integrally welded steel strap anchors for embedding in concrete.

2.12 CAST METAL NOSINGS

A. Type: Cast iron w/cast on anchors; for poured concrete, concealed integral anchor placed 3 inches from each end and 12 inches oc, 5/16 inch thickness, nose 1/4 inch underside.

1. Width: 3 inches.
2. Length: Full length of tread terminating not less than 4” from each end of step.
3. Surface: Crosshatched or fluted, 1/16 inch deep minimum and shall be clean and well defined.

2.13 MISCELLANEOUS STEEL TRIM

B. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.

C. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.

1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.

D. Galvanize exterior miscellaneous steel trim and interior miscellaneous steel trim, where indicated.

2.14 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal fabrications after assembly.

2.15 STEEL AND IRON FINISHES

C. Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:

1. ASTM A 123/A 123M, for galvanizing steel and iron products.

2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.

D. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:

1. Exteriors (SSPC Zone 1B): SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
2. Interiors (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."

E. Shop Priming: Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

2.16 STAINLESS-STEEL FINISHES

F. Remove tool and die marks and stretch lines or blend into finish.

G. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.

H. Bright, Directional Satin Finish: No. 4.

I. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

2.17 ALUMINUM FINISHES

J. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag bolts, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

F. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.

3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

B. Support steel girders on solid grouted masonry, concrete, or steel pipe columns. Secure girders with anchor bolts embedded in grouted masonry or concrete or with bolts through top plates of pipe columns.

1. Where grout space under bearing plates is indicated for girders supported on concrete or masonry, install as specified in "Installing Bearing and Leveling Plates" Article.

3.3 INSTALLING BEARING AND LEVELING PLATES

A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.

B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.

1. Use nonshrink grout, either metallic or nonmetallic, in concealed locations where not exposed to moisture; use nonshrink, nonmetallic grout in exposed locations, unless otherwise indicated.
2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.4 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 055000

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Aluminum Ships Ladder

1.02 REFERENCES

A. AFPA T10 - AA – Aluminum Association.

B. ASTM B 209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

C. ASTM B 221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

D. OSHA 1910.27 – Fixed Ladders.

1.03 SUBMITTALS

A. See Section 01 3300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide technical data on wood preservative materials and application instructions.

C. Shop Drawings:

1. Detail fabrication and erection of each ladder indicated. Include plans, elevations, sections, and details of metal fabrications and their connections.
2. Provide templates for anchors and bolts specified for installation under other Sections.
3. Provide reaction loads for each hanger and bracket.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: A firm experienced in producing aluminum metal ladders similar to those indicated for this Project.

1. Record of successful in-service performance.
2. Sufficient production capacity to produce required units.
3. Professional engineering competent in design and structural analysis to fabricate ladders in compliance with industry standards and local codes.

B. Installer Qualifications: Competent and experienced firm capable of selecting fasteners and installing ladders to attain designed operational and structural performance.

C. Product Qualification: Product design shall comply with OSHA 1910.27 minimum standards for ladders.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

1.06 PROJECT CONDITIONS

A. Field Measurements: Verify dimensions by field measurement before fabrication.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, indicate established dimensions on shop drawing submittal and proceed with fabrication.

1.07 WARRANTY

A. Manufacturer has responsibility for an extended Corrective Period for work of this Section for a period of 5 years commencing on the shipment date of the product against all the conditions indicated below, and when notified in writing from Owner, manufacturer shall promptly and without inconvenience and cost to Owner correct said deficiencies.

1. Defects in materials and workmanship.
2. Deterioration of material and surface performance below minimum OSHA standards as certified by independent third party testing laboratory. Ordinary wear and tear, unusual abuse or neglect excepted.
3. Within the warranty period, the manufacturer shall, at its option, repair, replace, or refund the purchase price of defective ladder.

B. Manufacturer shall be notified immediately of defective products, and be given a reasonable opportunity to inspect the goods prior to return. Manufacturer will not assume responsibility, or compensation, for unauthorized repairs or labor. Manufacturer makes no other warranty, expressed or implied, to the merchantability, fitness for a particular purpose, design, sale, installation, or use, of the ladder; and shall not be liable for incidental or consequential damages, losses of or expenses, resulting from the use of ladder products

1.08 EXTRA MATERIALS

A. Furnish touchup kit for each type and color of paint finish provided.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Ship Ladder with Platform.

1. Model 521 as manufactured by O'Keeffe's Inc.
2. Other manufacturers meeting specifications will be considered.

B. Incline: 60 deg.
C. Finish: Mill Finish

2.02 MATERIALS

A. Aluminum Sheet: Alloy 5005-H34 to comply with ASTM B209.

B. Aluminum Extrusions: Alloy 6063-T6 to comply with ASTM B221.

2.03 FABRICATION

A. Rungs: Not less than 1-1/4 inches (32 mm) in section and 18–3/8 inches (467mm) long, formed from tubular aluminum extrusions. Squared and deeply serrated on all sides.

1. Rungs shall withstand a 1,500 pound (454 kg) load without deformation or failure.

B. Channel Side Rails: Not less than 1/8 inch (3 mm) wall thickness by 3 inches (76 mm) wide.

C. Ship Ladders: Not less than 1-1/4 inches (32mm) high, 4-1/8 inch (105 mm) deep and 2 feet (610 mm) wide; tread spacing shall be 1 foot (305 mm) on center. Handrails shall be aluminum pipe, not less than 1-1/2 inches (38 mm) in diameter with hemispheric end caps.

D. Walk-Through Rail and Roof Rail Extension: Not less than 3 feet 6 inches (1067 mm) above the landing and shall be fitted with deeply serrated, square, tubular grab rails.

E. Landing Platform: 1-1/2 inches (38 mm) or greater diameter, tubular aluminum guardrails and decks of serrated aluminum treads.

PART 3 EXECUTION

3.01 EXAMINATION

A. Select material sizes to minimize waste Coordinate anchorages. Furnish setting drawings, templates, and anchorage structural loads for fastener resistance.

B. Do not begin installation until supporting structure is complete and ladder installation will not interfere with supporting structure work.

C. If supporting structure is the responsibility of another installer, notify Architect of unsatisfactory supporting work before proceeding.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions and in proper relationship with adjacent construction.

3.03 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Free-standing railings at exterior steps.

B. Related Sections:

1. Section 03 3300 - Cast-in-Place Concrete: Placement of anchors in concrete.
2. Section 09 9000 - Paints and Coatings: Paint finish.

1.02 REFERENCES

A. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2010.

1.03 SUBMITTALS

A. See Section 01 3300 - Administrative Requirements, for submittal procedures.

B. Shop Drawings:

1. Indicate profiles, sizes, connection attachments, anchorage, size and type of fasteners, and accessories.

1.04 QUALITY ASSURANCE

A. Structural Designer Qualifications: Professional Structural Engineer experienced in design of this work and licensed in Georgia, 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.

1.05 COORDINATION

A. Coordinate installation of anchorages for handrails and railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Design, fabricate, and test railing assemblies in accordance with the most stringent requirements of ASTM E985 and applicable local code.

B. Concentrated Loads: Design railing assembly, wall rails, and attachments to resist a concentrated force of 200 pounds applied at any point on the top of the assembly and in any direction, without damage or permanent set. Test in accordance with ASTM E 935.

C. Design railing assembly, wall rails, and attachments to resist lateral force of 75 lbs at any point without damage or permanent set. Test in accordance with ASTM E 935.

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 diameter, round.

2. Intermediate Rails: 1-1/2 inches diameter, round.
3. Posts: 1-1/2 inches diameter, round.
4. Balusters: 1/2 inch square solid bar.

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 welding 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.

H. Provide standard guardrail systems to provide fall protection for working spaces around mechanical and electrical equipment to permit ready and safe operation and maintenance of such equipment according to OSHA 29 CFR 1910.23(c)2) and OSHA 29 CFR 1910.303(g).

2.02 STEEL RAILING SYSTEM

A. Steel Tube: ASTM A 500, Grade B cold-formed structural tubing.

B. Steel Pipe: ASTM A 53/A 53M, Grade B Schedule 40, black finish.

C. Non-Weld Mechanical Fittings: Slip-on, galvanized malleable iron castings, for Schedule 40 pipe, with flush setscrews for tightening by standard hex wrench, no bolts or screw fasteners.

D. Welding Fittings: Factory- or shop-welded from matching pipe or tube; seams continuously welded; joints and seams ground smooth.

E. Exposed Fasteners: No exposed bolts or screws.

F. 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.

D. Welded Joints:
1. Exterior Components: Continuously seal joined pieces by continuous welds. Drill condensate drainage holes at bottom of members at locations that will not encourage water intrusion.
2. Interior Components: Continuously seal joined pieces by continuous welds.
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.

2.04 STEEL FINISHES

A. Fill vent and drain holes that will be exposed in the finished work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.

B. Painted Railings (Exterior only):

1. Color: Dark Bronze.

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 with setting templates, for installation as work of other sections.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install components plumb and level, accurately fitted, free from distortion or defects, with tight joints.

C. Anchor railings securely to structure.

D. Field weld anchors as indicated on drawings. Touch-up welds with primer. Grind welds smooth.

E. Conceal anchor bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.

3.04 TOLERANCES

A. Maximum Variation from Plumb: 1/4 inch per floor level, non-cumulative.

B. Maximum Offset from True Alignment: 1/4 inch.

C. Maximum Out-of-Position: 1/4 inch.

3.05 PROTECTION

A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by the railing manufacturer. Remove protective coverings at time of Substantial Completion.

B. Restore finishes damaged during installation and construction period so no evidence remains of corrective work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Framing with dimension lumber.
B. Framing with engineered wood products.
C. Rooftop equipment bases and support curbs.
D. Miscellaneous wood nailers, furring, and grounds.
E. Plywood backing panels.

1.02 REFERENCES

A. AFPA T10 - Wood Frame Construction Manual; American Forest and Paper Association; 2001.

B. ASTM A 153/A 153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2005.

C. ASTM D 2898 - Standard Test Methods for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing; 1994 (Reapproved 2004).

D. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2005.

E. AWPA C2 - Lumber, Timber, Bridge Ties and Mine Ties -- Preservative Treatment by Pressure Processes; American Wood-Preservers' Association; 2002.

F. AWPA C9 - Plywood -- Preservative Treatment by Pressure Processes; American Wood-Preservers' Association; 2003.

G. AWPA C20 - Structural Lumber -- Fire Retardant Treatment by Pressure Processes; American Wood-Preservers' Association; 2002.

H. AWPA C27 - Plywood -- Fire-Retardant Treatment by Pressure Processes; American Wood-Preservers' Association; 2002.

I. AWPA U1 - Use Category System: User Specification for Treated Wood; American Wood-Preservers' Association; 2006.

J. PS 1 - Construction and Industrial Plywood; National Institute of Standards and Technology (Department of Commerce); 1995.

K. PS 20 - American Softwood Lumber Standard; National Institute of Standards and Technology (Department of Commerce); 2005.

L. SPIB (GR) - Grading Rules; Southern Pine Inspection Bureau, Inc.; 2002.

1.03 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide technical data on wood preservative materials and application instructions.

1.04 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.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Dimension Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. Provide S4S, No. 2 or better grade lumber, unless otherwise indicated.

B. Maximum Moisture Content of Lumber: 19 percent, unless otherwise indicated.

C. Engineered Wood Products: Acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for project.

1. Allowable design stresses, as published by manufacturer, shall meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

2.02 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:
a. Arch Wood Protection, Inc: www.wolmanizedwood.com.
b. Hoover Treated Wood Products, Inc: www.frtw.com.
c. Substitutions: See Section 01600 - Product Requirements.

2. Exterior Type: AWPA Use Category UCFB, Commodity Specification H (Treatment C20 for lumber and C27 for plywood), chemically treated and pressure impregnated; capable of providing a maximum flame spread rating of 25 when tested in accordance with ASTM E 84, with no evidence of significant combustion when test is extended for an additional 20 minutes both before and after accelerated weathering test performed in accordance with ASTM D 2898.
a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
b. Do not use treated wood in direct contact with the ground.

3. Interior Type A: AWPA Use Category UCFA, Commodity Specification H (Treatment C20 for lumber and C27 for plywood), low temperature (low hygroscopic) type, chemically treated and pressure impregnated; capable of providing a maximum flame spread rating of 25 when tested in accordance with ASTM E 84, 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. Arch Wood Protection, Inc: www.wolmanizedwood.com.
b. Chemical Specialties, Inc: www.treatedwood.com.
c. Osmose, Inc: www.osmose.com.
d. Substitutions: See Section 01600 - Product Requirements.

D. Preservative Pressure Treatment of Lumber Above Grade: AWPA Use Category UC3B, Commodity Specification A (Treatment C2) using waterborne preservative to 0.25 lb/cu ft retention.
1. Kiln dry lumber after treatment to maximum moisture content of 19 percent.
2. Treat lumber in contact with roofing, flashing, or waterproofing.
3. Treat lumber in contact with masonry or concrete.
4. Treat lumber less than 18 inches above grade.
5. Preservative Pressure Treatment of Plywood Above Grade: AWPA Use Category UC2 and UC3B, Commodity Specification F (Treatment C9) using waterborne preservative to 0.25 lb/cu ft retention.
a. Kiln dry plywood after treatment to maximum moisture content of 19 percent.
b. Treat plywood in contact with roofing, flashing, or waterproofing.
c. Treat plywood in contact with masonry or concrete.
d. Treat plywood less than 18 inches above grade.

2.03 DIMENSION LUMBER

A. Non-Load-Bearing Interior Partitions: Construction or No. 2 grade.

1. Application: All interior partitions.
2. Species:

a. Southern pine or mixed southern pine; SPIB.
b. Northern species; NLGA.
c. Eastern softwoods; NeLMA.
d. Western woods; WCLIB or WWPA.

B. Framing Other Than Non-Load-Bearing Interior Partitions: No. 2 grade.

1. Application: Framing other than interior partitions.
2. Species:

a. Southern pine; SPIB.
b. Douglas Fir-Larch; WCLIB or WWPA.
c. Southern pine or mixed southern pine; SPIB.
d. Hem-fir (north); NLGA.
e. Spruce-pine-fir; NLGA.
f. Douglas fir-south; WWPA.
g. Hem-fir; WCLIB or WWPA.
h. Douglas fir-larch (north); NLGA.
i. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.

C. Framing Other Than Non-Load-Bearing Partitions: Any species and grade with a modulus of elasticity of at least 1,100,000 psi (7590 MPa) and an extreme fiber stress in bending of at least 850 psi (5.86 MPa) for 2-inch nominal (38-mm actual) thickness and 12-inch nominal (286-mm actual) width for single-member use or as required in structural documents.

1. Application: Framing other than interior partitions not indicated as load-bearing.

D. Exposed Framing: Hand-select material for uniformity of appearance and freedom from characteristics, on exposed surfaces and edges, that would impair finish appearance, including decay, honeycomb, knot-holes, shake, splits, torn grain, and wane.

1. Species and Grade: As indicated above for load-bearing construction of same type.

2.04 ENGINEERED WOOD PRODUCTS

A. Laminated-Veneer Lumber: Structural composite lumber made from wood veneers with grain primarily parallel to member lengths, evaluated and monitored according to ASTM D 5456 and manufactured with an exterior-type adhesive complying with ASTM D 2559.

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. Georgia-Pacific Building Products.
b. Jager Building Systems, Inc.
c. Weyerhaeuser Company.

2. Extreme Fiber Stress in Bending, Edgewise: Per structural design requirements.

3. Modulus of Elasticity, Edgewise: Per structural design requirements.

2.05 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

1. Blocking.
2. Nailers.
3. Rooftop equipment bases and support curbs.
4. Cants.
5. Furring.
6. Grounds.

B. For items of dimension lumber size, provide Construction or No. 2 grade lumber of any species.

C. For concealed boards, provide lumber with 19 percent maximum moisture content and any of the following species and grades:

1. Mixed southern pine; No. 2 grade; SPIB.
2. Nailers. Eastern softwoods; No. 2 Common grade; NeLMA.
3. Northern species; No. 2 Common grade; NLGA.
4. Western woods; Construction or No. 2 Common grade; WCLIB or WWPA.

2.06 PLYWOOD BACKING PANELS

A. Communications and Electrical Room Mounting Boards: Interior grade, A-D plywood, 3/4 inch thick; flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E 84.

B. Other Applications:
1. Concealed Plywood: PS 1, C-C Plugged, exterior grade.

2. Exposed Plywood: PS 1, A-D, interior grade.
3. Electrical Component Mounting: APA rated sheathing, fire retardant treated.

2.07 FASTENERS

A. General: Fasteners shall be of size and type indicated and shall comply with requirements specified in this article for material and manufacture.

1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

B. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

C. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on structural design requirements as appropriate for the substrate.

2.08 METAL FRAMING ANCHORS

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

1. Cleveland Steel Specialty Co.
2. KC Metals Products, Inc.
3. Simpson Strong-Tie Co., Inc.
4. USP Structural Connectors.
5. Phoenix Metal Products, Inc.

B. Allowable design loads, as published by manufacturer, shall meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency. Framing anchors shall be punched for fasteners adequate to withstand same loads as framing anchors.

C. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 (Z180) coating designation.

1. Use for interior locations unless otherwise indicated.

D. Hot-Dip, Heavy-Galvanized Steel Sheet: ASTM A 653/A 653M; structural steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G185 (Z550) coating designation; and not less than 0.036 inch (0.9 mm) thick.

1. Use for wood-preservative-treated lumber and where indicated.

2.09 MISCELLANEOUS MATERIALS

A. Sill-Sealer Gaskets: Glass-fiber-resilient insulation, fabricated in strip form, for use as a sill sealer; 1-inch (25-mm) nominal thickness, compressible to 1/32 inch (0.8 mm); selected from manufacturer's standard widths to suit width of sill members indicated.

B. Sill-Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch (6.4 mm) thick, selected from manufacturer's standard widths to suit width of sill members indicated.

C. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber or rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum

foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch (0.6 mm).

PART 3 EXECUTION

3.01 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.

D. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.

E. Install fire-retardant treated plywood backing panels with classification marking of testing agency exposed to view.

F. Metal Framing Anchors: Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.

G. Do not splice structural members between supports unless otherwise indicated.

H. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

I. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

J. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. NES NER-272 for power-driven fasteners.
2. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.

3.02 BLOCKING, NAILERS, AND SUPPORTS

A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.

3.03 INSTALLATION OF CONSTRUCTION PANELS

A. Communications and Electrical Room Mounting Boards: Secure with screws to studs with edges over firm; space fasteners at maximum 24 inches on center on all edges and into studs in field of board.
1. At fire-rated walls, install board over wall board indicated as part of the fire-rated assembly.
2. Where boards are indicated as full floor-to-ceiling height, install with long edge of board parallel to studs.
3. Install adjacent boards without gaps.

3.04 TOLERANCES

A. Framing Members: 1/4 inch from true position, maximum.

B. Surface Flatness of Floor: 1/8 inch in 10 feet maximum, and 1/4 inch in 30 feet maximum.

C. Variation from Plane (Other than Floors): 1/4 inch in 10 feet maximum, and 1/4 inch in 30 feet maximum.

3.05 PROTECTION

A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet enough that moisture content exceeds that specified, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

3.06 CLEANING

A. Waste Disposal: Comply with the requirements of Section 01732.
   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. Section includes:
   1. Fiberglass-mat faced, moisture and mold resistant gypsum sheathing.

B. Related Sections:
   1. Section 05 4000 Cold-Formed Metal Framing.
   2. Section 06 1000 Rough Carpentry.
   3. Section 09 2116 Gypsum Board Assemblies.

1.02 REFERENCES

A. American Society for Testing and Materials:
   1. ASTM C 297: Standard Test Method for Flatwise Tensile Strength of Sandwich Constructions
   2. ASTM C 954: Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 inch to 0.110 inch in Thickness
   3. ASTM C 1002: Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
   4. ASTM C 1177: Standard Specification for Glass Mat Gypsum – Substrate for use as Sheathing.
   5. ASTM C 1280: Standard Specification for Application of Gypsum Sheathing.
   6. ASTM C 1396: Standard Specification for Gypsum Board.
   7. ASTM D 226: Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
   8. ASTM E 84: Standard Test Method for Surface Burning Characteristics of Building Materials.
   9. ASTM E 119: Test Method for Fire Tests of Building Construction and Materials.
   10. ASTM E 1677: Standard Specification for an Air Retarder (AR) Material or System for Low-Rise Framed Building Walls.

B. Gypsum Association:
   1. GA 253: Recommended Specification for the Application of Gypsum Sheathing.

1.03 SUBMITTALS

A. Product Data: Manufacturer's specifications and installation instructions for each product specified.

1.04 DELIVERY, STORAGE AND HANDLING

A. All materials shall be delivered in their original unopened packages and stored in an enclosed shelter providing protection from damage and exposure to the elements. Store all Glass Mat Sheathing flat per manufacturer's recommendations.

1.05 WARRANTY

A. Provide products that offer twelve months of coverage against in-place exposure damage (delamination, deterioration and decay) commencing with the date of Substantial Completion.

B. Manufacturer's Warranty:
   1. Five years against manufacturing defects from the date of purchase of the product for installation.
   2. 12 years against manufacturing defects when used as a substrate in architecturally specified EIFS.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Georgia-Pacific Gypsum LLC:
   1. Fiberglass-Mat Faced Gypsum Sheathing: DensGlass Sheathing.

B. Other approved manufacturers:
   1. National Gypsum Company: Gold Bond EXP
   2. USG: Securock

2.02 MATERIALS

A. Fiberglass-Mat Faced Gypsum Sheathing: ASTM C1177:

   1. Thickness: 1/2 inch.
   2. Width: 4 feet.
   3. Length: 8 feet.
   4. Weight: 1.9 lb/sq. ft.
   5. Edges: Square.
   6. Surfacing: Fiberglass mat on face, back, and long edges.
   7. Racking Strength (Ultimate, not design value) (ASTM E72): Not less than 540 pounds per square foot, dry.
   8. Flexural Strength, Parallel (ASTM C473): 80 lbf, parallel.
   9. Humidified Deflection (ASTM C1177): Not more than 2/8 inch.
   10. Permeance (ASTM E96): Not less than 23 perms.
   11. R-Value (ASTM C518): 0.56.
   12. Mold Resistance (ASTM D3273): 10, in a test as manufactured.
   13. Microbial Resistance (ASTM D6329, UL Environmental GREENGUARD 3-week protocol): Will not support microbial growth.

B. Fire-Rated Fiberglass-Mat Faced Gypsum Sheathing: ASTM C1177, Type X: (Where Required)

   1. Thickness: 5/8 inch.
   2. Width: 4 feet.
   3. Length: 8 feet.
   4. Weight: 2.5 lb/sq. ft.
   5. Edges: Square.
   6. Surfacing: Fiberglass mat on face, back, and long edges.
   7. Racking Strength (Ultimate, not design value) (ASTM E72): Not less than 654 pounds per square foot, dry.
   8. Flexural Strength, Parallel (ASTM C1177): 100 lbf, parallel.
   9. Humidified Deflection (ASTM C1177): Not more than 1/8 inch.
   10. Permeance (ASTM E96): Not less than 17 perms.
   11. R-Value (ASTM C518): 0.67.
   12. Mold Resistance (ASTM D3273): 10, in a test as manufactured.
   13. Microbial Resistance (ASTM D6329, UL Environmental GREENGUARD 3-week protocol): Will not support microbial growth.

2.03 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and application.

   1. For wall sheathing, provide fasteners of Type 304 stainless steel.

B. Nails, Brads, and Staples: ASTM F 1667.

C. Power-Driven Fasteners: NES NER-272.

D. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing board to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.

1. For steel framing less than 0.0329 inch thick, attach sheathing to comply with ASTM C 1002.
2. For steel framing from 0.033 to 0.112 inch thick, attach sheathing to comply with ASTM C 954.

2.04 MISCELLANEOUS MATERIALS

A. Sealant for Glass Mat Gypsum Sheathing Board: Elastomeric, medium-modulus, neutral-curing silicone joint sealant compatible with joint substrates formed by gypsum sheathing and other materials.

B. Sealant for Glass-Mat Gypsum Sheathing Board: Silicone emulsion sealant complying with ASTM C 834, compatible with sheathing tape and sheathing.

C. Sheathing Tape for Glass-Mat Gypsum Sheathing Board: Self –adhering, glass fiber tape, minimum 2” wide for use with silicone emulsion sealant in sealing joints in glass-mat gypsum sheathing board.

D. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene film to produce an overall thickness of not less than 0.025 inch.

E. Primer for Flexible Flashing: Product recommended by manufacturer of flexible flashing for substrate.

PART 3 EXECUTION

3.01 INSTALLATION - GENERAL

A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

B. Cut panels at penetrations, edges, and other obstructions of work; fit closely against abutting construction, unless otherwise indicated.

C. Coordinate wall sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

D. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

3.02 SHEATHING INSTALLATION

A. Comply with ASTM C 1280, GA-253 and manufacturer's written instructions.
1. Fasten sheathing to wood framing with screws.
2. Fasten sheathing to cold-formed metal framing with screws.
3. Install boards with a 3/8-inch gap where non-load-bearing construction abuts structural elements.
4. Install boards with a 1/4-inch gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.

B. Apply fasteners so heads bear tightly against face of sheathing boards but do not cut into facing.

C. Sheathing may be installed with the long dimension of the sheathing either parallel or perpendicular to framing. Board orientation to be dictated by performance requirements. Abut ends and/or edges of the boards centered over face of framing members. Offset board joints by not less than one stud spacing.

1. Space fasteners a maximum of 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of boards. Adjust spacing of fasteners to meet specific fire or structural performance requirements.
2. For sheathing under stucco cladding, boards may be initially tacked in place with screws if overlying self-furring metal lath is screw-attached through sheathing to studs immediately after sheathing is installed.

3.03 SHEATHING JOINT-AND-PENETRATION TREATMENT

A. Seal sheathing joints according to sheathing manufacturer's written instructions.

1. Apply elastomeric sealant to joints and fasteners and trowel flat. Apply sufficient quantity of sealant to completely cover joints and fasteners after troweling. Seal other penetrations and openings.

3.04 FLEXIBLE FLASHING INSTALLATION

A. Apply flexible flashing where indicated to comply with manufacturers written instructions.

1. Prime substrates as recommended by flashing manufacturer.
2. Lap seams and junctures with other materials at least 4 inches, except that at flashing flanges of other construction, laps need not exceed flange width.
3. Lap flashing over weather-resistant building paper at bottom and sides of openings.
4. Lap weather-resistant building paper over flashing at heads of openings.
5. After flashing has been applied, roll surfaces with a hard rubber or metal roller to ensure that flashing is completely adhered to substrates.

END OF SECTION

PART 1 GENERAL

1.01 SUMMARY

A. Section includes:
   1. Wood cabinets.
   2. Plastic-laminate cabinets.
   3. Plastic-laminate countertops.
   4. Quartz countertops.
   5. Shop finishing of woodwork.

B. Related section includes:
   1. Division 06 Section "Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing woodwork and concealed within other construction before woodwork installation.

C. Interior architectural woodwork includes wood furring, blocking, shims, and hanging strips unless concealed within other construction before woodwork installation.

1.02 SUBMITTALS

A. Product Data: For solid-surfacing material, cabinet hardware and accessories, and finishing materials and processes.

B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

C. Samples:
   1. Lumber and panel products for transparent finish, for each species and cut, finished on one side and one edge.
   2. Lumber and panel products with shop-applied opaque finish, for each finish system and color, with exposed surface finished.
   3. Plastic-laminates, for each type, color, pattern, and surface finish.
   4. Quartz countertop: (2) 3”x3” samples in color selected in finish schedule.

D. Woodwork Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

1.03 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance. Casework manufacturer shall be a Certified Participant in the Architectural Woodwork Institute (AWI) Quality Certification Program.

B. Installer Qualifications: Certified participant in AWI's Quality Certification Program.

C. Quality Standard: Unless otherwise indicated, comply with AWI's Architectural Woodwork Quality Standards for grades of interior architectural woodwork, construction, finishes and other requirements. Provide AWI Quality Certification Program Certificates indicating that the woodwork, including installation, complies with requirements of grades specified.

   1. Provide AWI Quality Certification Program labels and certificates indicating that woodwork, including installation, complies with requirements of grades specified.

1.04 DELIVERY, STORAGE AND HANDLING

A. Do not deliver woodwork until painting and similar operations that could damage woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Project Conditions" Article.

B. Quartz Countertop:

1. Observe manufacturer’s recommendations and handle in a manner to prevent breakage. Brace parts if necessary. Transport in the near vertical position with finished face toward finished face. Do not allow finished surfaces to rub during shipping and handling.
2. Store in racks in near vertical position. Prevent warpage and breakage. Store inside away from direct exposure to sunlight.

1.05 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F (16 and 32 deg C) and relative humidity between 43 and 70 percent during the remainder of the construction period.

C. Field Measurements: Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed, and indicate measurements on Shop Drawings.

1.06 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that interior architectural woodwork can be supported and installed as indicated.

PART 2 PRODUCTS

2.01 GENERAL

A. Regional Materials: Wood cabinets for transparent finish shall be manufactured within 500 miles (800 km) of Project site.

2.02 WOODWORK FABRICATORS

A. Fabricators: Casework manufacturer shall be a Certified Participant in the Architectural Woodwork Institute (AWI) Quality Certification Program.

2.03 MATERIALS

A. General: Provide materials that comply with requirements of AWI's quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.

B. Wood Species and Cut for Transparent Finish: Select White Maple, or Select White ash, plain sawn or sliced.

C. Wood Species for Opaque Finish: Any closed-grain hardwood, Eastern white pine, sugar pine, or western white pine.

D. Wood Products:

1. Medium-Density Fiberboard: ANSI A208.2, Grade MD, made with binder containing no urea formaldehyde.
2. Particleboard: ANSI A208.1, Grade M-2.
3. Softwood Plywood: DOC PS 1, Medium Density Overlay.
4. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1, made with adhesive containing no urea formaldehyde.

E. Thermoset Decorative Panels: Particleboard or medium-density fiberboard finished with thermally fused, melamine-impregnated decorative paper complying with LMA SAT-1.

1. Provide PVC or polyester edge banding complying with LMA EDG-1 on components with exposed or semi-exposed edges.

F. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or, if not indicated, as required by woodwork quality standard.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering high-pressure decorative laminates that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturer: Subject to compliance with requirements, provide high-pressure decorative laminates by one of the following:
   a. Formica Corporation.
   b. Lamin-Art, Inc.
   c. Nevamar Company, LLC; Decorative Products Div.
   d. Panolam Industries International Incorporated.
   e. Wilsonart International; Div. of Premark International, Inc.

2.04 CABINET HARDWARE AND ACCESSORIES

A. General: Provide cabinet hardware and accessory materials associated with architectural woodwork, except for items specified in Division 08 Section "Door Hardware."

B. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 135 degrees of opening.

C. Back-Mounted Pulls: BHMA A156.9, B02011.

D. Wire Pulls: Back mounted, solid metal, 4 inches (100 mm) long, 5/16 inch (8 mm) in diameter.

E. Catches: Magnetic catches, BHMA A156.9, B03141.

F. Steel Pilaster Standards: Mortised metal standard, 5/8” wide x 3/16” deep, full height of cabinet. Zinc finish. Adjustable on 1/2” centers.

G. Adjustable Shelf Supports:

1. Adjustable shelf supports inserted in shelf holes drilled into the case end or partitions and adjustable on 1 1/4" centers.
   a. Shelf Rests: BHMA A156.9, B04013; Metal shelf supports designed for 1/4" holes. Pin length: 3/8". Shelf Rest: 1/2" width x 11/16" depth, Anochrome finish.
2. For use with mortised, metal shelf standards.
   a. Shelf Rests: BHMA A156.9, B04013; metal, two-pin type with shelf hold-down clip.

H. Drawer Slides: BHMA A156.9, B05091.

1. Heavy Duty (Grade 1HD-100 and Grade 1HD-200): Side mounted; full-extension type;

zinc-plated steel ball-bearing slides.
2. Box Drawer Slides: Grade 1HD-100; for drawers not more than 6 inches (150 mm) high and 24 inches (600 mm) wide.
3. File Drawer Slides: Grade 1HD-200; for drawers more than 6 inches (150 mm) high or 24 inches (600 mm) wide.
4. Pencil Drawer Slides: Grade 1; for drawers not more than 3 inches (75 mm) high and 24 inches (600 mm) wide.

I. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.

1. Satin Stainless Steel: BHMA 630.

J. Door Locks: BHMA A156.11, E07121.

K. Drawer Locks: BHMA A156.11, E07041.

L. Grommets for Cable Passage through Countertops: 1-1/4-inch (32-mm) OD, black, molded-plastic grommets and matching plastic caps with slot for wire passage.

2.05 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln-dried to less than 15 percent moisture content.

B. Adhesives, General: Do not use adhesives that contain urea formaldehyde

2.06 FABRICATION

A. Interior Woodwork Grade: Unless otherwise indicated, for interior woodwork provide Premium grade for transparent finish and Custom grade for plastic laminate clad finish, complying with referenced quality standard.

B. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.

C. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.

D. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:

1. Corners of Cabinets and Edges of Solid-Wood (Lumber) Members 3/4 Inch (19 mm) Thick or Less: 1/16 inch (1.5 mm)..
2. Corners of Cabinets and Edges of Solid-Wood (Lumber) Members and Rails: 1/16 inch (1.5 mm).

E. Complete fabrication, including assembly, finishing, and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

F. Shop-cut openings to maximum extent possible to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

1. Seal edges of openings in countertops with a coat of varnish.

2.07 WOOD CABINETS FOR TRANSPARENT FINISH

A. Grade: Premium.

B. AWI Type of Cabinet Construction: Flush overlay.

C. Wood Species and Cut for Exposed Surfaces: Select White Maple, or Select White ash, plain sawn or sliced.

1. Grain Direction: Vertically for drawer fronts, doors, and fixed panels.
2. Matching of Veneer Leaves: Book match.
3. Vertical Matching of Veneer Leaves: End match.
4. Veneer Matching within Panel Face: Running match.

D. Semi-exposed Surfaces: Provide surface materials indicated below:

1. Surfaces Other Than Drawer Bodies: Same species and cut indicated for exposed surfaces.
2. Drawer Sides and Backs: Thermoset decorative panels.
3. Drawer Bottoms: Hardwood plywood.

2.08 PLASTIC-LAMINATE CABINETS

A. Grade: Custom.

B. AWI Type of Cabinet Construction: Reveal overlay.

C. Reveal Dimension: 1/2 inch (13 mm).

D. Laminate Cladding for Exposed Surfaces: High-pressure decorative laminate complying with the following requirements:

1. Horizontal Surfaces Other Than Tops: Grade HGS.
2. Vertical Surfaces: Grade VGS.
3. Edges: PVC edge banding 0.12 inch (3 mm) thick, matching laminate in color, pattern, and finish.

E. Materials for Semi-exposed Surfaces:

1. Surfaces Other Than Drawer Bodies: Thermoset decorative panels.
   a. Edges of Plastic-Laminate Shelves: PVC tape, 0.018-inch (0.460-mm) minimum thickness, matching laminate in color, pattern, and finish.
   b. For semi-exposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, Grade VGS.
2. Drawer Sides and Backs: Minimum 1/2 inch (13 mm) Thermoset decorative panels.
3. Drawer Bottoms: Hardwood plywood or thermoset decorative panels.

F. Concealed Backs of Panels with Exposed Plastic Laminate Surfaces: High-pressure decorative laminate, Grade BKL.

G. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:

1. As indicated by laminate manufacturer's designations.

2.09 PLASTIC-LAMINATE COUNTERTOPS

A. Grade: Custom.

B. High-Pressure Decorative Laminate Grade: HGS.

C. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures

of exposed laminate surfaces complying with the following requirements:

1. As indicated by manufacturer's designations.

D. Edge Treatment: Same as laminate cladding on horizontal surfaces.

E. Core Material: 3/4-inch (19-mm) plywood.

F. Core Material at Sinks: 3/4-inch (19-mm) exterior-grade plywood.

G. Backer Sheet: Provide plastic-laminate backer sheet, Grade BKL, on underside of countertop substrate.

2.10 QUARTZ COUNTERTOPS

A. Manufacturer: Cambria (Basis-of-Design).

B. Color: Sutton #1760; Quarry Collection.

C. Thickness: 3 cm.

D. Finish: Polished.

E. Edge Profile: Volcanic (radiused top and bottom edges).

F. Adhesive: Provide type as recommended by countertop manufacturer for application and conditions of use.

2.11 WINDOW SILLS

A. Prefabricated solid surface window sill, similar to, as manufactured by Corian or as approved by the Architect. Sills shall be ½ inch thick with an eased front edge and 1 1/2 inch dog ear at each end and 1 inch projection from finished gwb wall. Color shall be as identified in Finish Schedule.

2.12 SHOP FINISHING

A. Grade: Provide finishes of same grades as items to be finished.

B. General: Finish architectural woodwork at fabrication shop as specified in this Section. Defer only final touchup, cleaning, and polishing until after installation.

C. Preparation for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing architectural woodwork, as applicable to each unit of work.

1. Back-priming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of woodwork. Apply two coats to back of paneling and to end-grain surfaces. Concealed surfaces of plastic-laminate-clad woodwork do not require back-priming when surfaced with plastic laminate, backing paper, or thermoset decorative panels.

D. Transparent Finish:
1. AWI Finish System: Catalyzed polyurethane.
2. AWI Finish System: Two-component polyester.
3. Staining: Match Design Professional's sample.
4. Wash Coat for Stained Finish: Apply wash-coat sealer to woodwork made from closed-grain wood before staining and finishing.
5. Open Finish for Open-Grain Woods: Do not apply filler to open-grain woods.
6. Filled Finish for Open-Grain Woods: After staining (if any), apply paste wood filler to open-grain woods and wipe off excess. Tint filler to match stained wood.

a. Apply wash-coat sealer after staining and before filling.

7. Sheen: Semigloss, 46-60 gloss units measured on 60-degree gloss meter per ASTM D 523.

PART 3 EXECUTION

3.01 PREPARATION

A. Before installation, condition woodwork to average prevailing humidity conditions in installation areas.

B. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and back-priming.

3.02 INSTALLATION

A. Grade: Install woodwork to comply with requirements for the same grade specified in Part 2 for fabrication of type of woodwork involved.

B. Assemble woodwork and complete fabrication at Project site to comply with requirements for fabrication in Part 2, to extent that it was not completed in the shop.

C. Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm).

D. Scribe and cut woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

E. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.

F. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.

1. Install cabinets with no more than 1/8 inch in 96-inch (3 mm in 2400-mm) sag, bow, or other variation from a straight line.
2. Maintain veneer sequence matching of cabinets with transparent finish.
3. Fasten wall cabinets through back, near top and bottom, at ends and not more than 16 inches (400 mm) o.c. with No. 10 wafer-head screws sized for 1-inch (25-mm) penetration into wood framing, blocking, or hanging strips or No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish.

G. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.

1. Install countertops with no more than 1/8 inch in 96-inch (3 mm in 2400-mm) sag, bow, or other variation from a straight line.
2. Secure backsplashes to walls with adhesive.
3. Calk space between backsplash and wall with sealant specified in Division 07 Section "Joint Sealants."

H. Touch up finishing work specified in this Section after installation of woodwork. Fill nail holes with matching filler where exposed.

3.03 ADJUSTING AND CLEANING

A. Repair damaged and defective woodwork, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

B. Clean, lubricate, and adjust hardware.

C. Clean woodwork on exposed and semi-exposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Foam-plastic board insulation.
2. Glass-fiber blanket insulation.
3. Sound-Attenuation Blanket Insulation

1.02 SUBMITTALS

A. See Section 01 3300 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit manufacturer's product data for each type indicated.

PART 2 PRODUCTS

2.01 FOAM-PLASTIC BOARD INSULATION

A. Extruded-Polystyrene Board Insulation: R-5 per inch, 2-inch minimum thickness unless indicated otherwise, ASTM C 578, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Dow Chemical Company (The).
   b. Owens Corning.
   c. Pactiv Building Products.

2 Type IV, 25 psi (173 kPa).

2.02 GLASS-FIBER BLANKET INSULATION

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. CertainTeed Corporation.
2. Guardian Building Products, Inc.
3. Johns Manville.
4. Knauf Insulation.
5. Owens Corning.

B. Recycled Content: Postconsumer recycled content plus one-half of pre-consumer recycled content not less than 25 percent.

C. Kraft faced, Glass-Fiber Blanket Insulation: Minimum R-13 unless indicated otherwise, ASTM C 665, Type II, Class C; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.

2.03 SOUND-ATTENUATION BLANKET INSULATION

A. Sound attenuation control blanket insulation shall be un-faced mineral wool fiber insulation, rated non-combustible in accordance with ASTM E136. Sound attenuation blanket insulation to have the following characteristics:

1. Thickness: 3 inch
2. Density: 2.5 pounds per cubic foot

PART 3 EXECUTION

3.01 INSTALLATION - GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications indicated.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

C. Extend insulation to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

3.02 INSTALLATION OF CAVITY-WALL INSULATION

A. Foam-Plastic Board Insulation: Install pads of adhesive spaced approximately 24 inches (610 mm) o.c. both ways on inside face, and as recommended by manufacturer. Fit courses of insulation between wall ties and other obstructions, with edges butted tightly in both directions. Press units firmly against inside substrates.

1. Supplement adhesive attachment of insulation by securing boards with two-piece wall ties designed for this purpose and specified in Section 042000 "Unit Masonry."

3.03 INSTALLATION OF INSULATION FOR FRAMED CONSTRUCTION

A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

B. Foam-Plastic Board Insulation: Seal joints between units by applying adhesive, mastic, or sealant to edges of each unit to form a tight seal as units are shoved into place. Fill voids in completed installation with adhesive, mastic, or sealant as recommended by insulation manufacturer.

C. Glass-Fiber or Mineral-Wool Blanket Insulation: Install in cavities formed by framing members according to the following requirements:
1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
3. Maintain 3-inch (76-mm) clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
4. For metal-framed wall cavities where cavity heights exceed 96 inches (2438 mm), support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.

D. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:
1. Loose-Fill Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft. (40 kg/cu. m).

3.04 INSTALLATION OF SOUND-ATTENUATION CONTROL BLANKET INSULATION

A. At sound attenuation control wall locations, install sound attenuation control blankets to fit between stud framing with insulation completely filling all voids. Install insulation to have ends butted tightly together, and have insulation blankets slightly bow outward toward the installer.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Application of single component, cold applied, liquid air/vapor barrier.

C. Application of materials to provide bridge and seal air leakage pathways in:

1. Wall and roof connections and penetrations.
2. Connections to foundation walls.
3. Walls, windows, curtain walls, storefronts, louvers or doors
4. Expansion and control joints.
5. Masonry ties.
6. All other penetrations through the wall assembly.

1.02 REFERENCES

A. ASTM D146-97 - Standard Test Methods for Sampling and Testing Bitumen-Saturated Felts and Fabrics Used in Roofing and Waterproofing.

B. ASTM D412-98a(2002)e1 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension.

C. ASTM E96-00e1 (Method B) - Standard Test Methods for Water Vapor Transmission of Materials.

D. ASTM E283-91 (1999) - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.

E. ASTM E783 - Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors.

F. ASTM E1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform or Cyclic Static Air Pressure Difference.

G. ASTM E2178-01 - Standard Test Method for Air Permeance of Building Materials.

H. ASTM E2357 - 05 Standard Test Method for Determining Air Leakage of Air Barrier Assemblies.

1.03 SUBMITTALS

A. See Section 01 3300 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit manufacturer's product data and application instructions.

1.04 QUALITY ASSURANCE

A. Installer Qualifications:

1. Use an experienced installer and adequate number of skilled personnel who are thoroughly trained and experienced in the application of the air barrier.

a. Air Barrier Installer performing Work shall be approved by air barrier membrane manufacturer.

B. Obtain air/vapor barrier materials from a single manufacturer regularly engaged in manufacturing the product.

C. Provide products which comply with all state and local regulations controlling use of volatile organic compounds (VOCs).

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

B. Store materials in a clean, dry area in accordance with manufacturer's instructions.

C. Store the material at room temperature or heat material to a minimum of 50° F (10°C) prior to application.

D. Do not store at temperatures above 90°F (32°C) for extended periods.

E. Protect materials during handling and application to prevent damage or contamination.

F. Do not apply to polystyrene insulation boards.

1.06 ENVIRONMENTAL REQUIREMENTS

A. Product not intended for uses subject to abuse or permanent exposure to the elements.

B. Do not apply membrane when air, material, or surface temperatures are expected to fall below 10°F (-12°C) within 4 hours of completed application.

C. Do not apply membrane if rainfall is forecast or imminent within 2 hours.

D. Do not apply to frozen substrate.

E. For spray applications, ensure material has been stored at room temperature or heated to a minimum of 50°F (10°C) prior to application.

PART 2 PRODUCTS

2.01 MATERIALS

A. Liquid Air Vapor Barrier System: One-component, polymer-modified, cold-applied, liquid air/vapor barrier membrane.

1. Performance : Air/vapor barrier membrane shall be an elastomeric asphalt emulsion having the following characteristics:

   a. Air Leakage ASTM E2357: 0.04 cfm / ft.^{2} @ 75 Pa (1.57 lb./ft.^{2}).
   b. Air Permeability ASTM E2178: 0.004 cfm /ft.^{2} @ 75 Pa (1.57 lb./ft.^{2}).
   c. Water Vapor Permeance ASTM E96 (Method B): ≤0.1 perms.
   d. Elongation ASTM D412: 1500 %.
   e. Tensile Strength ASTM D412: 15 psi.

B. Basis-of-Design: AIR-SHIELD LM by W. R. MEADOWS.

1. Other manufacturers meeting product performance requirements will be considered. Submit manufacturer’s product data for approval 10 days prior to bid date.

2.02 ACCESSORIES

A. Flashing and Transition Membrane: Self-adhesive polymeric sheet membrane having a thickness of 40 mils (1 mm).

1. AIR-SHIELD THRU-WALL FLASHING by W. R. MEADOWS, or equal.

B. Liquid Flashing and Joint Sealant for exterior sheathing panels: Fluid -applied, single-component, flashing membrane for rough openings and detailing.

1. AIR-SHIELD THRU-WALL FLASHING by W. R. MEADOWS, or equal.

C. Joint Tape: Self-adhesive polymeric membrane for joints of plywood and oriented strand board (OSB).

1. AIR-SHIELD by W. R. MEADOWS, or equal.

D. Membrane Adhesive:

1. Temperatures above 40° F (4° C): Water-Based Adhesive
   a. MEL-PRIME™ W/B Water-Based Adhesive by W. R. MEADOWS, or equal.

2. Temperatures below 30° F (-1° C): Solvent-Based Adhesive.
   a. MEL-PRIME Solvent-Based Adhesive by W. R. MEADOWS, or equal.

E. Pointing Mastic: mastic for sealing penetrations and terminations of membrane.

1. POINTING MASTIC by W .R. MEADOWS, or equal.

F. Detailing Membrane: non-slump waterproofing material for joint detailing.

1. BEM by W. R. MEADOWS, or equal.

G. Concrete Repair Materials: general purpose patching materials.

1. MEADOW-PATCH™ 5 and 20 Concrete Repair Mortars by W. R. MEADOWS, or equal.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine surfaces to receive membrane. Notify Architect if surfaces are not acceptable. Do not begin surface preparation or application until unacceptable conditions have been corrected.

3.02 SURFACE PREPARATION

A. Protect adjacent surfaces not designated to receive air/vapor barrier.

B. Clean and prepare surfaces to receive air/vapor barrier membrane in accordance with manufacturer's instructions.

C. Do not apply membrane to surfaces unacceptable to manufacturer.

D. Concrete surfaces must be clean, free of standing water, ice, snow, frost, dust, dirt, oil, curing compounds or any other foreign material that could prevent proper adhesion of the membrane.

E. Patch all holes and voids and smooth out any surface misalignments.

F. Patch all cracks, protrusions, small voids, offsets, details, irregularities, and small deformities with cementitious patching mortar at least two hours before application.

G. Ensure joints between dissimilar building materials are sealed with a strip of self-adhesive membrane 6" (150 mm) wide, centered over the joint.

H. Exterior Sheathing Panels:

1. Install and fasten exterior sheathing panels according to the sheathing manufacturer's instructions.
2. Treat all countersunk and removed fasteners with joint filler or liquid flashing material.
3. Inspect the joint to ensure that all areas to receive joint treatment are clean, dry, smooth, and free from all bond-breaking contaminants.
4. Remove and replace any damaged structural wall components.
5. Joint Treatment with self-adhesive membrane
    a. Prime either side of the joint extending 3" from the center with adhesive recommended by the manufacturer.
    b. Install a 4" (25.4 mm) strip of self-adhesive membrane centered over the joint and roll press firmly into place.
    c. Fill all joints wider than ¼" (6.4 mm) with detailing membrane prior to application of self-adhesive membrane.

3.03 APPLICATION OF AIR BARRIER SYSTEM

A. TRANSITION MEMBRANE:

1. Condition surfaces to be covered in one working day with applicable adhesive.
2. Apply transition membrane with a minimum overlap of 3" onto primed surface at all joints, columns, beams, and dissimilar materials.
3. Roll membrane firmly into place.
4. Ensure membrane is fully adhered and remove all wrinkles and fish mouths.
5. Overlap subsequent courses of membrane a minimum of 2" and ensure joints are fully adhered.
6. Seal top edge of transition membrane with pointing mastic.

B. ROUGH OPENING TRANSITION MEMBRANE

1. Self-adhesive Transition Membrane.
    a. Prime the area to be detailed using adhesive recommended by the membrane manufacturer according to the substrate.
    b. Pre-cut the self-adhesive membrane for each area of the rough opening to ensure ease of handling.
    c. Apply the first pre-cut strip at the base of the rough opening by removing the release paper and rolling firmly into place, ensuring that there is a minimum of 3" (75 mm) of membrane extending onto the wall and a minimum of 3" (75 mm) of membrane extending into the rough opening.
    d. Repeat this procedure for the vertical areas of the rough opening and the header portion of the opening.
    e. Ensure all edge overlaps are a minimum of 2" (50 mm) and end to end overlaps are 4" (100 mm).
    f. Seal all terminations with mastic recommended by membrane manufacturer.

C. THROUGH WALL FLASHING:

1. Condition surfaces to be covered in one working day with applicable adhesive.
2. Remove release paper prior to application.
3. Apply through wall flashing at based of masonry walls as indicated on drawings.
4. Recess through wall flashing 1/2” (13 mm) from the face of the masonry.
5. Apply a bead of pointing mastic if through wall flashing is not embedded into masonry.

D. AIR BARRIER MEMBRANE:

1. Apply air/vapor barrier membrane in accordance with manufacturer's instructions.
2. Thoroughly mechanically mix membrane prior to application.
3. Apply membrane by spray or roller at a minimum coverage rate of 20-25 $ft.^2$/gal. (60 mils wet, 45 mils dry). Two coats (30 mils wet) may be necessary.
4. Frequently inspect surface area with a wet mil gauge to ensure consistent thickness.
5. Work material into any fluted rib forming indentations.
6. Cured thickness of membrane should be 45 mils dry.
7. Avoid use of products which contain tars, solvents, pitches, polysulfide polymers, or PVC materials that may come into contact with air/vapor barrier system.

3.04 PROTECTION

A. Cover air/vapor barrier membrane as soon as possible, since it is not designed for permanent exposure.

END OF SECTION

PART 1 GENERAL

1.01 RELATED WORK

A. Structural metal roof decking.

1.02 SUBMITTALS

A. Product Data: For each type of product.

B. Submit shop drawings indicating insulation types and thicknesses, surfacing on insulation board, shapes, sizes, finishes and methods of attachment for all work of metal roofing system. Indicate connections, flashings (plan and details), provisions for expansion, and watertight joint conditions. Typical details shown on the drawings generally show products of one manufacturer as they apply to the applicable sections of the project. If any details shown are not in accordance with the manufacturer's standard recommended practice, the Architect shall be advised in writing at the time shop drawings are submitted.

C. At the time shop drawings are submitted, submit certification of the roofing manufacturer that the roofing system submitted is in compliance with these specifications, is UL 580, class 90 rated, and that the manufacturer will furnish the guarantees as specified.

1.03 WARRANTY

A. No Dollar Limit warranty specified is to be followed with no exceptions. The warranty period is specified as follows:
   1. Warranty coverage: 20 years.
   2. Manufacturer's liability requirement: No dollar limit.
   3. Warranty coverage to include: All system panels, insulation, system components and accessories manufactured by the roofing manufacturer. The warranty covers weathertightness, finish, materials, labor and workmanship.
   4. Roof system must be inspected at the completion of installation and must be certified as installed in compliance with manufacturer's application requirements and standards. The manufacturer's technical field representative/inspector shall conduct interim and final inspections. The manufacturer's field representative must be the SSRS manufacturer employee who is responsible for interim and final inspections.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver panels and other components so they will not be damaged or deformed. Package panels for protection against damage during transportation, storage or handling.

B. Handling: Exercise care in unloading, storing, and erecting roof panels to prevent bending, warping, twisting, and surface damage.

C. Stack materials on platforms or pallets covered with tarpaulins or other suitable weather resistant and ventilated covering. Store panels to ensure dryness. Do not store panels in contact with other materials that might cause staining, denting, or other surface damage.

1.05 PROJECT CONDITIONS

A. Field measurements: Verify location of structural members and openings in substrates by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.06 EXPERIENCE

A. The manufacturer of the metal roofing system shall be one with not less than ten years of experience in the field, shall have qualified field installers and fabricators, and shall have equipment on hand to perform fabrication required by job conditions.

B. The company erecting the metal roofing system and its job superintendent shall have had not

less than 5 years of experience in installing metal roofing systems, shall have installed roofing systems of the type and magnitude of this project, and shall be approved in writing by the manufacturer of the roofing system materials.

1.07 PERFORMANCE REQUIREMENTS

A. Panel performance requirements:
   1. Air infiltration: maximum 0.06 cubic feet per minute per lineal foot of steam at static pressure of 6.24 pounds per square foot when tested per ASTM E 283.
   2. Water Penetration:
      a. No controlled water penetration through panel joints when tested in accordance with AAMA 502.1.
      b. No controlled water penetration through the panel joints at a static pressure of 6.24 pounds per square foot when tested in accordance with ASTM E 331.

PART 2 PRODUCTS

2.01 MATERIALS

A. Roofing panels shall be .032" ingot-rolled aluminum, 3004-H134 alloy conforming to ASTM B 209 or 24 gage hot dipped galvanized steel, G-90, ASTM A 446/A 446B, Grade C, 40 KSI yield point, with 70% Kynar 500 fluorocarbon resin baked-on enamel finish. Color shall be as selected by Architect from manufacturer's standard colors.

B. Roofing system panels shall be standing seam type, meeting appearance of details indicated and as approved by the Architect, formed to 16" to 18" width, with vertical ribs 2" to 2-1/2" high, and with minor stiffening ribs 3/8" high equally spaced on the panel surface, if standard with the manufacturer. Ribs shall have continuous anchor reveals to allow anchor clips to resist positive and negative loading and allow expansion and contraction of panels due to thermal changes.

C. Site or factory formed panels shall be formed full length of the run from ridge to eave. There shall be no horizontal joints.

D. Anchor clips shall be extruded aluminum, 6061-T6 alloy, stainless steel, or hot-dipped galvanized steel conforming to ASTM A 653/A 653M, Class G90 if steel panels are used. All units shall have positioning legs to hold adjacent panels secure. Clips shall have projecting legs for additional panel alignment and provisions to allow 3" of thermal movement each direction along the longitudinal dimension.

E. Screw fasteners holding anchor clips to structure shall be #14 stainless steel sheet metal screws, of length to engage into metal roof deck. Exposed fasteners shall be stainless steel, #14 size, or 3/16" diameter, waterproofed with neoprene washers.

F. Flashing members, fascia, soffits and closures shall be formed from the same material as the roofing panels, formed as approved, and complete with concealed supports and fastenings. Flashing members shall be furnished in not less than 10'-0" lengths with 6" splice plate to allow for thermal movement. Soffit panels shall be 12" wide, 24 ga, smooth panels with concealed fasteners.

G. Fascias, soffits and panels shall be color to match roof.

H. Gutters and downspouts shall be factory fabricated to profiles shown on the Drawings from a minimum of .050 gage smooth aluminum or same thickness steel in the same finish to match metal roof panels. Gutters shall have splice plates 24' O. C. between downspouts to allow for thermal movement.

I. Close ends of panels at eaves with "J" flashings and sealants to provide water-tight conditions.

J. Tape and sealants shall have an indicated life of 20 years. All tape sealant shall be pressure sensitive, 100 percent solid, sealing tape with a release paper backing. Provide permanently

elastic, non-sagging, non-toxic, non-staining tape sealant approved by the roofing panel manufacturer.

K. Provide closures and pan-end of panel at all ridge conditions.

L. Fluoropolymer coating shall be Kynar 500 based. Coating shall be applied in accordance with the coating manufacturer's instructions to metal that is free from scratches and blemishes. The top finish color coat shall be no less than 1 mil thick. A 20 year warranty against failure of the fluoropolymer coating finish shall begin upon Substantial Completion.

M. Underlayment Waterproof Membrane: ASTM D 1970, self-adhering membrane with resistance to direct exposure to sunlight for at least 42 days. Minimum high temperature resistance of 230 degrees F. Maximum water vapor permeance of 0.1 perms.

2.02 INSULATION

A. Roof insulation shall provide "U" factor of not less than .05. The completed roof assembly shall provide characteristics indicated on the Drawings.

B. Assembly shall consist of the metal deck, composite board consisting of nominal 5" isocyanurate foam roof insulation (min. R-30) with fiberglass reinforced facing vapor barrier laminated to bottom and nominal 7/16" nailable board laminated to the insulation or secured with screw fastenings through the insulation into the metal deck, a layer of self-adhering underlayment, a minimum of 6" at joints to receive roofing anchor clips and 36" wide underlayment centered on roof valleys, hips and ridges running the full length of hip or ridge and from ridge to eave. The manufacturer's standard bearing plates and bearing clips shall be provided so that the system, including the attachment to the steel deck, has been tested and is certified to meet UL 580, class 90.

2.03 FABRICATION

A. Roofing panels and caps shall be roll-formed. Detail of forming shall conform to approved shop drawings. Forming equipment shall be operated to prevent damage to finishes and to base metal.

B. Gutters shall be factory fabricated, roll formed to approved profile, and factory welded in as long lengths as appropriate for handling and shipment to the site. Corners of gutters shall be factory formed and welded. On site gutters shall be pop riveted and sealed together to indicated sizes and layout.

C. Flashing and closure components shall be factory formed to approved details.

D. Roofing manufacturer shall provide all items associated with roof to accommodate penetrations or connections such as fan curbs. Curb fabrication shall be coordinated with impacted trades.

PART 3 EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

A. Examine substrates and conditions, with installer present, for compliance with requirements indicated for conditions affecting performance of metal panel roofing.

1. Panel Supports and Anchorage: Examine roof framing to verify that purlins, angles, channels and other secondary structural panel support members and anchorage have been installed according to written instructions of panel manufacturer.
2. Do not proceed with roof panel installation until unsatisfactory conditions have been corrected.

B. Panel Supports and Anchorage: Examine roof framing to verify that purlins, angles, channels,

and other secondary structural panel support members and anchorage have been installed according to written instructions of panel manufacturer.

1. Do not proceed with roof panel installation until unsatisfactory conditions have been corrected.

C. Inspect surfaces to which roofing will be installed to insure its suitability to receive metal roofing. Insure that preliminary construction is completed and approved by the Architect before beginning metal roofing work.

D. The contractor shall be responsible for performing his work and for coordinating the work of installing roof insulation so that all roof insulation installed in a day will be protected from the weather at the end of the day. Protect exposed edges of roof insulation at the end of each day's work with water cut-offs.

E. Use soft cushioned shoes and padded construction equipment where in contact with the metal roofing system during installation.

F. There will be a pre-roofing conference with Architect, Contractor and roofing subcontractor prior to beginning installation. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion and submit report to Architect. Notify Architect and Owner 48 hours in advance of date and time of inspection.

3.02 INSTALLATION

A. Install the layer of insulation with the nailable surface on top over the structural metal roof decking and secure in place with one self-tapping large washer headed fasteners per four square feet of board as per the insulation manufacturer's instructions. Place a ply of self-adhering underlayment over the nailing surface of the insulation, with 4" side laps and 6" end laps. Install 36" wide self-adhering underlayment centered on roof valleys, hips and ridges running the full length of the run from ridge to eave. Nail all underlayment 9" o.c. along laps; stagger-nail along center of sheet at intervals of 18". Nails shall be galvanized large-head 1-1/2" roofing nails. Install anchor clips for the metal roofing with screw fastenings of length to penetrate the structural metal roof deck, and install metal roofing as approved on shop drawings.

B. Install roofing panels to correct alignment and arrangement as approved on shop drawings. Sheets shall be free from surface blemishes, and shall be without warp, bow, twist, bent corners, cracks and damaged coating. Fasteners, anchors and exposed edges of the roofing panels shall be concealed in the finished work.

C. Provide sealants, tapes and weatherproofing materials required for a complete water tight installation.

D. Provide pre-manufactured moldings, ridge caps, closures and trim as required and approved on shop drawings. All exposed work shall have matching finishes as specified. Fasteners shall be concealed as recommended by the manufacturer of the roofing system.

E. Make provisions for expansion and contraction of metal roofing system.

F. Install gutters to permit independent movement of the gutters and roof system.

G. The roofing installer shall furnish paint to match the finish of the metal roofing and shall paint protrusions through the roof to match the roof color.

I. The roofing material manufacturer's technical representative shall visit the job site prior to the metal roofing installation, two times during the metal roofing installation, and after final completion of the metal roofing.

J. Prior to each visit, the technical representative shall inform the Architect one week in advance of

each visit.

K. After each visit, the manufacturer's technical representative shall write a report of his findings with a copy to the architect, contractor and installer.

3.03 CLEANING

A. Clean exposed pre-finished surfaces as recommended by the roofing manufacturer. Touch up exposed cuts with primer and finish matching the pre-finishing on the panels. Protect roofing surfaces and work until final inspection.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Aluminum composite panels used as exterior cladding.

1.02 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design metal-faced composite wall panel assembly, including comprehensive engineering analysis by a qualified professional engineer licensed in the State of Georgia, using performance requirements and design criteria indicated.

B. Structural Performance: Provide exterior wall cladding assemblies capable of withstanding the effects of load and stresses from dead loads, wind loads, and normal thermal movement without evidence of permanent defects of assemblies or components.

1. Dead Load: As required by applicable building code.
2. Wind Load: As identified on structural drawings.
3. Thermal Movements: Provide assemblies that allow for thermal movements resulting from the following maximum changes in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components and other detrimental effects:

    a. Temperature Change (range): 120 deg F, ambient ; 180 deg F, material surfaces.

C. Sealed joints shall allow for free and silent movement of panels during expansion and contraction while preventing uncontrolled penetration of moisture.

D. Manufacturing, installation, and sealing shall prevent deformation of exposed surfaces.

E. Design panel system to accommodate substructure tolerance of +0 to -1/8 inch.

F. Not Permitted: Vibration harmonics; wind whistles; noises caused by thermal movement; thermal movement transmitted to other building elements; loosening, weakening or fracturing of attachments or components of system.

G. Preformed metal panel system to withstand code-imposed design loads. Maximum allowable of span: L/60.

H. Air Infiltration: Panel system shall not have air infiltration rate more than 0.06 cfm per sq. ft. of fixed wall area when tested in accordance with ASTM E283 at static air pressure differential of 1.57 psf.

I. Water Penetration: Panel system shall have no water penetration as defined by in test method when tested in accordance with ASTM E331 at inward static pressure differential of not less than 6.24 psf and not more than 12.0 psf.

1.03 SUBMITTALS

A. See Section 01 3300 - Submittal Requirements, for submittal procedures.

B. Product Data: Provide manufacturer’s product literature for the panel specified.

C. Shop Drawings: Show fabrication and installation layouts of metal-faced composite wall panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details. Distinguish among factory, shop, and field-assembled work.

D. Structural Calculations: Submit a comprehensive analysis of design loads, including dead loads, live loads, wind loads and thermal movement.

E. Samples: Provide color samples of selected color. Samples shall involve normal color and texture variations, include sample sets showing the full range of variations expected.

1.04 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Minimum of 5 years experience in manufacturing exterior wall panels similar to those specified.

B. Installer's Qualifications: Acceptable to manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

1. Store materials in accordance with manufacturer's recommendations.
2. Handle materials carefully to avoid damage to materials and finishes.

1.06 PROJECT CONDITIONS

A. Field Measurements: Verify actual supporting and adjoining construction by field measurements before fabrication, and indicate recorded measurements on final shop drawings. Coordinate construction to ensure that the wall panel assemblies fit properly to supporting and adjoining construction and coordinate schedule with construction progress to avoid delaying the work.

1. Established Dimensions: Where field measurements can not be made without delaying the work, guarantee dimensions and proceed with the fabrication of wall panel assemblies corresponding to the established dimensions.

1.07 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal-faced composite wall panel assemblies that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five (5) years from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal-faced composite wall panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Finish Warranty Period: Twenty (20) years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 MATERIALS

A. Basis of Design: Series 1000 Aluminum Composite Wall Panel System, as manufactured by Firestone Metal Products.

1. Other manufacturers meeting specified product requirements will be considered, provided

alternate manufacturer is approved prior to bid. See Substitution Requirements per Section 01 3300.

B. Panel shall be 4mm, PE core, aluminum composite material.

C. Composite panels shall have a Class “A” building material rating when tested in accordance with ASTM E84 (Stiener Tunnel Test) and shall exhibit a flame spread of 15 and a smoke developed rating of 120, with a center panel joint.
D. Panels shall have passed the ASTM E108 modified test.

2.02 FABRICATION - GENERAL

A. Composition:
   1. Aluminum composite material shall be composed of a thermoplastic core sandwiched between two aluminum sheets formed in a continuous process with no glues or adhesives.
   2. Bond integrity per ASTM D1781-76 and ASTM C481 Cycle B, shall be a minimum of 40 in-lb.in. (Peel Strength)

B. Aluminum face sheets:
   1. Thickness: .020” of 3105 H25 aluminum alloy.

C. Tolerances:
   1. Panel bow shall not exceed 3.8% of panel overall dimension in width or length.
   2. Panel dimensions shall be such that there will be an allowance for field adjustment and thermal movement.
   3. Panel lines, breaks and curves shall be sharp, smooth and free from warps or buckles.

D. Panel surfaces shall be free from scratches or marks caused during fabrication.

E. Ensure that entire project is manufactured from single color coil paint run to ensure color uniformity.

F. If a metallic color is selected, ensure that panel grain is maintained. Under no circumstances are panel blank sizes to be rotated even if material waste is increased.

2.03 ACCESSORIES

A. All exposed rivets/fasteners shall be stainless steel.

B. All hidden fasteners shall be Climaseal coated or stainless steel.

C. Flashing: Aluminum, same finish as for aluminum panel where exposed; secured with concealed fastening method.

D. Panel System Sub-girts: Provide G90 galvanized steel of gauge and spacing required for panel system structural requirements, as recommended by panel manufacturer and in accordance with approved shop drawings. To avoid galvanic reaction, separate dissimilar metals.

2.04 FINISHES - GENERAL

A. Comply with NAAMM’s Metal Finishes Manual for architectural metal products recommendations for applying and designating finishes.

2.05 ALUMINUM FINISHES

A. Panel Finishes:
   1. Coating shall be a fluoropolymer coating utilizing 70% Kynar 500 resins.
   2. Color: Champagne Metallic

3. Coating shall be factory applied on a continuous process paint line. Coating shall consist of a 0.2 mil prime coat, a 0.75 mil barrier coat, a0.75 metallic/color coat containing 70% Kynar resins, and a 0.5 mil clear coat containing 70% Kynar resins.

B. Pencil Hardness: Complying with ASTM D3352-74.

C. Shall be HB-H minimum (Eagle Turquoise).

D. Impact Adhesion: Complying with ASTM D294-84
1. Coating shall show no cracking and no loss of adhesion.

E. Cure Test: Complying with NCCA 11-18
1. Coating shall withstand 50+ double rubs of MEK.

F. Humidity Resistance: Complying with ASTM D2247-87
1. Coating shall show no blisters after 3000 hours of 100% humidity at 95 deg F.

G. Weatherometer Test: ASTM D882-86/G23-88 Coating shall show no cracking, peeling, blistering or loss of adhesion after 2000 hours.
1. Chalking Resistance: ASTM D659-86.
2. Color Change : ASTM D2244-74.

H. Abrasion Resistance: ASTM D968-81 Coating shall resist 65 +/- 15 liters/mil minimum of falling sand.

PART 3 EXECUTION

3.01 PREPARATION

A. Coordinate setting, drawings, diagrams, templates, instructions, and directions for installation. Panel substructure shall be level and plumb. Panel substructure shall be structurally sound as determined by that subcontractor's engineer. Panel substructure shall be free of defects detrimental to work and erected in accordance with established building tolerances. Coordinate delivery of such items to project site.

3.02 INSTALLATION

A. Erect panels level and plumb, in proper alignment in relation to substructure framing and established lines.

B. Panels shall be erected in accordance with approved shop drawings.

C. Panel anchorage shall be structurally sound and per engineering recommendations.

D. Where aluminum materials come in contact with dissimilar materials, an isolation shim or tape shall be installed at fastening locations.

E. Locate and place wall panels level, plumb, and at indicated alignment with adjacent work.

3.03 CLEANING AND PROTECTING

A. Clean exposed surfaces of wall panels that are not protected by temporary covering to remove fingerprints and soil during construction period.

B. Clean exposed surfaces with water and a mild soap detergent not harmful to finishes. Thoroughly rinse surfaces and dry.

C. Protect wall panels from damage during construction. Use temporary protective coverings where needed as approved by the wall panel manufacturer.

D. Clean and touch up minor abrasions in finished with air-dried coating that matches color and gloss, and is compatible with factory-applied finish coating.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Formed roof-drainage sheet metal fabrications.
B. Formed steep-slope roof sheet metal fabrications.
C. Formed low-slope roof sheet metal fabrications.
D. Formed wall sheet metal fabrications.

1.02 SUBMITTALS

A. See Section 01 3300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide product data for each type of product.

C. Shop Drawings: For sheet metal flashing and trim.

1. Include plans, elevations, sections, and attachment details.
2. Distinguish between shop- and field-assembled work.
3. Include identification of finish for each item.
4. Include pattern of seams and details of termination points, expansion joints and expansion-joint covers, direction of expansion, roof-penetration flashing, and connections to adjoining work.

D. Samples: For each exposed product and for each color and texture specified.

1.03 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.04 QUALITY ASSURANCE

A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

1. For copings and roof edge flashings that are SPRI ES-1 tested, shop shall be listed as able to fabricate required details as tested and approved.

1.05 WARRANTY

A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. General: Sheet metal flashing and trim assemblies shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.

B. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's "The NRCA Roofing Manual" and SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.

C. SPRI Wind Design Standard: Manufacture and install copings and roof edge flashings tested according to SPRI ES-1 and capable of resisting the following design pressure:

1. Design Pressure: As required by local codes.

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
2. Provide expansion joints as required by roofing manufacturer.

2.02 SHEET METALS

A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.

B. Aluminum Sheet: ASTM B 209 (ASTM B 209M), alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required.

1. As-Milled Finish: Mill.
2. Clear Anodic Finish, Coil Coated: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.
3. Exposed Coil-Coated Finish:

a. Three-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

4. Color: Clear anodized aluminum.

C. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304, dead soft, fully annealed; 2D (dull, cold rolled) finish.

D. Metallic-Coated Steel Sheet: Provide zinc-coated (galvanized) steel sheet according to ASTM A 653/A 653M, G90 (Z275) coating designation or aluminum-zinc alloy-coated steel sheet according to ASTM A 792/A 792M, Class AZ50 (Class AZM150) coating designation, Grade 40 (Grade 275); prepainted by coil-coating process to comply with ASTM A 755/A 755M.

1. Surface: Manufacturer's standard clear acrylic coating on both sides.
2. Exposed Coil-Coated Finish:

a. Three-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

3. Color: Match existing.

2.03 UNDERLAYMENT MATERIALS

A. Felt: ASTM D 226/D 226M, Type II (No. 30), asphalt-saturated organic felt; non-perforated.

B. Synthetic Underlayment: Laminated or reinforced, woven polyethylene or polypropylene, synthetic roofing underlayment; bitumen free; slip resistant; suitable for high temperatures over 220 deg F (111 deg C); and complying with physical requirements of ASTM D 226/D 226M for Type I and Type II felts.

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. Atlas Roofing Corporation.
b. Engineered Coated Products.
c. Kirsch Building Products, LLC.
d. SDP Advanced Polymer Products Inc.

C. Self-Adhering, High-Temperature Sheet: Minimum 30 mils (0.76 mm) thick, consisting of a slip-resistant polyethylene- or polypropylene-film top surface laminated to a layer of butyl- or SBS-modified asphalt adhesive, with release-paper backing; specifically designed to withstand high metal temperatures beneath metal roofing. Provide primer according to written recommendations of underlayment manufacturer.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Carlisle Coatings & Waterproofing Inc.
b. Grace Construction Products; W.R. Grace & Co.
c. Owens Corning.
d. Polyguard Products, Inc.

2. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F (116 deg C) or higher.

3. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F (29 deg C) or lower.

D. Slip Sheet: Rosin-sized building paper, 3 lb/100 sq. ft. (0.16 kg/sq. m)minimum.

2.04 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, solder, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.

1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.

a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.

2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
3. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.
4. Fasteners for Zinc-Coated (Galvanized) or Aluminum-Zinc Alloy-Coated Steel Sheet: Series 300 stainless steel or hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.

C. Solder:

1. For Stainless Steel: ASTM B 32, Grade Sn60, with acid flux of type recommended by stainless-steel sheet manufacturer.
2. For Zinc-Coated (Galvanized) Steel: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead or Grade Sn60, 60 percent tin and 40 percent lead.

D. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.

E. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane or silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

F. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

G. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.

H. Bituminous Coating: Cold-applied asphalt emulsion according to ASTM D 1187.

I. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.05 FABRICATION – GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with details shown and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required. Fabricate sheet metal flashing and trim in shop to greatest extent possible.

1. Obtain field measurements for accurate fit before shop fabrication.
2. Form sheet metal flashing and trim to fit substrates without excessive oil canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
3. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.

B. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.

1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with butyl sealant concealed within joints.
2. Use lapped expansion joints only where indicated on Drawings.

C. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal to provide for proper installation of elastomeric sealant according to cited sheet metal standard.

D. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard for application, but not less than thickness of metal being secured.

E. Seams: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.

F. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal

with epoxy seam sealer. Rivet joints where necessary for strength.

2.06 ROOF-DRAINAGE SHEET METAL FABRICATIONS

A. Hanging Gutters: Fabricate to cross section required, complete with end pieces, outlet tubes, and other accessories as required. Fabricate in minimum 96-inch- (2400-mm-) long sections. Furnish flat-stock gutter brackets and gutter spacers and straps fabricated from same metal as gutters, of size recommended by cited sheet metal standard but with thickness not less than twice the gutter thickness. Fabricate expansion joints, expansion-joint covers, and gutter accessories from same metal as gutters. Shop fabricate interior and exterior corners.

1. Accessories: Continuous, removable leaf screen with sheet metal frame and hardware cloth screen.

B. Downspouts: Fabricate rectangular downspouts to dimensions indicated, complete with mitered elbows. Furnish with metal hangers from same material as downspouts and anchors.

1. Fabricate from the following materials:

a. Aluminum: 0.024 inch (0.61 mm) thick.

C. Splash Pans: Fabricate to dimensions and shape required and from the following materials:

1. Aluminum: 0.040 inch (1.02 mm) thick.

2.07 STEEP-SLOPE ROOF SHEET METAL FABRICATIONS

A. Apron, Step, Cricket, and Backer Flashing: Fabricate from the following materials:

1. Aluminum: 0.032 inch (0.81 mm) thick.
2. Stainless Steel: 0.016 inch (0.40 mm) thick.

B. Drip Edges: Fabricate from the following materials:

1. Aluminum: 0.032 inch (0.81 mm) thick.
2. Stainless Steel: 0.016 inch (0.40 mm) thick.

C. Eave, Rake Flashing: Fabricate from the following materials:

1. Aluminum: 0.032 inch (0.81 mm) thick.
2. Stainless Steel: 0.016 inch (0.40 mm) thick.

2.08 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

A. Roof Edge Flashing (Gravel Stop) and Fascia Cap: Fabricate in minimum 96-inch- (2400-mm-) long, but not exceeding 12-foot- (3.6-m-) long sections. Furnish with 6-inch- (150-mm-) wide, joint cover plates.

1. Fabricate from the Following Materials:
   a. Aluminum: 0.050 inch (1.27 mm) thick.

B. Copings: Fabricate in minimum 96-inch- (2400-mm-) long, but not exceeding 12-foot- (3.6-m-) long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous concealed cleats to support edge of external leg and interior leg. Miter corners, fasten and seal watertight. Shop fabricate interior and exterior corners.

1. Fabricate from the Following Materials:

a. Aluminum: 0.050 inch (1.27 mm) thick.

C. Base Flashing: Fabricate from the following materials:

1. Aluminum: 0.040 inch (1.02 mm) thick.
2. Stainless Steel: 0.019 inch (0.48 mm) thick.

D. Counterflashing and Flashing Receivers: Fabricate from the following materials:

1. Aluminum: 0.032 inch (0.81 mm) thick.
2. Stainless Steel: 0.019 inch (0.48 mm) thick.

E. Roof-Penetration Flashing: Fabricate from the following materials:

1. Stainless Steel: 0.019 inch (0.48 mm) thick.
2. Galvanized Steel: 0.028 inch (0.71 mm) thick.

2.09 WALL SHEET METAL FABRICATIONS

A. Through-Wall Flashing: Fabricate continuous flashings in minimum 96-inch- (2400-mm-) long, but not exceeding 12-foot- (3.6-m-) long, sections, under copings, and at shelf angles. Fabricate discontinuous lintel, sill, and similar flashings to extend 6 inches (150 mm) beyond each side of wall openings; and form with 2-inch- (50-mm-) high, end dams. Fabricate from the following materials:

1. Stainless Steel: 0.016 inch (0.40 mm) thick.

B. Opening Flashings in Frame Construction: Fabricate head, sill, and similar flashings to extend 4 inches (100 mm) beyond wall openings. Form head and sill flashing with 2-inch- (50-mm-) high, end dams. Fabricate from the following materials:

1. Aluminum: 0.032 inch (0.81 mm) thick.
2. Stainless Steel: 0.016 inch (0.40 mm) thick.

PART 3 EXECUTION

3.01 UNDERLAYMENT INSTALLATION

A. Felt Underlayment: Install felt underlayment, wrinkle free, using adhesive to minimize use of mechanical fasteners under sheet metal flashing and trim. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches (50 mm).

B. Synthetic Underlayment: Install synthetic underlayment, wrinkle free, according to manufacturers' written instructions, and using adhesive where possible to minimize use of mechanical fasteners under sheet metal.

C. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free. Prime substrate if recommended by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer for installing underlayment at low temperatures. Apply in shingle fashion to shed water, with end laps of not less than 6 inches (150 mm) staggered 24 inches (600 mm) between courses. Overlap side edges not less than 3-1/2 inches (90 mm). Roll laps and edges with roller. Cover underlayment within 14 days.

3.02 INSTALLATION - GENERAL

A. General: Anchor sheet metal flashing and trim and other components of the Work securely in

place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.

1. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
3. Space cleats not more than 12 inches (300 mm) apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
4. Install exposed sheet metal flashing and trim with limited oil canning, and free of buckling and tool marks.
5. Torch cutting of sheet metal flashing and trim is not permitted.

B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.

1. Coat concealed side of uncoated-aluminum and stainless-steel sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at maximum of 10 feet (3 m) with no joints within 24 inches (600 mm) of corner or intersection.

1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with sealant concealed within joints.
2. Use lapped expansion joints only where indicated on Drawings.

D. Fasteners: Use fastener sizes that penetrate wood blocking or sheathing not less than 1-1/4 inches (32 mm) for nails and not less than 3/4 inch (19 mm) for wood screws.

E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.

F. Seal joints as required for watertight construction. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."

G. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets with solder to width of 1-1/2 inches (38 mm); however, reduce pre-tinning where pre-tinned surface would show in completed Work.

1. Do not solder metallic-coated steel and aluminum sheet.
2. Do not use torches for soldering.
3. Heat surfaces to receive solder, and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.
4. Stainless-Steel Soldering: Tin edges of uncoated sheets, using solder for stainless steel and acid flux. Promptly remove acid flux residue from metal after tinning and soldering. Comply with solder manufacturer's recommended methods for cleaning and neutralization.

H. Rivets: Rivet joints in uncoated aluminum where necessary for strength.

3.03 ROOF-DRAINAGE SYSTEM INSTALLATION

A. General: Install sheet metal roof-drainage items to produce complete roof-drainage system according to cited sheet metal standard unless otherwise indicated. Coordinate installation of roof perimeter flashing with installation of roof-drainage system.

B. Hanging Gutters: Join sections with riveted and soldered joints or joints sealed with sealant. Provide for thermal expansion. Attach gutters at eave or fascia to firmly anchor them in position. Provide end closures and seal watertight with sealant. Slope to downspouts.

1. Install gutter with expansion joints at locations not exceeding, 50 feet (15.24 m) apart. Install expansion-joint caps.
2. Install continuous gutter screens on gutters with noncorrosive fasteners, removable for cleaning gutters.

C. Downspouts: Join sections with 1-1/2-inch (38-mm) telescoping joints. Provide hangers with fasteners designed to hold downspouts securely to walls. Locate hangers at top and bottom and at approximately 60 inches (1500 mm) o.c.

D. Splash Pans: Install where downspouts discharge on lower roof surfaces. Set in asphalt roofing cement or elastomeric sealant compatible with the substrate.

E. Expansion-Joint Covers: Install expansion-joint covers at locations of expansion joints. Lap joints minimum of 4 inches (100 mm) in direction of water flow.

3.04 ROOF FLASHING INSTALLATION

A. General: Install sheet metal flashing and trim to comply with performance requirements and cited sheet metal standard. Provide concealed fasteners where possible, and set units true to line, levels, and slopes. Install work with laps, joints, and seams that are permanently watertight and weather resistant.

B. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in cited sheet metal standard unless otherwise indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate.

C. Copings: Anchor to resist uplift and outward forces according to recommendations in cited sheet metal standard unless otherwise indicated.

D. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending minimum of 4 inches (100 mm) over base flashing. Install stainless-steel draw band and tighten.

E. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches (100 mm) over base flashing. Lap counterflashing joints minimum of 4 inches (100 mm).

F. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with elastomeric sealant and clamp flashing to pipes that penetrate roof.

3.05 WALL FLASHING INSTALLATION

A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to cited sheet metal standard unless otherwise indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

B. Opening Flashings in Frame Construction: Install continuous head, sill, and similar flashings to extend 4 inches (100 mm) beyond wall openings.

3.06 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder.

C. Clean off excess sealants.

D. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Penetrations in fire-resistance-rated walls.
B. Penetrations in horizontal assemblies.
C. Penetrations in smoke barriers.

1.02 SUBMITTALS

A. See Section 01 3300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide product data for each type of product.

C. Product Schedule: For each penetration firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing and inspecting agency.

1. Engineering Judgments: Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping system, submit illustration, with modifications marked, approved by penetration firestopping system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly. Obtain approval of authorities having jurisdiction prior to submittal.

D. Samples: For each exposed product and for each color and texture specified.

1.03 CLOSEOUT SUBMITTALS

A. Installer Certificates: From Installer indicating that penetration firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: A firm that has been approved by FM Global according to FM Global 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with its "Qualified Firestop Contractor Program Requirements."

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics:

1. Perform penetration firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
2. Test per testing standards referenced in "Penetration Firestopping Systems" Article. Provide rated systems complying with the following requirements:

a. Penetration firestopping systems shall bear classification marking of a qualified testing agency.

a.1 UL in its "Fire Resistance Directory."
a.2 Intertek Group in its "Directory of Listed Building Products."
a.3 FM Global in its "Building Materials Approval Guide."

2.02 PENETRATION FIRESTOPPING SYSTEMS

A. Penetration Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming

openings, and with penetrating items if any.

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. 3M Fire Protection Products.
    b. Hilti, Inc.
    c. HOLDRITE.
    d. Specified Technologies, Inc.
    e. Tremco, Inc.

B. Penetrations in Fire-Resistance-Rated Walls: Penetration firestopping systems with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).

1. F-Rating: Not less than the fire-resistance rating of constructions penetrated.

C. Penetrations in Horizontal Assemblies: Penetration firestopping systems with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).

1. F-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated.
2. T-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.
3. W-Rating: Provide penetration firestopping systems showing no evidence of water leakage when tested according to UL 1479.

D. Penetrations in Smoke Barriers: Penetration firestopping systems with ratings determined per UL 1479, based on testing at a positive pressure differential of 0.30-inch wg (74.7 Pa).

1. L-Rating: Not exceeding 5.0 cfm/sq. ft. (0.025 cu. m/s per sq. m) of penetration opening at and no more than 50-cfm (0.024-cu. m/s) cumulative total for any 100 sq. ft. (9.3 sq. m) at both ambient and elevated temperatures.

E. Exposed Penetration Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, per ASTM E 84.

F. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping system manufacturer and approved by qualified testing and inspecting agency for conditions indicated.

PART 3 EXECUTION

3.01 INSTALLATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.

B. General: Install penetration firestopping systems to comply with manufacturer's written installation instructions and published drawings for products and applications.

C. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings.

1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not forming permanent components of firestopping.

D. Install fill materials by proven techniques to produce the following results:
   1. Fill voids and cavities formed by openings, forming materials, accessories and penetrating items to achieve required fire-resistance ratings.
   2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
   3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.02 IDENTIFICATION

A. Wall Identification: Permanently label walls containing penetration firestopping systems with the words "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS," using lettering not less than 3 inches (76 mm) high and with minimum 0.375-inch (9.5-mm) strokes.

   1. Locate in accessible concealed floor, floor-ceiling, or attic space at 15 feet (4.57 m) from end of wall and at intervals not exceeding 30 feet (9.14 m).

B. Penetration Identification: Identify each penetration firestopping system with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches (150 mm) of penetration firestopping system edge so labels are visible to anyone seeking to remove penetrating items or firestopping systems. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:

   1. The words "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
   2. Contractor's name, address, and phone number.
   3. Designation of applicable testing and inspecting agency.
   4. Date of installation.
   5. Manufacturer's name.
   6. Installer's name.

3.03 FIELD QUALITY CONTROL

A. Where deficiencies are found or penetration firestopping system is damaged or removed because of testing, repair or replace penetration firestopping system to comply with requirements.

B. Proceed with enclosing penetration firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Silicone joint sealants.
B. Non-staining silicone joint sealants.
C. Urethane joint sealants.
D. Mildew-resistant joint sealants.
E. Latex joint sealants.
F. Acoustical joint sealants

1.02 SUBMITTALS

A. See Section 01 3300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide product data for each joint-sealant product.

C. Samples: For each kind and color of joint sealant required.

D. Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

1.03 WARRANTY

A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 JOINT SEALANTS - GENERAL

A. Colors of Exposed Joint Sealants: Match colors of existing classroom buildings.

2.02 SILICONE JOINT SEALANTS

A. Silicone, S, NS, 50, NT: Single-component, non-sag, plus 50 percent and minus 50 percent movement capability, non-traffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 50, Use NT.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Dow Corning Corporation.
b. GE Construction Sealants; Momentive Performance Materials Inc.
c. Pecora Corporation.
d. Sika Corporation.

B. Silicone, S, NS, 50, T, NT: Single-component, non-sag, plus 50 percent and minus 50 percent movement capability, traffic- and non-traffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 50, Uses T and NT.

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. Dow Corning Corporation.
b. Soudal USA.
c. Pecora Corporation

2.03 NON-STAINING JOINT SEALANTS

A. Non-staining Joint Sealants: No staining of substrates when tested according to ASTM C 1248.

B. Silicone, Non-staining, S, NS, 50, NT: Non-staining, single-component, non-sag, plus 50 percent
and minus 50 percent movement capability, non-traffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 50, Use NT.

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. Dow Corning Corporation.
b. GE Construction Sealants; Momentive Performance Materials Inc.
c. Pecora Corporation.
d. Tremco Incorporated.

2.04 URETHANE JOINT SEALANTS

A. Urethane, S, P, 25, T, NT: Single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and non-traffic-use, urethane joint sealant; ASTM C 920, Type S, Grade P, Class 25, Uses T and NT.

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-Construction Systems.
b. Pecora Corporation.
c. Bostik, Inc.
d. Tremco Incorporated.

B. Urethane, M, NS, 25, NT: Multi-component, non-sag, plus 25 percent and minus 25 percent movement capability, non-traffic-use, urethane joint sealant; ASTM C 920, Type M, Grade NS, Class 25, Use NT.

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-Construction Systems.
b. Pecora Corporation.
c. Tremco, Incorporated.

C. Urethane, M, P, 25, T, NT: Multi-component, pourable, plus 25 percent and minus 25 Urethane, M, P, 25, T, NT: Multi-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and non-traffic-use, urethane joint sealant; ASTM C 920, Type M, Grade P, Class 25, Uses T and NT.

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-Construction Systems.
b. Bostik, Inc.
c. Pecora Corporation.
d. Tremco Incorporated.

2.05 MILDEW-RESISTANT JOINT SEALANTS

A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.

B. Silicone, Mildew Resistant, Acid Curing, S, NS, 25, NT: Mildew-resistant, single-component, Non-sag, plus 25 percent and minus 25 percent movement capability, non-traffic-use, acid-curing
silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT.

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. Dow Corning Corporation.
b. GE Construction Sealants; Momentive Performance Materials Inc.
c. May National Associates, Inc.; a subsidiary of Sika Corporation.
d. Tremco Incorporated.

2.06 LATEX JOINT SEALANTS

C. Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.

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-Construction Systems.
b. Pecora Corporation.
c. Bostik, Inc.
d. Tremco Incorporated.

2.07 ACOUSTICAL JOINT SEALANTS

A. Acoustical Joint Sealant: Manufacturer’s standard non-sag, paintable, non-staining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

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

a. Pecora Corporation.
b. USG Corporation.
c. Tremco Incorporated.

2.08 JOINT-SEALANT BACKING

A. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

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-Construction Systems.
b. Construction Foam Products; a division of Nomaco, Inc.
c. Nomaco, Incorporated

B. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer.

2.09 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 EXECUTION

3.01 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove laitance and form-release agents from concrete.
2. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces.

3.02 INSTALLATION OF JOINT SEALANTS

A. General: Comply with ASTM C 1193 and joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

C. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

D. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

E. Tooling of Non-sag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants to form smooth, uniform beads of configuration indicated. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.

1. Provide concave joint profile per Figure 8A in ASTM C 1193 unless otherwise indicated.

3.03 JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces.

1. Joint Locations:
   a. Isolation and contraction joints in cast-in-place concrete slabs.
   b. Tile control and expansion joints.
   c. Joints between different materials listed above.

2. Joint Sealant: Urethane, M, P, 50, T, NT.
3. Joint-Sealant Color: Match existing.

B. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal non-traffic surfaces.

1. Joint Locations:
   a. Construction joints in cast-in-place concrete.
   b. Joints between plant-precast architectural concrete units.
   c. Control and expansion joints in unit masonry.
   d. Joints in dimension stone cladding.
   e. Other joints as indicated on Drawings.

2. Joint Sealant: Silicone, non-staining, S, NS, 50, NT.
3. Joint-Sealant Color: Match existing.

C. Joint-Sealant Application: Interior joints in horizontal traffic surfaces.

1. Joint Locations:
   a. Isolation joints in cast-in-place concrete slabs.
   b. Control and expansion joints in tile flooring.
   c. Other joints as indicated on Drawings.

2. Joint Sealant: Urethane, S, P, 25, T, NT.
3. Joint-Sealant Color: Match existing.

D. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal non-traffic surfaces.

1. Joint Locations:
   a. Control and expansion joints on exposed interior surfaces of exterior walls.
   b. Tile control and expansion joints.
   c. Vertical joints on exposed surfaces of walls and partitions.

d. Other joints as indicated on Drawings.

2. Joint Sealant: Urethane, S, NS, 25, NT.
3. Joint-Sealant Color: Match existing.

E. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal non-traffic surfaces not subject to significant movement.

1. Joint Locations:
   a. Control joints on exposed interior surfaces of exterior walls.
   b. Perimeter joints between interior wall surfaces and frames of interior doors and windows.
   c. Other joints as indicated on Drawings.

2. Joint Sealant: Acrylic latex.
3. Joint-Sealant Color: Match existing.

F. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal Non-traffic surfaces.

1. Joint Locations:
   a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
   b. Tile control and expansion joints where indicated.
   c. Other joints as indicated on Drawings.

2. Joint Sealant: Silicone, mildew resistant, acid curing, S, NS, 25, NT.
3. Joint-Sealant Color: Match existing.

G. Joint-Sealant Application: Concealed mastics.

1. Joint Locations:
   a. Aluminum thresholds.
   b. Sill plates.
   c. Other joints as indicated on Drawings.

2. Joint Sealant: Butyl-rubber based.
3. Joint-Sealant Color: Match existing.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Hollow metal doors and frames.

1.02 SUBMITTALS

A. See Section 01 3300 - Administrative Requirements, for submittal procedures.

B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes; and one copy of referenced grade standard.

C. Shop Drawings: Include elevations, door edge details, glazing, frame profiles, metal thicknesses, preparations for hardware, and identifying locations of different finishes, if any.

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.

F. Schedule: Prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings.

1.03 REGULATORY REQUIREMENTS

A. Fire-Rated Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings and temperature-rise limits indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.

B. Fire-Rated, Borrowed-Lite Assemblies: Complying with NFPA 80 and listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9.

1.04 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum 5 years documented experience.

B. Maintain at the project site a copy of all reference standards dealing with installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

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

1. Ceco Door; ASSA ABLOY.
2. Windsor Republic Doors.
3. Steelcraft.
4. D & D Specialties, Inc.
5. Curries Hollow Metal Doors and Frames.

2.02 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, CS, Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, CS, Type B.

C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

D. Frame Anchors: ASTM A 591/A 591M, Commercial Steel (CS), 40Z (12G) coating designation; mill phosphatized.

1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.

E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.

F. Grout: ASTM C 476, except with a maximum slump of 4 inches (102 mm), as measured according to ASTM C 143/C 143M.

G. Mineral-Fiber Insulation: ASTM C 665, Type I.

H. Glazing: See Section 08 8000 Glazing.

I. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil (0.4-mm) dry film thickness per coat

2.03 HOLLOW METAL DOORS

A. General: Comply with ANSI/SDI A250.8.

1. Design: Flush panel.
2. Core Construction: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core.

a. Fire Door Core: As required to provide fire-protection and temperature-rise ratings indicated.
b. Thermal-Rated (Insulated) Doors: R-value of not less than 12.3 deg F x h x sq. ft./Btu (2.166 K x sq. m/W) when tested according to ASTM C 1363.

3. Vertical Edges for Single-Acting Doors: Manufacturer's standard.
4. Top and Bottom Edges: Closed with flush or inverted 0.042-inch- (1.0-mm-) thick, end closures or channels of same material as face sheets.
5. Tolerances: SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."
6. Finish: Factory primed, for field finishing.

B. Interior doors:

1. Face sheets fabricated from cold-rolled steel sheet unless metallic-coated sheet is indicated. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:

a. Level 1 and Physical Performance Level C (Standard Duty), Model 1 (Full Flush).
b. Width: 1-3/4 inches (44.5 mm).

C. Exterior doors:

1. Face sheets fabricated from metallic-coated steel sheet. Comply with ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:

a. Level 1 and Physical Performance Level C (Standard Duty), Model 1 (Full Flush).
b. Width: 1-3/4 inches (44.5 mm).

D. Hardware Reinforcement: ANSI/SDI A250.6.

2.04 HOLLOW METAL FRAMES

A. General: Comply with ANSI/SDI A250.8.

1. Comply with the requirements of grade specified for corresponding door.
a. Level 1 Doors: 16 gage frames.
b. Level 3 Doors: 14 gage frames.
c. Level 4 Doors: 12 gage frames.
d. Frames for Wood Doors: Comply with frame requirements specified in ANSI A250.8 for Level 1, 16 gage
e. Frames for Sound-Rated Wood Doors: Comply with frame requirements specified in ANSI A250.8 for Level 3, 14 gage

2. Finish: Factory primed, for field finishing.
3. Provide mortar guard boxes for hardware cut-outs in frames to be installed in masonry or to be grouted.
4. Frames wider than 48 Inches: Reinforce with steel channel fitted tightly into frame head, flush with top.

B. Interior frames:

1. Fabricated from cold-rolled steel sheet.
a. Fully welded
b. Frames for Interior Steel Doors: 0.042-inch- (1.0-mm-) thick steel sheet.
c. Frames for Wood Doors: 0.053-inch- (1.3-mm-).
d. Frames for Borrowed Lights: Same as adjacent door frame.

C. Exterior frames:

1. Fabricated from metallic-coated steel sheet.
a. Fully welded
b. Frames for Level 1 Steel Doors: 0.042-inch- (1.0-mm-) thick steel sheet.
c. Frames for Exterior Steel Doors: 0.053-inch- (1.3-mm-) thick steel sheet.

D. Hardware Reinforcement: ANSI/SDI A250.6.

2.05 FRAME ANCHORS

A. Jamb Anchors:

1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch (1.0 mm) thick, with corrugated or perforated straps not less than 2 inches (50 mm) wide by 10 inches (250 mm) long; or wire anchors not less than 0.177 inch (4.5 mm) thick.

2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch (1.0 mm) thick.
3. Post-installed Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch- (9.5-mm-) diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.

B. Floor Anchors:

1. Formed from same material as frames, minimum thickness of 0.042 inch (1.0 mm), and as follows:

a. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
b. Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 2-inch (50-mm) height adjustment. Terminate bottom of frames at finish floor surface.

2.06 HOLLOW METAL PANELS

A. Provide hollow metal panels of same materials, construction, and finish as specified for adjoining hollow metal work.

2.07 STOPS AND MOLDINGS

A. Moldings for Glazed Lites in Doors: Minimum 0.032 inch (0.8 mm) thick, same material as door face sheet, with custom color powder coated finish to match Design Professional's sample.

B. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch (16 mm) high unless otherwise indicated.

C. Loose Stops for Glazed Lites in Frames: Minimum 0.032 inch (0.8 mm) thick, same material as frames.

2.08 LOUVERS

A. Provide sight-proof louvers for interior doors, where indicated, that comply with SDI 111C, with blades or baffles formed of 0.020-inch- (0.5-mm-) thick, cold-rolled steel sheet set into 0.032-inch- (0.8-mm-) thick steel frame, with custom color painted finish to match Design Professional's sample.

2.09 ACCESSORIES

A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.

B. Ceiling Struts: Minimum 1/4-inch-thick by 1-inch- (6.4-mm-thick by 25.4-mm-) wide steel.

C. Grout Guards: Formed from same material as frames, not less than 0.016 inch (0.4 mm) thick.

2.10 FABRICATION

A. Tolerances: Fabricate hollow metal work to tolerances indicated in SDI 117.

B. Hollow Metal Doors:
1. Exterior Doors: Provide weep-hole openings in bottom of exterior doors. Seal joints in top edges of doors against water penetration.
2. Glazed Lites: Factory cut openings in doors
3. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated.

C. Hollow Metal Frames: Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.

1. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
2. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
3. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
4. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
5. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
6. Jamb Anchors: Provide number and spacing of anchors as follows:

    a. Masonry Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and as follows:
        a.1 Two anchors per jamb up to 60 inches (1524 mm) high.
        a.2 Three anchors per jamb from 60 to 90 inches (1524 to 2286 mm) high.
        a.3 Four anchors per jamb from 90 to 120 inches (2286 to 3048 mm) high.
        a.4 Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches (610 mm) or fraction thereof above 120 inches (3048 mm) high.

    b. Stud-Wall Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and as follows:
        b.1 Three anchors per jamb up to 60 inches (1524 mm) high.
        b.2 Four anchors per jamb from 60 to 90 inches (1524 to 2286 mm) high.
        b.3 Five anchors per jamb from 90 to 96 inches (2286 to 2438 mm) high.
        b.4 Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches (610 mm) or fraction thereof above 96 inches (2438 mm) high.
        b.5 Two anchors per head for frames more than 42 inches (1066 mm) wide and mounted in metal-stud partitions.

    c. Compression Type: Not less than two anchors in each jamb.

    d. Post-installed Expansion Type: Locate anchors not more than 6 inches (152 mm) from top and bottom of frame. Space anchors not more than 26 inches (660 mm) o.c.

7. Door Silencers: Except on weather-stripped doors, drill stops to receive door silencers.

    a. Single-Door Frames: Three door silencers.
    b. Double-Door Frames: Two door silencers.

D. Hardware Preparation: Factory prepare hollow-metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.

1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
2. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
3. Comply with applicable requirements in SDI A250.6 and BHMA A156.115 for preparation of hollow-metal work for hardware.
4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26

electrical Sections.

E. Stops and Moldings: Provide stops and moldings around glazed lites and louvers where indicated. Form corners of stops and moldings with mitered hairline joints.

1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow metal work.
2. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
3. Provide loose stops and moldings on inside of hollow-metal work.
4. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.

2.11 STEEL FINISHES

A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.

1. Shop Primer: SDI A250.10.

PART 3 EXECUTION

3.01 PREPARATION

A. Coat inside of frames to be installed in masonry or to be grouted, with bituminous coating, prior to installation.

B. Coat inside of frames with bituminous coating to a thickness of 1/16 inch.

3.02 INSTALLATION

A. Hollow Metal Frames: Comply with ANSI/SDI A250.11.

1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.

a. At fire-protection-rated openings, install frames according to NFPA 80.
b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
c. Install frames with removable glazing stops located on secure side of opening.
d. Install door silencers in frames before grouting.
e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
f. Check plumbness, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
g. Field apply bituminous coating to backs of frames that are filled with grout containing antifreezing agents.

2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.

a. Floor anchors may be set with powder-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.

3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation behind frames.
4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.

5. Ceiling Struts: Extend struts vertically from top of frame at each jamb to overhead structural supports or substrates above frame unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction. Provide adjustable wedged or bolted anchorage to frame jamb members.
6. Installation Tolerances: Adjust hollow metal door frames for squareness, alignment, twist, and plumb to the following tolerances:

    a. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
    b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
    c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
    d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.

B. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.

1. Non-Fire-Rated Standard Steel Doors:
    a. Jambs and Head: 1/8 inch (3 mm) plus or minus 1/16 inch (1.6 mm).
    b. Between Edges of Pairs of Doors: 1/8 inch (3 mm) plus or minus 1/16 inch (1.6 mm).
    c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch (9.5 mm).
    d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch (19 mm).

2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
3. Smoke-Control Doors: Install doors according to NFPA 105.

C. Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with hollow metal manufacturer's written instructions.

1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches (230 mm) o.c. and not more than 2 inches (50 mm) o.c. from each corner.

3.03 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow-metal work that is warped, bowed, or otherwise unacceptable.

B. Remove grout and other bonding material from hollow-metal work immediately after installation.

C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

D. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

E. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Flush wood doors; flush configuration; fire rated, non-rated, acoustical, and special function.

1.02 RELATED SECTIONS

A. Section 081113 – Hollow Metal Doors and Frames.

B. Section 087100 - Door Hardware.

C. Section 088000 - Glazing.

D. Section 099000 - Paints and Coatings:

1.03 REFERENCES

A. ASTM E 413 - Classification for Rating Sound Insulation; 2004.

B. ASTM E 1408 - Standard Test Method for Laboratory Measurement of the Sound Transmission Loss of Door Panels and Door Systems; 1991 (Reapproved 2000).

C. AWI/AWMAC (QSI) - Architectural Woodwork Quality Standards Illustrated; Architectural Woodwork Institute and Architectural Woodwork Manufacturers Association of Canada; 2006, 8th Ed., Version 2.0.

D. ICC (IBC) - International Building Code; 2006.

E. NFPA 80 - Standard for Fire Doors and Fire Windows; National Fire Protection Association; 2007.

F. UL (BMD) - Building Materials Directory; Underwriters Laboratories Inc.; current edition.

G. UL 752 - Standard for Bullet-Resisting Equipment; 2005.

1.04 SUBMITTALS

A. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.

B. Specimen warranty.

C. Shop Drawings: Illustrate door opening criteria, elevations, sizes, types, swings, undercuts required, special beveling, special blocking for hardware, factory machining criteria, factory finishing criteria, identify cutouts for glazing and louvers.

D. Samples: For factory-finished doors.

E. Manufacturer's Installation Instructions: Indicate special installation instructions.

F. Warranty, executed in Owner's name.

1.05 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum 5 years of documented experience.

B. Installed Fire Rated Door: Conform to NFPA 80 for fire rated class as scheduled.

1.06 DELIVERY, STORAGE, AND PROTECTION

A. Package, deliver and store doors in accordance with specified quality standard.

B. Accept doors on site in manufacturer's packaging. Inspect for damage.

C. Protect doors with resilient packaging sealed with heat shrunk plastic. Do not store in damp or

wet areas; or in areas where sunlight might bleach veneer. Seal top and bottom edges with tinted sealer if stored more than one week. Break seal on site to permit ventilation.

D. Store doors in strict accordance with manufacturer's recommendations.

E. Any doors damaged before or after installation during construction shall be replaced by and at the Contractor's expense.

1.07 PROJECT CONDITIONS

A. Coordinate the work with door opening construction, door frame and door hardware installation.

1.08 WARRANTY

A. Interior Doors: Provide manufacturer's warranty for the life of the installation.

B. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

PART 2 PRODUCTS

2.01 DOORS AND PANELS

A. All Doors: See drawings for locations and additional requirements.
   1. Quality Level: Custom Grade, in accordance with AWI/AWMAC Architectural Woodwork Quality Standards Illustrated, Section 1300.
   2. Wood Veneer Faced Doors: 5-ply or 7-ply unless otherwise indicated.

B. Interior Doors: 1-3/4 inches thick unless otherwise indicated; flush construction.
   1. Provide solid core doors at all locations.
   2. Fire Rated Doors: Tested to ratings indicated on drawings in accordance with International Building Code ("positive pressure"); UL labeled without any visible seals when door is open.
   3. Wood veneer facing.

2.02 DOOR PANEL CORES

A. Non-Rated Solid Core and 20 Minute Rated Doors: Type particleboard core (PC), plies and faces as indicated above.

B. Fire Rated Doors: Mineral core, Type FD, plies and faces as indicated above; with core blocking as required to provide adequate anchorage of hardware without through-bolting.

C. Sound Retardant Doors: Equivalent to Type PC construction with core as required to achieve rating specified; plies and faces as indicated above.

2.03 DOOR FACINGS

A. Wood Veneer Facing for Stain Finish: Natural Birch, factory finished.
   1. Vertical Edges: Same species as face veneer.
   2. Stain Finish: To be selected by architect from manufacturer’s full line of colors.

B. Facing Adhesive: Type II - water resistant.

2.04 ACCESSORIES

A. Glazing Stops: Rolled steel "V" shape, mitered corners; prepared for countersink style tamper proof screws.

2.05 DOOR CONSTRUCTION

A. Fabricate doors in accordance with door quality standard specified.

B. Cores Constructed with Stiles and Rails:

C. Provide solid blocks at lock edge and top of door for closer for hardware reinforcement.

D. Fit door edge trim to edge of stiles after applying veneer facing.

E. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.

F. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.

G. Provide edge clearances in accordance with AWI Quality Standards Illustrated Section 1700.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

3.02 INSTALLATION

A. Install doors in accordance with manufacturer's instructions and specified quality standard.
   1. Install fire-rated doors in accordance with NFPA 80 requirements.

B. Use machine tools to cut or drill for hardware.

C. Coordinate installation of doors with installation of frames and hardware.

D. Coordinate installation of glazing.

3.03 INSTALLATION TOLERANCES

A. Conform to specified quality standard for fit and clearance tolerances.

B. Conform to specified quality standard for maximum diagonal distortion.

C. Maximum Vertical Distortion (Bow): 1/8 inch measured with straight edge or taut string, top to bottom, over an imaginary 36 by 84 inches surface area.

D. Maximum Width Distortion (Cup): 1/16 inch measured with straight edge or taut string, edge to edge, over an imaginary 36 by 84 inches surface area.

3.04 ADJUSTING

A. Adjust doors for smooth and balanced door movement.

B. Adjust closers for full closure.

3.05 SCHEDULE - See Drawings

END OF SECTION

PART 1 GENERAL

1.01 SUMMARY

A. Section includes:

1. Exterior and interior storefront framing.
2. Storefront framing for window walls.
3. Storefront framing for punched openings.
4. Exterior and interior manual-swing entrance doors.

1.02 PERFORMANCE REQUIREMENTS

A. Air Infiltration: Provide aluminum-framed systems with maximum air leakage through fixed glazing and framing areas of 0.06 cfm/sq. ft. (0.03 L/s per sq. m) of fixed wall area when tested according to ASTM E 283 at a minimum static-air-pressure difference of 1.57 lbf/sq. ft. (75 Pa).

B. Water Penetration under Static Pressure: Provide aluminum-framed systems that do not evidence water penetration through fixed glazing and framing areas when tested according to ASTM E 331 at a minimum static-air-pressure difference of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft. (300 Pa).

1.03 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For aluminum-framed systems. Include plans, elevations, sections, details, and attachments to other work.

1. Include details of provisions for system expansion and contraction and for drainage of moisture in the system to the exterior.

C. Entrance Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams.

D. Warranties: Sample of special warranties.

1.04 CLOSEOUT SUBMITTAL

A. Maintenance Data

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project

B. Product Options: Information on Drawings and in Specifications establishes requirements for systems' aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.

C. Accessible Entrances: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

D. Source Limitations for Aluminum-Framed Systems: Obtain from single source from single manufacturer.

1.06 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of aluminum-framed systems that do not comply with requirements or that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

B. Special Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes do not comply with requirements or that fail in materials or workmanship within specified warranty period. Warranty does not include normal weathering.

1. Warranty Period: Ten years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 ALUMINUM FRAMES

A. Frames for exterior doors and exterior fixed glazing as scheduled shall be of sizes and arrangements shown on the Drawings, including sidelights and transoms. Provide reinforcement for hardware and snap-in neoprene gasketed glazing beads. Provide approximately 5" high bases at sidelights and at fixed glazing extending to the floor.

B. Frames shall be 2" x 4-1/2" overall sizes, arranged for 1" insulating glass, center set, fabricated from 6063-T5 extruded aluminum.

C. Finish on exposed surfaces shall be AAMA 611, Clear anodized. Finish shall match that of aluminum doors.

D. Joints shall be mechanically fastened and reinforced. Joints shall show only hairline cracks at connections. Provide anchors for building into masonry and floor anchors into concrete. Fasteners where exposed shall be aluminum, finished to match the dark bronze finish. Concealed fasteners shall be stainless steel. Steel strap anchors shall be galvanized. All frames at door jambs and heads shall have internal reinforcing included.

2.02 ALUMINUM DOORS

A. Aluminum doors shall be wide stile, with intermediate rail as shown, with joints both mechanically fastened and welded, and reinforced.

B. Aluminum finish shall be AAMA 611, Clear anodized. Finish shall match that of frames.

C. Provide stainless steel back pile cloth weatherstripping on all three sides of each door.

D. Provide bottom mounted pile door sweep.

2.03 HARDWARE

A. Storefront hardware items indicated to be furnished have been selected from Kawneer. Products matching the design and functions of the specified hardware items are approved. Hardware manufacturers shown are provided for quality and design only.

B. Hardware for single doors, colors to match doors unless specified otherwise:
1. Cylinder shall be provided under Section 08710.
2. 1 aluminum threshold size to match full opening width.

PART 3 EXECUTION

3.01 INSTALLATION

A. Secure frames in masonry by built-in anchors, to concrete with expansion bolts, and to steel structural members with wood blocking with wood screws. Install frames as per approved shop drawings, level, plumb, and square.

B. Provide galvanic protection against dissimilar materials and pressure treated wood blocking,

except that galvanized steel in contact with aluminum requires no additional insulating material. Coat dissimilar metal with prime and two coats of aluminum paint or coat with heavy-bodied bituminous paint. Coat aluminum in contact with masonry or concrete with two coats water-white methacrylate lacquer or one coat of heavy-bodied bituminous paint.

C. Protect completed work until final acceptance of the project.

D. Clean exposed aluminum work.

3.02 DOORS

A. Hardware specified to be furnished with the doors shall be installed at the factory, with reinforcements installed to sustain applied loads. Install hardware as shown on the hardware schedule included in Section 8710, and approved shop drawings.

B. Install doors in aluminum frames and adjust for perfect operation.

END OF SECTION

PART 1 GENERAL

1.01 SUMMARY

A. The work required under this section consists of furnishing hardware and supervising the installation of hardware and related items that are necessary to complete the work, as indicated on the drawings and described in this section.

B. Related work described in other sections includes:
   1. Hollow metal work
   2. Wood doors
   3. Aluminum doors and frames
   4. Electrical
   5. Carpentry

1.02 REFERENCES

A. ANSI A117.1 - Specifications for making buildings and facilities usable by physically handicapped people.
B. AWI - Architectural Woodwork Institute
C. BHMA - Builders' Hardware Manufacturers Association
D. DHI - Door and Hardware Institute
E. NAAMM - National Association of Architectural Metal Manufacturers
F. NFPA - National Fire Protection Association
   1. NFPA 80 - Fire Door and Windows
   2. NFPA 101 - Life Safety Code
   3. NFPA 252 - Fire Test of Door Assemblies
   4. NFPA 105 - Smoke and Draft Control Door Assemblies
G. UL - Underwriters Laboratories
   1. UL 10C - Fire Test of Door Assemblies
   2. UL 305 - Panic Hardware

1.03 SUBMITTALS

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

B. Product Data: For each type of product.

C. Shop Drawings: Details of electrified door hardware.

D. Door Hardware Schedule: Prepared by or under the supervision of Installer, detailing fabrication and assembly of door hardware, as well as installation procedures and diagrams. Coordinate final door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

   1. Format: Use same scheduling sequence and format and use same door numbers as in the Contract Documents.

   2. Content: Include the following information:
      a. Identification number, location, hand, fire rating, size, and material of each door and frame.
      b. Locations of each door hardware set, cross-referenced to Drawings on floor plans and to door and frame schedule.
      c. Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.
      d. Description of electrified door hardware sequences of operation and interfaces with other building control systems.

E. Keying Schedule: Prepared by or under the supervision of Installer, detailing Owner's final keying instructions for locks.

F. Templates: Furnish templates and approve schedule to each related manufacturer of equipment which require same for the fabrication of their material.

G. Physical Samples: When requested, submit physical samples of each item of hardware and show manufacturer's name, model, and finish.

1.04 QUALITY ASSURANCE

A. Provide hardware in compliance with the local building code requirements. Also comply with NFPA 101 Life Safety Code and ANSI A117.1 where applicable.

B. Accessibility Requirements: Comply with applicable provisions in the DOJ's 2010 ADA Standards for Accessible Design for door hardware on doors in an accessible route.

C. Provide the services of a finish hardware supplier who has been furnishing hardware in the project's vicinity (Within 90 Miles) for a period of not less than (5) years and is an experienced hardware consultant (AHC). The consultant shall be available during the course of the work to the architect, and contractor.

D. Source Limitations: Provide electrified door hardware from same manufacturer as mechanical door hardware, unless otherwise indicated. Manufacturers that perform electrical modifications and that are listed by a testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.

E. Fire-Rated Door Assemblies: Where fire-rated door assemblies are indicated, provide door hardware rated for use in assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C, unless otherwise indicated.

F. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meet requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.

1. Air Leakage Rate: Maximum air leakage of 0.3 cfm/sq. ft. (3 cu. m per minute/sq. m) at the tested pressure differential of 0.3-inch wg (75 Pa) of water.

F. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

G. Means of Egress Doors: Latches do not require more than 15 lbf (67 N) to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver finish hardware to project site in manufacturer's protective packaging. All items are to be marked to indicate door opening number, hardware schedule number, or other identifying marks.

B. Store hardware in secure lock-up area that is dry and lighted.

1.06 WARRANTY

A. Warrant door closers against failure due to defective materials and workmanship for a period of TEN (10) years beginning at date of substantial completion. Closers judged defective during this

period shall be replaced or repaired at no cost to the owner.

B. Warrant exit devices against failure due to defects in material or workmanship for a period of five (5) years.

PART 2 PRODUCTS

2.01 FINISH

A. Finish shall be as follows unless otherwise listed in schedule:
   1. Hinges – US32D / US26D
   2. Exit Devices – 630
   3. Locksets – 626
   4. Closers - Sprayed Aluminum. 689
   5. Stops and Miscellaneous – US32D
   6. Flat Goods – US32D

2.02 KEYING

A. Exterior locks and cylinders to be construction keyed, or to have construction temporary cores during construction.

B. The keying layout shall match owners be a BEST Patented master key system. All cylinders to have proper blocking rings and tail pieces as required.

C. Provide the following number of keys:
   1. Two change keys per lock
   2. Five Master keys
   3. One Control key

D. Must Have keying meeting with Owner during Construction to Discuss Keying Requirements.

E. Building to have One Grandmaster and Submaster Levels of Keying.

2.03 HINGES

A. Types and materials as listed in the schedule.

B. Size shall be 4.5 x 4.5 unless otherwise listed in schedule. Provide 2 pair hinges for door leaves over 7'- 6"in height.

C. Bearings are not to be installed in hinge before electro-plating the hinge. If frozen bearings are found, replace the complete shipment.

D. Manufacturer's whose product meets the criteria of this specification and are acceptable.
   1. Stanley
   2. Hager
   3. McKinney

2.04 LOCKSETS AND LATCHES

A. All cylindrical locksets are to be ANSI 156.2 Grade 1. They shall meet ANSI A117.1 and ADA standards.

B. All locksets shall be manufactured by the same manufacturer. All lever trim is to be cast solid. Provide locks with interchangeable core cylinders.

C. Manufacturer's whose product meets the criteria of this specification and are acceptable:
   1. Best Access Solutions
   2. Dorma
   3. Sargent

2.05 EXIT DEVICES

A. Exit devices shall be listed by Underwriters' Laboratories, Inc. for Accident Hazard. Exit Devices for use on fire-rated openings shall bear factory installed UL markings that indicate a three (3) hour fire rating.

B. All exit devices shall be of one manufacturer. All latch bolts are to be deadlocking type. Attach surface applied items to doors with sex nuts and bolts.

C. Manufacturer's whose product meets the criteria of this specification and are acceptable:
   1. Precision
   2. Von Duprin
   3. Dorma

2.06 SURFACE MOUNTED DOOR CLOSERS

A. All surface closers shall be of one manufacturer. The closers shall be non-handed and non-sized. They will be hydraulically controlled and full rack and pinion operation. They shall have cast bodies and will have adjustments for back check, general speed, and latch speed.

B. Provide mounting plates as required, use sex nuts and bolts for application to all doors.

C. Manufacturer's whose product meets the criteria of this specification and are acceptable:
   1. Stanley
   2. Corbin
   3. Norton

2.07 CONTINUOUS HINGES

A. Continuous gear hinges shall be manufactured of extruded 6063-T6 aluminum alloy/temper. Hinges shall consist of three interlocking extrusions in a pinless assembly applied to the full height of the door and frame. All hinges shall be manufactured to template screw locations and be non-handed. Frame leaf and door leaf shall be independently milled. Thrust bearings shall carry the vertical loads and be completely concealed by the gear cap the full length of the hinge. The frame leaf and door leaf shall be anodized after milling and drilling processes are complete. Thru-bolt fasteners shall be templated so as not to make contact with the frame assembly. All mortise hinges shall cover and wrap the edge of door completely. All hinges shall be tested by a certified independent testing laboratory to 1,500,000 cycles and certified functional ANSI 156.1.

B. Manufacturers whose product meets the criteria of the specification and are acceptable.
   1. Pemko
   2. Stanley
   3. Select

2.08 OVERHEAD STOPS AND HOLDERS

A. Manufacturer's whose product meet the criteria of this specification and are acceptable:
   1. Rixson,
   2. ABH
   3. GLYNN JOHNSON

2.09 STOPS AND MISCELLANEOUS

A. Types as indicated in Hardware Schedule.

B. Manufacturer's whose product meets the criteria of this specification and are acceptable:
   1. Trimco
   2. ROCKWOOD
   3. DONJO

2.10 BOLTS

A. Flush bolts shall be 1" x 6-3/4" brass, rectangular front, per lengths indicated with 3/4" throw. Furnish bottom strike and top strike plate. Wrought bolts are unacceptable.

B. Bolts and accessories for use on fire-rated doors shall be Underwriters' Laboratories listed.

C. Manufacturer's whose product meets the criteria of this specification and are acceptable:
   1. Trimco
   2. ROCKWOOD
   3. HAGER

2.11 FLAT GOODS

A. All kick plates shall be 6" in height and 2" less than door width unless listed otherwise.

B. All mop plates shall be 6" in height and 1" less than door width unless listed otherwise.

C. All kick plates and mop plates shall be 1/8 in. thickness plastic.

D. Manufacturer's whose product meets the criteria of this specification and are acceptable:
   1. Trimco
   2. ROCKWOOD
   3. DONJO

2.12 THRESHOLDS AND WEATHERSTRIP

A. All thresholds shall be installed with flat head sleeve anchors.

B. Manufacturer's whose product meets the criteria of this specification and are acceptable:
   1. Pemko
   2. NGP
   3. HAGER

PART 3 EXECUTION

3.01 PRELIMINARY

A. Receive, store in temporary bins, and be responsible for all finish hardware. Tag, index, and file all keys temporarily during construction.

B. Check all hardware upon arrival on job site against approved Finish Hardware Schedule. Function of hardware shall be examined against the job site conditions and interference's. If exceptions in these regards are found, notify Architect at once and retain subject hardware in its original packing carton. Adjustment and/or substitutions shall be made only as authorized by Architect.

3.02 INSTALLATION

A. Install hardware to doors as listed in the door schedule. Comply with "Recommended Locations for Builders Hardware for Custom Steel Doors and Frames" as published by the Door and Hardware Institute. Application shall be by skilled workmen, who work with proper equipment, and shall be in accord with manufacturer's instructions, fit to work of others accurately, applied securely, and adjusted properly. Hardware let into work of others shall be neatly done from template and shall fit perfectly. Exercise care not to injure work of others.

B. Install finish hardware to template. Cut and fit substrate to avoid damage or weakening. Cover cut-outs with hardware item. Mortise work to correct location and size without gouging, splintering, or causing irregularities in exposed finished work.

C. Where cutting and fitting is required on substrates to be painted or similarly finished, install, fit, and adjust hardware prior to finishing, and then remove and place in original packaging. Reinstall hardware after finishing operation is completed.

D. Attach thresholds with flathead sleeve anchors, spaced at 24"o.c. maximum and symmetrical with the center of door opening. On cast thresholds where cast-on-anchors are used, apply utilizing an epoxy grout mixture.

E. Attach door closers to door, whether wood or metal, with nut and bolt assemblies. Where closers have stop function, install closer to stop the door before striking obstructions.

3.03 CLEANING AND ADJUSTING

A. At the time of hardware installation, adjust each hardware item to perform function intended. Lubricate moving parts with lubricant acceptable to hardware manufacturer.

B. Prior to "Date of Substantial Completion", readjust and re-lubricate hardware. Repair or replace defective materials. Clean hardware as recommended by manufacturer to remove dust and stains.

3.04 FASTENINGS

A. All exposed screws shall be Phillips head, finished to match item and sized to suit job requirements.

B. Surface applied items such as closers and overhead holders shall be applied with sex nut and bolt assemblies.

3.05 OPERATION AND ADJUSTMENT

A. After installation, all templates, installation instructions, As-Built and Special Details to be placed in a properly identified Binder. This binder and all special tools are to be turned over to the Architect at Final Acceptance of the project.

B. After Final Acceptance, the hardware supplier shall instruct the Owner's designated personnel in the proper operation, adjustment, and maintenance of hardware and finishes.

3.06 COORDINATION

A. Coordinate finish hardware and electrical hardware installation with other trades to ensure proper installation and function for a complete operating system.

GENERAL NOTE:

ALL HARDWARE SHALL BE ATTACHED ONLY WITH FASTENERS PROVIDED WITH PRODUCTS BY MANUFACTURER. TEK SCREWS WILL NOT BE ACCEPTABLE UNLESS SPECIFICALLY NOTED.

3.07 DOOR HARDWARE SCHEDULE

Hardware Set No. 1:

Doors: *122A, 155D, 155E, 158*

2 ea.	Mortise Cylinder	1E-76 STD	626	BE
	NOTE: Balance of hardware by Aluminum door supplier.			

Hardware Set No. 2:

Doors: *161, 164A*

1 ea.	Continuous Hinge	SL-24HD 83"	CL	SP
1 ea.	Exit Device	2101	630	PR
1 ea.	Door Closer	CLD-4550 CS SN	689	SD
1 ea.	Weatherstrip	303 AVTST 1 x 36" 2 x 84"		PE
1 ea.	Door Bottom	345 AV 36”	626	PE
1 ea.	Threshold	171 A 36”		PE

Hardware Set No. 3:

Doors: *162, 163, 164*

1 ea.	Continuous Hinge	SL-24HD 83"	CL	SP
1 ea.	Exit Device	2103	630	PR
1 ea.	Keypad Exit Trim	LP1020B	US26D	ILCO
1 ea.	Door Closer	CLD-4550 CS SN	689	SD
1 ea.	Weatherstrip	303 AVTST 1 x 36" 2 x 84"		PE
1 ea.	Door Bottom	345 AV 36”		PE
1 ea.	Threshold	171 A 36”		PE
1 ea.	Back Plate	BP21		PR

Hardware Set No. 4:

Door: *154*

2 ea.	Continuous Hinges	SL-24HD 83”	CL	SP
2 ea.	Surface Bolts	580-8	US26D	RO
1 ea.	Lockset	9K3-7AB15D STD	690	BE
2 ea.	Door Closer	CLD-4550 HCS SN	689	SD

2 ea.	Protection Plates	K1050 34”x34” SS Tek Screws (24)	US32D	RO
1 ea.	Weatherstrip	303 AVTST 1 x 72" 2 x 84"		PE
2 ea.	Door Bottom	345 AV 36”		PE
1 ea.	Threshold	171 A 72”		PE

Hardware Set No. 5:

Door: 155

6 ea.	Hinges	FBB179 4 1/2 X 4 1/2	US26D	ST
1 ea.	Removable Mullion	FLKR822	689	PR
2 ea.	Exit Device	FL2108 X 4908A	630	PR
3 ea.	Rim Cylinder	12E-72 STD	626	BE
2 ea.	Door Closer	CLD-4550 CS SN	689	SD
2 ea.	Protection Plates	K1050 8”x34”	US32D	RO
2 ea.	Wall Bumper	409	US32D	RO
1 ea.	Mullion Gasketing	5110 BL 120"		PE
2 ea.	Door Silencers	608-RKW	GREY	RO

Hardware Set No. 6:

Door: 155A

6 ea.	Hinges	FBB179 4 1/2 X 4 1/2	US26D	ST
2 ea.	Surface Bolts	580-8	US26D	RO
1 ea.	Lockset	7KC3-7R15D STD	626	BE
2 ea.	Door Closer	CLD-4550 EDA SN	689	SD
2 ea.	Wall Bumper	409	US32D	RO
2 ea.	Door Silencers	608-RKW	GREY	RO

Hardware Set No. 7:

Door: 158A

3 ea.	Hinges	FBB179 4 1/2 X 4 1/2	US26D	ST
1 ea.	Electronic Lock	9KZ3-7DV15KP STD	626	BE
1 ea.	Electric Strike Body	1006 J	630	HS
1 ea.	Door Closer	CLD-4550 EDA SN	689	SD
1 ea.	Wall Bumper	409	US32D	RO
1 ea.	Power Supply	BPS-12/24-1		SN
1 ea.	Surface Mini Box	660-PB		LO
3 ea.	Door Silencers	608-RKW	GREY	RO

Hardware Set No. 8:

Doors: 117, 121, 155C

3 ea.	Hinges	FBB179 4 1/2 X 4 1/2	US26D	ST
1 ea.	Push Button Lock	L1021B	26D	ILCO
1 ea.	Door Closer	CLD-4550 EDA SN	689	SD
1 ea.	Wall Bumper	409	US32D	RO
3 ea.	Door Silencers	608-RKW	GREY	RO

Hardware Set No. 9:

Doors: 115, 116, 137, 138, 200

3 ea.	Hinges	FBB179 4 1/2 X 4 1/2	US26D	ST
1 ea.	Lockset	7KC3-7D15D STD	US26D	BE
1 ea.	Door Closer	CLD-4550 STD W/PA BRKT SN	689	SD
1 ea.	Wall Bumper	409	US32D	RO
3 ea.	Door Silencers	608-RKW	GREY	RO

Hardware Set No. 10:

Doors: 118, 141, 153, 155B

3 ea.	Hinges	FBB179 4 1/2 X 4 1/2	US26D	ST
1 ea.	Lockset	7KC3-7R15D STD	626	BE
1 ea.	Door Closer	CLD-4550 STD W/PA BRKT SN	689	SD
1 ea.	Wall Bumper	409	US32D	RO
3 ea.	Door Silencers	608-RKW	GREY	RO

Hardware Set No. 11:

Doors: *100, 101, 102, 103, 103A, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 122, 125, 126, 127, 128, 129, 131,132, 133, 134, 135, 136, 140, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152*

3 ea.	Hinges	FBB179 4 1/2 X 4 1/2	US26D	ST
1 ea.	Lockset	7KC3-7AB15D STD	626	BE
1 ea.	Wall Bumper	409	US32D	RO
3 ea.	Door Silencers	608-RKW	GREY	RO

Hardware Set No. 12:

Doors: *123, 124, 156, 156A, 157, 157A*

3 ea.	Hinges	FBB179 4 1/2 X 4 1/2	US26D	ST
1 ea.	Door Pull	107 x 70C	US32D	RO
1 ea.	Push Plate	70C-RKW 4x16	US32D	RO
1 ea.	Door Closer	CLD-4550 STD W/PA BRKT SN	689	SD
1 ea.	Protection Plate	K1050 8”x34”	US32D	RO
1 ea.	Protection Plate	K1050 6”x35”	US32D	RO
1 ea.	Wall Bumper	409	US32D	RO
3 ea.	Door Silencers	608-RKW	GREY	RO

Hardware Set No. 13:

Doors: *119, 123A, 123B, 124A, 139, 156B, 156C, 157B, 157C, 157D*

3 ea.	Hinges	FBB179 4 1/2 X 4 1/2	US26D	ST
1 ea.	Lockset	7KC3-0L15D	626	BE
1 ea.	Wall Bumper	409	US32D	RO
3 ea.	Door Silencers	608-RKW	GREY	RO

Hardware Set No. 14:

Doors: *154A, 154B*

3 ea.	Hinges	FBB179 4 1/2 X 4 1/2	US26D	ST
1 ea.	Passage Set	7KC3-0N15D	626	BE
1 ea.	Door Closer	CLD-4550 CS SN	689	SD
1 ea.	Protection Plate	K1050 8”x34”	US32D	RO
1 ea.	Wall Bumper	409	US32D	RO
3 ea.	Door Silencers	608-RKW	GREY	RO

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Glass for windows, doors, interior borrowed lites, and storefront framing.

B. Glazing sealants and accessories.

1.02 SUBMITTALS

A. See Section 01 3300 - Administrative Requirements, for submittal procedures.

B. Product Data: For each type of product.

C. Samples: Provide (1) 12”x12” sample for each glass type.

D. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

1.03 QUALITY ASSURANCE

A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

B. Safety Glazing Labeling: Where safety glazing labeling is indicated, permanently mark glazing with certification labels of the SGCC the SGCC or another certification agency acceptable to authorities having jurisdiction or the manufacturer. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

C. Fire-Protection-Rated Glazing Labeling: Permanently mark fire-protection-rated glazing with certification label of a testing agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, test standard, whether glazing is for use in fire doors or other openings, whether or not glazing passes hose-stream test, whether or not glazing has a temperature rise rating of 450 deg F (250 deg C), and the fire-resistance rating in minutes.

D. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.

1.04 WARRANTY

A. Manufacturer's Special Warranty for Insulating Glass: Manufacturer agrees to replace Insulating glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Structural Performance: Glazing shall withstand the following design loads within limits and

under conditions indicated determined according to the International Building Code and ASTM E 1300.

1. Design Wind Pressures: As indicated on Structural Drawings.
2. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.

B. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.

C. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:

1. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F (W/sq. m x K).
2. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
3. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

2.02 GLASS PRODUCTS - GENERAL

A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. GANA Publications: "Glazing Manual."
2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

B. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IgCC.

C. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than the thickness indicated.

D. Strength: Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where fully tempered float glass is indicated, provide fully tempered float glass.

2.03 GLASS PRODUCTS

A. Fully Tempered Float Glass: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

B. Heat-Strengthened Float Glass: ASTM C 1048, Kind HS (heat strengthened), Type I, Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

2.04 LAMINATED GLASS

A. Laminated Glass: ASTM C 1172. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.

1. Construction: Laminate glass with polyvinyl butyral interlayer, ionomeric polymer interlayer or cast-in-place and cured-transparent-resin interlayer to comply with interlayer manufacturer's written instructions.
2. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
3. Interlayer Color: Individual panels of red, yellow and blue primary colors.

2.05 INSULATING GLASS

A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190.

1. Sealing System: Dual seals.
2. Spacer: Manufacturer's standard spacer material and construction.

2.06 GLAZING SEALANTS

A. General:
1. Compatibility: Provide glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
3. VOC Content: For sealants used inside of the weatherproofing system, not more than 250 g/L when calculated according to 40 CFR 59, Subpart D.
4. Colors of Exposed Glazing Sealants: As selected by Design Professional from manufacturer's full range.

B. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.

C. Glazing Sealants for Fire-Rated Glazing Products: Products that are approved by testing agencies that listed and labeled fire-resistant glazing products with which they are used for applications and fire-protection ratings indicated.

2.07 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; non-staining and non-migrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:

1. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
2. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:

1. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.08 MISCELLANEOUS GLAZING MATERIALS

A. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

B. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

C. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

D. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

E. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

2.09 GLASS SCHEDULE

A. Monolithic Glass:

1. Glass Type (#3): Clear fully tempered float glass.
   a. Minimum Thickness: 1/4".
   b. Safety glazing required.

B. Insulating Glass:

1. Glass Type (#1): Fully Tempered, Low-E-coated, tinted insulating glass.
   a. Overall Unit Thickness: 1 inch (25 mm).
   b. Minimum Thickness of Each Glass Lite: 6 mm.
   c. Outdoor Lite: Tinted fully tempered float glass.
   d. Interspace Content: Air.
   e. Tint Color: Gray.
   f. Indoor Lite: Clear fully tempered float glass.
   g. Low-E Coating: Pyrolytic or sputtered on second or third surface.
   h. Solar Heat Gain Coefficient: 0.30 maximum.

2. Glass Type (#2): Fully Tempered, Low-E-coated, tinted insulating glass.
   a. Overall Unit Thickness: 1 inch (25 mm).
   b. Minimum Thickness of Each Glass Lite: 6 mm.
   c. Outdoor Lite: Tinted fully tempered float glass.
   d. Interspace Content: Air.
   e. Tint Color: Gray.
   f. Indoor Lite: Clear fully tempered float glass.
   g. Low-E Coating: Pyrolytic or sputtered on second or third surface.
   h. Solar Heat Gain Coefficient: 0.22 maximum.

PART 3 EXECUTION

3.01 GLAZING - GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.

C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

F. Provide spacers for glass lites where length plus width is larger than 50 inches (1270 mm).

G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

3.02 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first, then to jambs. Cover horizontal framing joints by applying tapes to jambs, then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped.

Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Center glass lites in openings on setting blocks, and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

3.03 GASKET GLAZING (DRY)

A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket. Install dense compression gaskets and pressure glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints

with sealant recommended by gasket manufacturer.

E. Install gaskets so they protrude past face of glazing stops.

3.04 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.05 CLEANING AND PROTECTION

A. Immediately after installation remove nonpermanent labels and clean surfaces.
B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.

    1. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.

C. Remove and replace glass that is damaged during construction period.

END OF SECTION

PART 1 GENERAL

1.01 DELIVERY AND STORAGE

A. Deliver materials in original, unopened packages. Store in enclosed space providing protection from damage and from the elements. Remove damaged or deteriorated materials from the premises.

1.02 ENVIRONMENTAL CONDITIONS

A. During the heating season when installing gypsum drywall and joint finishing, maintain temperatures within the building of 55 to 70 deg. F. Provide ventilation to carry off moisture.

1.03 SUBMITTALS

A. Product Data: Provide product data on each gypsum wall board specified.

B. Samples: Submit (2) samples of each product used, 12” x 12” with manufacturer name and product name on each sample.

PART 2 PRODUCTS

2.01 MATERIALS

A. Basis of design: Products of National Gypsum Company.

B. Alternate manufacturers that meet product descriptions will be acceptable.

2.02 STANDARD GYPSUM BOARD (INTERIOR WALLS AND CEILINGS)

A. Panel physical characteristics:

1. Core: Regular

2. Surface Paper: 100% recycled content paper on front, back and long edges

3. Long Edges: Tapered

4. Thickness: 5/8”

5. Panel complies with requirements of ASTM C1396 Standard Specification for Gypsum Board.

2.03 STANDARD GYPSUM BOARD (INTERIOR SIDE OF EXTERIOR WALLS)

A. Basis of design: Gold Bond XP Gypsum Board

B. Panel physical characteristics:

1. Core: Mold and moisture resistant gypsum core

2. Surface Paper: 100% recycled content moisture/mold/mildew resistant paper on front, back and long edges.

3. Long Edges: Tapered

4. Thickness: 5/8”

5. Panel complies with requirements of ASTM C1396 Standard Specification for Gypsum Board.

2.04 FIRE RESISTANCE RATED GYPSUM BOARD

A. Basis of design: Gold Bond Fire-Shield Gypsum Board

B. Panel physical characteristics (Type X):

1. Core: Fire-resistant rated gypsum core
2. Surface Paper: 100% recycled content paper on front, back and long edges.
3. Long Edges: Tapered
4. Thickness: 5/8”
5. Panel complies with requirements of ASTM C1396 Standard Specification for Gypsum Board.

2.05 ACOUSTICALLY ENHANCED GYPSUM BOARD (TOILET WALLS)

A. Basis of design: Gold Bond Sound Break XP Gypsum Board

B. Panel physical characteristics:

1. Overall Thickness: 5/8”
   a. Inner Layer: Viscoelastic damping polymer
   b. Outer Layers: Enhanced, high density mold-resistant gypsum board
2. Long Edges: Tapered
3. Mold Resistance:
   a. ATM D3273, Score 10
   b. ATM G21, score 0

PART 3 EXECUTION

3.01 PREPARATORY WORK

A. Insure that items to be built into walls have been completed and approved before beginning work specified in this Section. Insure that electric boxes are located and that all penetrations that will require accommodation are installed.

B. Inspect stud framing to insure that studs are located on 16" centers, true and plumb, and ready to receive gypsum board.

C. Insure that acoustical and insulation batts are securely in place before covering the cavities.

3.02 ERECTION OF GYPSUM WALLBOARD

A. Install gypsum board on ceilings before installing gypsum board on walls.

B. Ends and edges of gypsum wallboard shall occur over furring or wall stud members, except when joints are at right angles to framing members as in horizontal application or when the end joints are to be back-blocked.

C. To minimize end joints, use wallboard of maximum practical lengths. Bring boards into contact, but do not force into place. Where ends or edges abut, they shall be back-blocked. Stagger end joints.

D. Space fastenings not less than 7" o.c. on ceilings and 8" o.c. on walls; space 3/8" from edges and ends of wallboard. Fasteners shall not be staggered on adjoining edges or ends. While the fasteners are being driven, the wallboard shall be held in firm contact with the underlying support. Attachment shall proceed from central portion of the wallboard toward ends and edges. Drive fasteners home with the heads slightly below the surface of the gypsum wallboard. Do not break the paper face.

E. At laminated construction, place first layer of gypsum wallboard with long dimension perpendicular to supports, fastened as specified for single layer application. Apply second layer with laminating adhesive or the approved joint compound spread with notched spreaders, size

and spacing as recommended by the compound manufacturer to provide coverage. Place boards in place vertically with all joints offset from the previous layer, adhesive bonded, and screw fasten at edges only.

F. Where partitions extend to the underside of metal decking, scribe the gypsum wallboard to fit the flutes of the decking. Where two hour fire rating is required laminate a second layer of gypsum wallboard, similarly scribed, to the first ply, extending not less than 4" below the underside of the metal decking. The assembly shall provide complete closure.

3.03 ACOUSTICAL TREATMENT

A. Partitions indicated shall receive sound attenuation treatment, including acoustical sealants. Provide a bead of acoustical sealant around all penetrations through gypsum wallboard partitions. Apply buttered coat of sealant on backs of outlets and switch boxes occurring in partitions indicated to be acoustically treated. Provide bead of sealant against runner members before gypsum board sheets are installed. Apply sealant to completely fill gap between concrete floor slab and bottom of gypsum board sheet. Install around room perimeter or at wall location schedule for sound attenuation blanket insulation.

3.04 TRIM

A. Provide metal edge trim at perimeters of wallboard areas where they abut other construction. At exposed exterior corners, provide metal corner beads. Edges of wallboard having metal trim shall be fastened through flanges of metal with the specified fasteners.

3.05 FINISHING GYPSUM WALLBOARD

A. Mix joint compound in compliance with the manufacturer's printed instructions.

B. Apply compound in a thin uniform layer to all joints and interior corners to be reinforced. Immediately apply reinforcing tape centered over the joint and seated into compound. Insure that not less than 1/64" or more than 1/32" thickness of compound remains under the tape for bond in order to comply with the manufacturer's printed recommendations. Follow immediately with a thin skim coat to embed tape. Fold and embed tape in all interior corners to provide a true 90 deg. angle.

C. Apply second coat of joint compound over embedding coat, filling panel taper flush with the surface and feather out at least 2" beyond the first coat. On joints with no taper, provide at least 4" taper on either side of tape. Apply finish coat 2" beyond second coat.

D. Apply compound to fastener depressions, feathered out, until a total of three coats are applied.

E. Beads and trim shall be covered with a coat of compound feathered out. Subsequent coats shall be extended slightly past the previous coat.

F. Each application of finishing compound shall be allowed to dry before applying subsequent coats. Sand between coats to remove rough spots for a smooth finish. Finished coat shall be smooth, ready for paint application, and with no abrasion of the paper surface.

3.06 PATCHING

A. Before finishes area applied by the painter, provide patching of gypsum drywall surfaces that have become damaged. Finished surfaces, after patching, shall be smooth, without protrusions, loose tape or trim edges.

END OF SECTION

PART 1 GENERAL

1.01 SUMMARY

A. Section includes:
   1. Non-load-bearing steel framing systems for interior gypsum board assemblies.
   2. Suspension systems for interior gypsum ceilings, soffits, and grid systems.

1.02 SUBMITTALS

A. Product Data: For each type of product.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

2.02 FRAMING SYSTEMS

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of pre-consumer recycled content not less than 25 percent.

B. Framing Members, General: Comply with ASTM C 754 for conditions indicated.

   1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal unless otherwise indicated.
   2. Protective Coating: ASTM A 653/A 653M, G40 (Z120) or ASTM A 653/A 653M, G60 (Z180), hot-dip galvanized unless otherwise indicated.

C. Studs and Runners: ASTM C 645.

   1. Steel Studs and Runners:
      a. Minimum Base-Metal Thickness: 0.027 inch (0.68 mm).
      b. Depth: As indicated on Drawings.

D. Slip-Type Head Joints: Where indicated, provide one of the following:

   1. Single Long-Leg Runner System: ASTM C 645 top runner with 2-inch- (51-mm-) deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top runner and with continuous bridging located within 12 inches (305 mm) of the top of studs to provide lateral bracing.
   2. Double-Runner System: ASTM C 645 top runners, inside runner with 2-inch- (51-mm-) deep flanges in thickness not less than indicated for studs and fastened to studs, and outer runner sized to friction fit inside runner.
   3. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.

      a. Products: Subject to compliance with requirements, [provide one of the following:
         a.1. Dietrich Metal Framing; SLP-TRK Slotted Deflection Track.

a.2. MBA Building Supplies; Slotted Deflecto Track.
a.3. Steel Network Inc. (The); VertiClip SLD Series.
a.4. Superior Metal Trim; Superior Flex Track System (SFT).

E. Firestop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Fire Trak Corp.; Fire Trak System[attached to studs with Fire Trak Posi Klip].
   b. Grace Construction Products; FlameSafe FlowTrak System.
   c. Metal-Lite, Inc.; The System.

F. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.

1. Minimum Base-Metal Thickness: 0.033 inch (0.84 mm).

G. Cold-Rolled Channel Bridging: Steel, 0.053-inch (1.34-mm) minimum base-metal thickness, with minimum 1/2-inch- (13-mm-) wide flanges.

1. Depth: Not less than 1-1/2 inches (38 mm).
2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches (38 by 38 mm), 0.068-inch- (1.72-mm-) thick, galvanized steel.

H. Hat-Shaped, Rigid Furring Channels: ASTM C 645.

1. Minimum Base-Metal Thickness: 0.018 inch (0.45 mm).
2. Depth: As indicated on Drawings.

I. Resilient Furring Channels: 1/2-inch- (13-mm-) deep, steel sheet members designed to reduce sound transmission.

1. Configuration: Asymmetrical.

J. Cold-Rolled Furring Channels: 0.053-inch (1.34-mm) uncoated-steel thickness, with minimum 1/2-inch- (13-mm-) wide flanges.

1. Depth: 3/4 inch (19 mm).
2. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum uncoated-steel thickness of 0.033 inch (0.8 mm).
3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- (1.59-mm-) diameter wire, or double strand of 0.048-inch- (1.21-mm-) diameter wire.

K. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches (32 mm), wall attachment flange of 7/8 inch (22 mm), minimum uncoated-metal thickness of 0.018 inch (0.45 mm), and depth required to fit insulation thickness indicated.

2.03 SUSPENSION SYSTEMS

A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- (1.59-mm-) diameter wire, or double strand of 0.048-inch- (1.21-mm-) diameter wire.

B. Hanger Attachments to Concrete:

1. Anchors: Fabricated from corrosion-resistant materials with holes or loops for attaching

wire hangers and capable of sustaining, without failure, a load equal to 5 times that imposed by construction as determined by testing according to ASTM E 488 by an independent testing agency.

a. Type: Cast-in-place anchor, designed for attachment to concrete forms.

2. Powder-Actuated Fasteners: Suitable for application indicated, fabricated from corrosion-resistant materials with clips or other devices for attaching hangers of type indicated, and capable of sustaining, without failure, a load equal to 10 times that imposed by construction as determined by testing according to ASTM E 1190 by an independent testing agency.

C. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.16 inch (4.12 mm) in diameter.

D. Flat Hangers: Steel sheet, 1 by 3/16 inch (25 by 5 mm) by length indicated.

E. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.053 inch (1.34 mm) and minimum 1/2-inch- (13-mm-) wide flanges.

1. Depth: 2-1/2 inches (64 mm).

F. Furring Channels (Furring Members):

1. Cold-Rolled Channels: 0.053-inch (1.34-mm) uncoated-steel thickness, with minimum 1/2-inch- (13-mm-) wide flanges, 3/4 inch (19 mm) deep.

2. Steel Studs and Runners: ASTM C 645.

a. Minimum Base-Metal Thickness: 0.027 inch (0.68 mm).

b. Depth: 3-5/8 inches (92 mm).

3. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch (22 mm) deep.

a. Minimum Base-Metal Thickness: 0.018 inch (0.45 mm).

4. Resilient Furring Channels: 1/2-inch- (13-mm-) deep members designed to reduce sound transmission.

a. Configuration: Asymmetrical.

G. Grid Suspension System for Gypsum Board Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.

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

a. Armstrong World Industries, Inc.; Drywall Grid Systems.

b. Chicago Metallic Corporation; Drywall Grid System.

c. USG Corporation; Drywall Suspension System.

2.04 AUXILLARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards.

1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

B. Sill-Sealer Gasket at Exterior Walls: Provide the following:

1. Foam Gasket: Closed-cell neoprene foam strips that allow fastener penetration without foam displacement, 1/8 inch (3.2 mm) thick, in width to suit steel stud size.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.

1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

B. Coordination with Sprayed Fire-Resistive Materials:

1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling runners (tracks) to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches (610 mm) o.c.

2. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of non-load-bearing steel framing. Do not reduce thickness of fire-resistive materials below that required for fire-resistance ratings indicated. Protect adjacent fire-resistive materials from damage.

3.03 INSTALLATION - GENERAL

A. Installation Standard: ASTM C 754

1. Gypsum Plaster Assemblies: Also comply with requirements in ASTM C 841 that apply to framing installation.

2. Portland Cement Plaster Assemblies: Also comply with requirements in ASTM C 1063 that apply to framing installation.

3. Gypsum Veneer Plaster Assemblies: Also comply with requirements in ASTM C 844 that apply to framing installation.

4. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.

B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

C. Install bracing at terminations in assemblies.

D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently

3.04 INSTALLING FRAMED ASSEMBLIES

A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.

1. Single-Layer Application: 16 inches (406 mm) o.c. unless otherwise indicated.

2. Multilayer Application: 16 inches (406 mm) o.c. unless otherwise indicated.

3. Tile Backing Panels: 16 inches (406 mm) o.c. unless otherwise indicated.

B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

C. Install studs so flanges within framing system point in same direction.

D. Install tracks (runners) at floors and overhead supports. Install sill-sealer gasket under tracks at exterior walls.

E. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.

1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.

2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.

a. Install two studs at each jamb unless otherwise indicated.
b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch (13-mm) clearance from jamb stud to allow for installation of control joint in finished assembly.
c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.

3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.

4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.

a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.

5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.

6. Curved Partitions:

a. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
b. Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of no fewer than two studs at ends of arcs, place studs 6 inches (150 mm) o.c.

F. Brace full height partitions over 15 feet tall with diagonal stud bracing (kickers), matching wall stud size and thickness, at 48 inches o.c.

G. Direct Furring:

1. Screw to wood framing.

2. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches (610 mm) o.c.

H. Z-Furring Members:

1. Erect insulation, specified in Section 072100 "Thermal Insulation," vertically and hold in place with Z-furring members spaced 24 inches (610 mm) o.c.

2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners

spaced 24 inches (610 mm) o.c.

3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches (305 mm) from corner and cut insulation to fit.

I. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch (3 mm) from the plane formed by faces of adjacent framing.

J. Brace full height partitions over 15 feet tall with diagonal stud bracing (kickers), matching wall stud size and thickness, at 48 inches o.c.

3.05 INSTALLING SUSPENSION SYSTEMS

A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.

1. Hangers: 48 inches (1219 mm) o.c.
2. Carrying Channels (Main Runners): 48 inches (1219 mm) o.c.
3. Furring Channels (Furring Members): 16 inches (406 mm) o.c.

B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.

C. Suspend hangers from building structure as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.

   a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.

2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.

   a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.

3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.

4. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.

5. Do not attach hangers to steel roof deck.

6. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.

7. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.

8. Do not connect or suspend steel framing from ducts, pipes, or conduit.

D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.

E. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

F. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet (3 mm in 3.6 m) measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION

PART 1 GENERAL

1.01 SUMMARY

A. Section includes:

1. Ceramic Tile
2. Stone Thresholds.
3. Waterproof Membrane.
4. Crack Isolation Membrane.
5. Tile Backing Panels.
6. Metal Edge Strips

1.02 SUBMITTALS

A. See Section 01 3300 - Administrative Requirements, for submittal procedures.

B. Product Data: For each type of product. Include preparation requirements and application instructions.

C. Samples:

1. Each type and composition of tile and for each color and finish required.
2. Assembled samples, with grouted joints, for each type and composition of tile and for each color and finish required.
3. Stone thresholds in 6-inch (150-mm) lengths.

1.03 EXTRA MATERIALS

A. Furnish extra materials described below that are from same production run (batch mix) as materials applied and that are packaged for storage and identified with labels describing contents.

1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.

PART 2 PRODUCTS

2.01 TILE PRODUCTS

A. ANSI Ceramic Tile Standard: Provide Standard grade tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.

B. FloorScore Compliance: Tile for floors shall comply with requirements of FloorScore Standard.

C. Tile Type [T1]: Glazed through-body color porcelain floor tile.

1. Basis of Design: DalTile, Affinity Collection.
   a. Color: Beige #AF02
   b. Pattern: Staggered brick joint (overlap not to exceed 33%).

2. Composition: Porcelain, through-body color.
3. Face Size: 12” x 24”.

4. Thickness: 3/8”.
5. Grout:
   a. Color: Light Smoke #145 (Custom Building Products)
   b. Joint Spacing: 3/16”

6. Trim Units:
   a. Style: Floor bullnose #P-43C9
   b. Size: 3” x 12”

D. Tile Type [T2]: Glazed through-body color porcelain wall tile.

1. Basis of Design: DalTile, Santino Collection.
   a. Color: Chiaro #SN07
   b. Pattern: Grid (Carried to height of 4’-10” A.F.F.)

2. Composition: Porcelain, through-body color.
3. Face Size: 6” x 24”.
4. Thickness: 3/8”.
5. Grout:
   a. Color: Light Smoke #145 (Custom Building Products)
   b. Joint Spacing: 1/8”

6. Trim Units:
   a. Style: Bullnose #S-44H9
   b. Size: 4” x 18”

2.02 THRESHOLDS

A. General: Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes.

1. Bevel edges at 1:2 slope, with lower edge of bevel aligned with or up to 1/16 inch (1.5 mm) above adjacent floor surface. Finish bevel to match top surface of threshold. Limit height of threshold to 1/2 inch (12.7 mm) or less above adjacent floor surface.

B. Marble Thresholds: ASTM C 503, abrasion resistant per ASTM C 1353 or ASTM C 241 with honed finish.

1. Description: Uniform, fine- to medium-grained dark gray marble stone with gray veining.

2.03 TILE BACKING PANELS

A. Cementitious Backer Units: ANSI A118.9 or ASTM C 1325.

1. Thickness: 1/2 inch

2.04 WATERPROOF MEMBRANE

A. General: Manufacturer's standard product, selected from the following, that complies with ANSI A118.10 and is recommended by the manufacturer for the application indicated.

B. Chlorinated-Polyethylene-Sheet: Non-plasticized, chlorinated polyethylene faced on both sides with nonwoven polyester fabric; 0.030-inch (0.76-mm) nominal thickness.

C. PVC Sheet: Two layers of PVC sheet heat-fused together and to facings of nonwoven polyester; 0.040-inch (1.01-mm) nominal thickness.

D. Fabric-Reinforced, Modified-Bituminous Sheet: Self-adhering, SBS-modified-bituminous sheet with woven reinforcement facing; 0.040-inch (1.01-mm) nominal thickness.

2.05 CRACK ISOLATION MEMBRANE

A. General: Manufacturer's standard product, selected from the following, that complies with ANSI A118.12 for standard performance and is recommended by the manufacturer for the application indicated.

B. Fabric-Reinforced, Fluid-Applied Membrane: System consisting of liquid-latex rubber or elastomeric polymer and fabric reinforcement.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Boiardi Products, a QEP company; Elastiment 344 Reinforced Waterproofing and Anti- Fracture/Crack Suppression Membrane.
   b. Bonsal American, an Oldcastle company; B 6000 Waterproof Membrane with Glass Fabric.
   c. Bostik, Inc.; Hydroment Blacktop 90210.
   d. Custom Building Products; 9240 Waterproofing and Anti-Fracture Membrane.
   e. Laticrete International, Inc.; Laticrete Blue 92 Anti-Fracture Membrane.
   f. MAPEI Corporation; Mapelastic HPG with MAPEI Fiberglass Mesh.
   g. Mer-Kote Products, Inc.; Hydro-Guard 2000.
   h. Summitville Tiles, Inc.; S-9000.

2.06 SETTING MATERIALS

A. Latex-Portland Cement Mortar (Thin Set): ANSI A118.4.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Bonsal American; an Oldcastle company.
   b. Bostik, Inc.
   c. C-Cure.
   d. Custom Building Products.
   e. Laticrete International, Inc.
   f. MAPEI Corporation.
   g. Mer-Kote Products, Inc.
   h. Southern Grouts & Mortars, Inc.
   i. Summitville Tiles, Inc.

2. For wall applications, provide non-sagging mortar.

2.07 GROUT MATERIALS

A. Polymer-Modified Tile Grout: Sanded and unsanded, ANSI A118.7.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Boiardi Products; a QEP company.
   b. Bonsal American; an Oldcastle company.
   c. Bostik, Inc.
   d. C-Cure.
   e. Custom Building Products.
   f. Jamo Inc.
   g. Laticrete International, Inc.

h. MAPEI Corporation.
i. Southern Grouts & Mortars, Inc.
j. Summitville Tiles, Inc.

2.08 ELASTOMERIC SEALANTS

A. Sealants shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. One-Part, Mildew-Resistant Silicone Sealant: ASTM C 920; Type S; Grade NS; Class 25; Uses NT, G, A, and, as applicable to nonporous joint substrates indicated, O; formulated with fungicide, intended for sealing interior ceramic tile joints and other nonporous substrates that are subject to in-service exposures of high humidity and extreme temperatures.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. DAP Inc.; Titanium Enriched Kitchen and Bath Sealant.
   b. Dow Corning Corporation; Dow Corning 786.
   c. GE Silicones, a division of GE Specialty Materials; Sanitary 1700.
   d. Laticrete International, Inc.; Latasil Tile & Stone Sealant.
   e. Pecora Corporation; Pecora 898 Sanitary Silicone Sealant.
   f. Tremco Incorporated; Tremsil 600 White.

C. Multipart, Pourable Urethane Sealant for Use T: ASTM C 920; Type M; Grade P; Class 25; Uses T, M, A, and, as applicable to joint substrates indicated, O.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Bostik, Inc.; Chem-Calk 550.
   b. Degussa Building Systems; Sonneborn Sonolastic SL 2.
   c. Sika Corporation; Sikaflex-2c SL.

2.09 MISCELLANEOUS MATERIALS

A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

B. Metal Edge Strips: Decorative edge protection with S-shaped bend, height to match tile and setting-bed thickness, ¼ inch visible surface, designed specifically for flooring applications with trapezoid shaped perforated concealed anchoring leg; stainless-steel, ASTM A 666, 304 Series exposed-edge material.

C. Corner Protection Strip: Bullnose quarter-round-shape, height to match tile and setting-bed thickness, with perforated concealed anchoring leg, designed specifically for wall applications; stainless-steel, ASTM A 666, 304 Series exposed-edge material.

D. Grout Sealer: Manufacturer's standard silicone product for sealing grout joints and that does not change color or appearance of grout.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Bonsal American, an Oldcastle company; Grout Sealer.
   b. Bostik, Inc.; CeramaSeal Silox 8 or Siloxane 220.
   c. C-Cure; Penetrating Sealer 978.
   d. MAPEI Corporation; KER 003, Silicone Spray Sealer for Cementitious Tile Grout.
   e. Southern Grouts & Mortars, Inc.; Silicone Grout Sealer.
   f. Summitville Tiles, Inc.; SL-15, Invisible Seal Penetrating Grout and Tile Sealer.

g. TEC, a subsidiary of H. B. Fuller Company; TA-257 Silicone Grout Sealer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.

1. Verify that substrates for setting tile are firm, dry, clean, free of coatings that are incompatible with tile-setting materials including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.

3.02 PREPARATION

A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thin-set mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.

B. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot (1:50) toward drains.

C. Blending: For tile exhibiting color variations, use factory blended tile or blend tiles at Project site before installing.

D. Field-Applied Temporary Protective Coating: If indicated under tile type or needed to prevent grout from staining or adhering to exposed tile surfaces, precoat them with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.

3.03 INSTALLATION

A. Comply with TCNA's "Handbook for Ceramic Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 Series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.

1. For the following installations, follow procedures in the ANSI A108 Series of tile installation standards for providing 95 percent mortar coverage:
   a. Tile floors in wet areas.
   b. Tile floors in laundries.
   c. Tile floors composed of tiles 8 by 8 inches (200 by 200 mm) or larger.
   d. Tile floors composed of rib-backed tiles.

B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

D. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.

E. Provide bullnose metal corner protection strips at outside corners if appropriate tile trim shapes are not available from tile manufacturer.

F. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.

G. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:
   1. Mosaic Wall Tile: 1/16 inch (1.6 mm).
   2. Floor Tile: 1/8 inch (3.2 mm), except 3/16 inch (4.8 mm) at floors with tiles larger than 12 x12 inches.
   3. Wall Tile: 1/16 inch (1.6 mm).

H. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.

I. Expansion Joints: Provide sealant-filled joints where indicated but not less than 16 feet o.c.. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
   1. Where joints occur in concrete substrates, locate sealant-filled joints in tile surfaces directly above them.
   2. Prepare joints and apply sealants to comply with requirements in Section 07 9200 "Joint Sealants."

J. Stone Thresholds: Install at door openings where exposed edge of tile flooring meets carpet, wood, or other flooring and at other locations indicated. Install stone thresholds in same type of setting bed as adjacent floor unless otherwise indicated.

K. Metal Edge Strips: Install where exposed edge of tile flooring meets carpet, wood, or other flooring and no threshold is indicated and at other locations indicated.

L. Grout Sealer: Apply grout sealer to cementitious grout joints according to grout-sealer manufacturer's written instructions. As soon as grout sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

M. Install cementitious backer units and treat joints according to ANSI A108.11 and manufacturer's written instructions for type of application indicated. Use latex-portland cement mortar for bonding material unless otherwise directed in manufacturer's written instructions.

N. Install waterproofing to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness and bonded securely to substrate.

O. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness and bonded securely to substrate.

3.04 INTERIOR TILE INSTALLATION SCHEDULE

A. Interior Floor Installations, Concrete Subfloor:

   1. Tile Installation F113: Thin-set mortar; TCNA F113.
      a. Tile Type Designation: All, unless otherwise indicated.
      b. Thin-Set Mortar: Latex-portland cement mortar.
      c. Grout: Sand-portland cement grout.

B. Interior Wall Installations, Metal Studs or Furring:

1. Tile Installation W244: Thin-set mortar on cementitious backer unit underlayment; TCNA W244C.
   a. Tile Type Designation: All, unless otherwise indicated.
   b. Thin-Set Mortar: Latex-portland cement mortar.
   c. Grout: Polymer-modified unsanded grout.

END OF SECTION

PART 1 GENERAL

1.01 SUMMARY

A. Section includes:

1. This Section includes acoustical tiles and concealed suspension systems for ceilings.

1.02 SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed finish.

1.03 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.04 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics:

1. Fire-Resistance Characteristics: Where indicated, provide acoustical tile ceilings identical to those of assemblies tested for fire resistance per ASTM E 119 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

a. Identify materials with appropriate markings of applicable testing and inspecting agency.

2. Surface-Burning Characteristics: Acoustical tiles complying with ASTM E 1264 for Class A materials, when tested per ASTM E 84.

a. Smoke-Developed Index: 450 or less.

1.05 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Acoustical Ceiling Units: Full-size tiles equal to 5.0 percent of quantity installed.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Armstrong World Industries, Inc.
B. Certainteed Ceilings.
C. USG Interiors, Inc.

2.02 ACOUSTICAL TILE CEILINGS - GENERAL

A. Recycled Content: Postconsumer recycled content plus one-half of pre-consumer recycled content not less than 10 percent.
B. Acoustical Tile Standard: Comply with ASTM E 1264.

C. Metal Suspension System Standard: Comply with ASTM C 635.

D. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

1. Anchors in Concrete: Expansion anchors fabricated from corrosion-resistant materials, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing per ASTM E 488 or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.

E. Wire Hangers, Braces, and Ties: Zinc-coated carbon-steel wire; ASTM A 641/A 641M, Class 1 zinc coating, soft temper.

1. Size: Select wire diameter so its stress at 3 times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106-inch- (2.69-mm-) diameter wire.

F. Seismic struts and seismic clips.

G. Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension system runners.

2.03 ACOUSTICAL TILE

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

1. American Gypsum.
2. CertainTeed Corporation.
3. Georgia-Pacific Building Products.
4. National Gypsum Company.
5. Temple-Inland Building Products by Georgia-Pacific.
6. United States Gypsum Company.

B. Acoustical Tile : Painted mineral fiber, ASTM E 1264 Type III, form 2 with the following characteristics:

1. Basis of design: Armstrong; Ultima Tegular #1911
2. Size: 24” x 24”
3. Thickness: ¾” (19mm)
4. Composition: Wet formed mineral fiber with factory applied vinyl latex paint.
5. Light Reflectance: 0.85 min.
6. NRC: 0.70 min., per ASTM E 795
7. CAC: 35 min.
8. Edge / Joint Detail: Beveled Tegular
9. Color: White

2.04 METAL SUSPENSION SYSTEM FOR ACOUSTICAL TILE CEILING

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

1. Armstrong World Industries, Inc.; Prelude XL Fire Guard, 15/16 inch.
2. CertainTeed Ceilings: Classic 15/16 inch.
3. Donn DX/DXL, 15/16-inch

2.05 METAL EDGE MOLDINGS AND TRIM

A. Extruded-Aluminum Edge Moldings and Trim: Where indicated, provide manufacturer's extruded-aluminum edge moldings and trim of profile indicated or referenced by manufacturer's designations, including splice plates, corner pieces, and attachment and other clips, curved to radius shown on Drawings and complying with seismic design requirements and the following:

1. Aluminum Alloy: Alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than the strength and durability properties of aluminum extrusions complying with ASTM B 221 (ASTM B 221M) for Alloy and Temper 6063-T5.

2. Baked-Enamel Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; organic coating: as specified below). Apply baked enamel complying with paint manufacturer's written instructions for cleaning, conversion coating, and painting.

    a. Organic Coating: Thermosetting, enamel primer/topcoat system with a minimum dry film thickness of 0.8 to 1.2 mils (0.02 to 0.03 mm).

PART 3 EXECUTION

3.01 INSTALLATION

A. Comply with ASTM C 636 and seismic design requirements indicated, per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

B. Measure each ceiling area and establish layout of acoustical tiles to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width tiles at borders.

C. Suspend ceiling hangers from building's structural members, plumb and free from contact with insulation or other objects within ceiling plenum. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers, use trapezes or equivalent devices. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.

1. Do not support ceilings directly from permanent metal forms or floor deck; anchor into concrete slabs.

2. Do not attach hangers to steel deck tabs or to steel roof deck.

D. Install edge moldings and trim of type indicated at perimeter of acoustical tile ceiling area and where necessary to conceal edges of acoustical tiles. Screw attach moldings to substrate at intervals not more than 16 inches (400 mm) o.c. and not more than 3 inches (75 mm) from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3.2 mm in 3.6 m). Miter corners accurately and connect securely.

E. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

F. Install acoustical tiles in coordination with suspension system and exposed moldings and trim. Place splines or suspension system flanges into kerfed edges so tile-to-tile joints are closed by double lap of material.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Resilient base.

B. Resilient molding accessories.

1.02 SUBMITTALS

A. See Section 01 3300 - Administrative Requirements, for submittal procedures.

B. Product Data: For each type of product.

C. Samples: For each type of product indicated, in manufacturer's standard-size Samples but not less than 12 inches (300 mm) long, of each resilient product color, texture, and pattern required.

1.03 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Provide (1) full, unopened box of each type scheduled.

1.04 PROJECT CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer in spaces to receive resilient products.

B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer.

C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 PRODUCTS

2.01 RESILIENT BASE

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

1. Armstrong World Industries, Inc.
2. Burke Mercer Flooring Products, Division of Burke Industries Inc.
3. Flexco.
4. Johnsonite; A Tarkett Company.
5. Roppe Corporation, USA.
6. VPI Corporation.

B. Resilient Base Standard: ASTM F 1861, Type TP.

1. Group: I (solid, homogeneous).
2. Style: Recessed with toe.

C. Minimum Thickness: 0.125 inch (3.2 mm).

D. Height: 4 inches (102 mm).

E. Lengths: Cut lengths 48 inches (1219 mm) long or coils in manufacturer's standard length.

F. Outside Corners: Factory preformed.

G. Inside Corners: Job formed or preformed.

H. Color: As noted on Index to Finish Schedule.

2.02 RESILIENT MOLDING ACCESSORY

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

1. Armstrong World Industries, Inc.
2. Burke Mercer Flooring Products, Division of Burke Industries Inc.
3. Flexco.
4. Johnsonite; A Tarkett Company.
5. Musson Rubber Company.
6. Roppe Corporation, USA.

B. Description: Vinyl joiner for tile and carpet and transition strips.

C. Locations: At transitions of floor finishes.

D. Colors and Patterns: To be selected by architect from manufacturer’s full line of colors.

2.03 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.

PART 3 EXECUTION

3.01 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

C.. Do not install resilient products until they are the same temperature as the space where they are to be installed.

1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

D. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.02 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.

G. Preformed Corners: Install preformed outside corners before installing straight pieces.

H. Job-Formed Corners:
   1. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches (76 mm) in length.
      a. Miter corners to minimize open joints.

3.03 RESILIENT ACCESSORY INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient accessories.

B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

3.04 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.

B. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Solid vinyl floor tile (L.V.T.).

1.02 SUBMITTALS

A. See Section 01 3300 - Administrative Requirements, for submittal procedures.

B. Product Data: For each type of product.

C. Shop Drawings: Shop Drawings: For each type of floor tile. Include floor tile layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.

1. Show details of special patterns.

D. Samples: Full-size units of each color and pattern of floor tile required.

1.03 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Provide (1) full, unopened box of each type scheduled.

1.04 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.05 PROJECT CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer in spaces to receive floor tile.

B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer.

C. Close spaces to traffic during floor tile installation.

D. Close spaces to traffic for 48 hours after floor tile installation.

E. Install floor tile after other finishing operations, including painting, have been completed.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For resilient tile flooring, as determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

2.02 SOLID VINYL FLOOR TILE (L.V.T.)

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

1. Shaw Contract Group; a Berkshire Hathaway company.
2. Armstrong World Industries, Inc.

3. Centiva.
4. Johnsonite; A Tarkett Company.
5. Altro Group.

B. Tile Standard: ASTM F 1700.

1. Class: Class III, printed film vinyl tile.
2. Type: B, embossed surface.

C. Thickness: 0.125 inch (3.2 mm).

D. Size:

1. Wood: 6” x 36”.
2. Stone: 18” x 18”

E. Wear Layer: 20 mil.

F. Colors and Patterns: As noted on index to finish schedule.

2.03 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by floor tile manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by floor tile and adhesive manufacturers to suit floor tile and substrate conditions indicated.

C. Floor Polish: Provide protective, liquid floor-polish products recommended by floor tile manufacturer.

PART 3 EXECUTION

3.01 PREPARATION

A. Prepare substrates according to floor tile manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates: Prepare according to ASTM F 710.
1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by floor tile manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by floor tile manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
4. Moisture Testing: Proceed with installation only after substrates pass testing according to floor tile manufacturer's written recommendations, but not less stringent than the following:

    a. Perform anhydrous calcium chloride test according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
    b. Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative

humidity level.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install floor tiles until they are the same temperature as the space where they are to be installed.

E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

3.02 FLOOR TILE INSTALLATION

A. Comply with manufacturer's written instructions for installing floor tile.

B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.

1. Lay tiles square with room axis.

C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.

1. Lay tiles with grain direction alternating in adjacent tiles (basket-weave pattern).

D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.

E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent marking device.

G. Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in finished floor areas. Maintain overall continuity of color and pattern between pieces of tile installed on covers and adjoining tiles. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.

H. Adhere floor tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.03 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting resilient sheet flooring.

B. Floor Polish: Remove soil, adhesive, and blemishes from flooring surfaces before applying liquid floor polish.

1. Apply three coat(s).

C. Cover resilient flooring until Substantial Completion.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Tufted sheet carpeting

1.02 SUBMITTALS

A. See Section 01 3300 - Administrative Requirements, for submittal procedures.

B. Product Data: For each type of product.

C. Shop Drawings: For carpet installation, showing the following:

1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet.
2. Carpet type, color, and dye lot.
3. Locations where dye lot changes occur.
4. Seam locations, types, and methods.
5. Type of subfloor.
6. Type of installation.
7. Pattern type, repeat size, location, direction, and starting point.
8. Pile direction.
9. Types, colors, and locations of insets and borders.
10. Types, colors, and locations of edge, transition, and other accessory strips.
11. Transition details to other flooring materials.

D. Samples: For each exposed product and for each color and texture required.

1.03 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Certified by the International Certified Floor covering Installers Association at the Commercial II certification level.

1.05 WARRANTY

A. Special Warranty for Carpet: Manufacturer agrees to repair or replace components of carpet installation that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 10 years from date of Substantial Completion.

1.06 EXTRA MATERIALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Carpet: Full-width rolls equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd. (8.3 sq. m).

PART 2 PRODUCTS

2.01 TUFTED SHEET CARPET

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering

products that may be incorporated into the Work include, but are not limited to, the following:

1. Mohawk Group (The); Mohawk Carpet, LLC. (Basis -of -Design)
2. Shaw Contract Group; a Berkshire Hathaway company.
3. Bentley Prince Street, Inc.
4. Patcraft; a division of Shaw Industries, Inc.
5. Tandus; a Tarkett company.
6. Interface, LLC.
7. Mannington Mills, Inc.

B. Color and Pattern: Connector #7968, Modem BQ347.

C. Fiber Content: 100 percent nylon 6, 6.

D. Pile Characteristic: Multilevel-loop pile.

E. Pile Thickness: 0.148 inches for finished carpet according to ASTM D 6859.

F. Gage: 1/10 inch.

G. Face Weight: 22 oz./sq.yd.

H. Primary Backing: Woven polypropylene.

I. Secondary Backing: Woven synthetic.

J. Backcoating: Manufacturer's standard material.

K. Roll Width: 12 feet (3.7 m).

L. Applied Treatments:

1. Applied Soil-Resistance Treatment: Manufacturer's standard material.
2. Antimicrobial Treatment: Manufacturer's standard material.
   a. Antimicrobial Activity: Not less than 2-mm halo of inhibition for gram-positive bacteria, not less than 1-mm halo of inhibition for gram-negative bacteria, and no fungal growth, according to AATCC 174.

M. Performance Characteristics:
1. Appearance Retention Rating: Heavy traffic, 3.0 minimum according to ASTM D 7330.
2. Critical Radiant Flux Classification: Not less than 0.45 W/sq. cm according to NFPA 253.
3. Dry Breaking Strength: Not less than 100 lbf (445 N) according to ASTM D 2646.
4. Tuft Bind: Not less than 5 lbf (22 N) according to ASTM D 1335.
5. Delamination: Not less than 3.5 lbf/in. (0.6 N/mm) according to ASTM D 3936.
6. Colorfastness to Crocking: Not less than 4, wet and dry, according to AATCC 165.
7. Colorfastness to Light: Not less than 4 after 60 AFU (AATCC fading units) according to AATCC 16, Option E.
8. Electrostatic Propensity: Less than 3.5 kV according to AATCC 134.

2.02 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet manufacturer.

B. Adhesives: Water-resistant, mildew-resistant, nonstaining type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet and is recommended or provided by carpet manufacturer.

C. Seam Adhesive: Hot-melt adhesive tape or similar product recommended by carpet manufacturer for sealing and taping seams and butting cut edges at backing to form secure seams and to prevent pile loss at seams.

PART 3 EXECUTION

3.01 EXAMINATION

A. Concrete Slabs:

1. Moisture Testing: Perform tests so that each test area does not exceed 1000 sq. ft. (304.8 sq. m), and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.

    a. Anhydrous Calcium Chloride Test: ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
    b. Relative Humidity Test: Using in situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
    c. Perform additional moisture tests recommended in writing by adhesive and carpet manufacturers. Proceed with installation only after substrates pass testing.

B. Wood Subfloors: Verify that underlayment surface is free of irregularities and substances that may interfere with adhesive bond or show through surface.

3.02 PREPARATION

A. General: Comply with CRI's "CRI Carpet Installation Standard" and with carpet manufacturer's written installation instructions for preparing substrates.

B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch (3 mm) wide or wider, and protrusions more than 1/32 inch (0.8 mm), unless more stringent requirements are required by manufacturer's written instructions.

C. Concrete Substrates: Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by adhesive and carpet manufacturers.

D. Broom and vacuum clean substrates to be covered immediately before installing carpet.

3.03 INSTALLATION

A. Comply with CRI's "CRI Carpet Installation Standard" and carpet manufacturer’s written installation instructions for the following:

1. Direct-glue-down installation.
2. Carpet with attached-cushion installation.
3. Preapplied adhesive installation.
4. Hook-and-loop installation.
5. Stretch-in installation.

6. Stair installation.

B. Comply with carpet manufacturer's written instructions and Shop Drawings for seam locations and direction of carpet; maintain uniformity of carpet direction and lay of pile. At doorways, center seams under the door in closed position.

C. Do not bridge building expansion joints with carpet.

D. Cut and fit carpet to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet manufacturer.

E. Extend carpet into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on carpet as marked on subfloor. Use nonpermanent, nonstaining marking device.

G. Protect carpet against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods recommended in writing by carpet manufacturer and carpet adhesive manufacturer.

3.04 CLEANING AND PROTECTION

A. Comply Perform the following operations immediately after installing carpet:

1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet manufacturer.
2. Remove yarns that protrude from carpet surface.
3. Vacuum carpet using commercial machine with face-beater element.

B. Protect installed carpet to comply with CRI 104, Section 16, "Protecting Indoor Installations."

C. Protect carpet against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet manufacturer and carpet adhesive manufacturer.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation and the application of paint systems on the following exterior substrates:

1. Concrete.
2. Fiber-cement board.
3. Steel and iron.
4. Galvanized metal.
5. Aluminum (not anodized or otherwise coated).
6. Wood.
7. Plastic.
8. Gypsum board.

1.02 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: For each type of product. Include preparation requirements and application instructions.

1. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.

C. Samples: For each type of paint system and each color and gloss of topcoat.

1.03 EXTRA MATERIALS

A. Furnish extra materials described below that are from same production run (batch mix) as materials applied and that are packaged for storage and identified with labels describing contents.

1. Quantity: Furnish an additional 5 percent, but not less than 1 gal. (3.8 L) of each material and color applied.

1.04 DEFINITIONS

A. MPI Gloss Level 1: Not more than five units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.

B. MPI Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.

C. MPI Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.

D. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.

E. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.

F. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

PART 2 PRODUCTS

2.01 EXTERIOR PAINT - GENERAL

A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."

B. Material Compatibility:

1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.

C. Colors: Match existing classroom building exterior colors.

2.02 EXTERIOR PAINT

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

1. Behr Process Corporation.
2. Benjamin Moore & Co.
3. Duron, Inc.
4. Glidden Professional.
5. Pratt & Lambert.
6. Rust-Oleum Corporation; a subsidiary of RPM International, Inc.
7. Sherwin-Williams Company (The).

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Concrete: 12 percent.
2. Fiber-Cement Board: 12 percent.
3. Masonry (Clay and CMUs): 12 percent.
4. Wood: 15 percent.
5. Gypsum Board: 12 percent.

C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

D. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.02 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.

3.03 INSTALLATION

A. Apply paints according to manufacturer's written instructions and recommendations in "MPI Manual."

B. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

3.04 CLEANING AND PROTECTION

A. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

B. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.05 EXTERIOR PAINT SCHEDULE

A. Concrete Substrates, Non-traffic Surfaces:

1. Latex System MPI EXT 3.1A:
   a. Prime Coat: Primer, alkali resistant, water based, MPI #3.
   b. Intermediate Coat: Latex, exterior, matching topcoat.
   c. Topcoat: Latex, exterior, semi-gloss (MPI Gloss Level 5), MPI #11.

B. Concrete Substrates, Traffic Surfaces:

1. Clear Water-Based Sealer System MPI EXT 3.2H:
   a. Prime Coat: Sealer, water based, matching topcoat.
   b. Topcoat: Sealer, water based, for concrete floors, MPI #99.

C. Cement Board Substrates:

1. Latex System MPI EXT 3.3A:
   a. Prime Coat: Latex, exterior, matching topcoat.
   b. Intermediate Coat: Latex, exterior, matching topcoat.
   c. Topcoat: Latex, exterior, low sheen (MPI Gloss Level 3-4), MPI #15.

D. CMU Substrates:

1. Latex System MPI EXT 4.2A:
   a. Prime Coat: Block filler, latex, interior/exterior, MPI #4.
   b. Intermediate Coat: Latex, exterior, matching topcoat.
   c. Topcoat: Latex, exterior, semi-gloss (MPI Gloss Level 5) MPI #11.

E. Steel and Iron Substrates:

1. Water-Based Light Industrial Coating System MPI EXT 5.1C:

a. Prime Coat: Primer, alkyd, anti-corrosive for metal, MPI #79.
b. Intermediate Coat: Light industrial coating, exterior, water based, matching topcoat.
c. Topcoat: Light industrial coating, exterior, water based, semi-gloss (MPI Gloss Level 5), MPI #163.

2. Aluminum Paint System MPI EXT 5.1K:
a. Prime Coat: Primer, alkyd, anti-corrosive, for metal, MPI #79.
b. Intermediate Coat: Aluminum paint, matching topcoat.
c. Topcoat: Aluminum paint, MPI #1.

F. Galvanized-Metal Substrates:

1. Latex System MPI EXT 5.3H:
a. Prime Coat: Primer, galvanized, water based, MPI #134.
b. Intermediate Coat: Latex, exterior, matching topcoat.
c. Topcoat: Latex, exterior, semi-gloss (MPI Gloss Level 5), MPI #11.

G. Aluminum Substrates:

1. Latex System MPI EXT 5.4H:
a. Prime Coat: Primer, quick dry, for aluminum, MPI #95.
b. Intermediate Coat: Latex, exterior, matching topcoat.
c. Topcoat: Latex, exterior, semi-gloss (MPI Gloss Level 5), MPI #11.

H. Wood Substrates: Glued-laminated construction.

1. Latex over Latex Primer System MPI EXT 6.1L:
a. Prime Coat: Primer, latex for exterior wood, MPI #6.
b. Intermediate Coat: Latex, exterior, matching topcoat.
c. Topcoat: Latex, exterior, semi-gloss (MPI Gloss Level 5), MPI #11.

I. Wood Substrates: Exposed framing.

1. Latex over Latex Primer System MPI EXT 6.2M:
a. Prime Coat: Primer, latex for exterior wood, MPI #6.
b. Intermediate Coat: Latex, exterior, matching topcoat.
c. Topcoat: Latex, exterior, flat (MPI Gloss Level 1), MPI #10.

J. Wood Substrates: Architectural woodwork and wood fences.

1. Latex over Latex Primer System MPI EXT 6.3L:
a. Prime Coat: Primer, latex for exterior wood, MPI #6.
b. Intermediate Coat: Latex, exterior, matching topcoat.
c. Topcoat: Latex, exterior, low sheen (MPI Gloss Level 3-4), MPI #15.

K. Plastic Trim Fabrication Substrates:

1. Latex System MPI EXT 6.8A:
a. Prime Coat: Primer, bonding, water based, MPI #17.
b. Intermediate Coat: Latex, exterior, matching topcoat.
c. Topcoat: Latex, exterior, low sheen (MPI Gloss Level 3-4), MPI #15.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation and the application of paint systems on the following exterior substrates:

1. Concrete.
2. Fiber-cement board.
3. Steel and iron.
4. Galvanized metal.
5. Aluminum (not anodized or otherwise coated).
6. Wood.
7. Plastic.
8. Gypsum board.

1.02 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: For each type of product. Include preparation requirements and application instructions.

1. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.

C. Samples: For each type of paint system and each color and gloss of topcoat.

1.03 EXTRA MATERIALS

A. Furnish extra materials described below that are from same production run (batch mix) as materials applied and that are packaged for storage and identified with labels describing contents.

1. Quantity: Furnish an additional 5 percent, but not less than 1 gal. (3.8 L) of each material and color applied.

1.04 DEFINITIONS

A. MPI Gloss Level 1: Not more than five units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.

B. MPI Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.

C. MPI Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.

D. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.

E. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.

F. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

PART 2 PRODUCTS

2.01 INTERIOR PAINT - GENERAL

A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."

B. Material Compatibility:

1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.

C. Colors: Match existing classroom building interior colors.

2.02 INTERIOR PAINT

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

1. Behr Process Corporation.
2. Benjamin Moore & Co.
3. Coronado Paint; Benjamin Moore Company.
4. Duron, Inc.
5. Glidden Professional.
6. Sherwin-Williams Company (The).

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Concrete: 12 percent.
2. Fiber-Cement Board: 12 percent.
3. Masonry (Clay and CMUs): 12 percent.
4. Wood: 15 percent.
5. Gypsum Board: 12 percent.

C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

D. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.02 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.

3.03 INSTALLATION

A. Apply paints according to manufacturer's written instructions and recommendations in "MPI Manual."

B. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

3.04 CLEANING AND PROTECTION

A. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

B. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.05 INTERIOR PAINT SCHEDULE

A. Concrete Substrates, Non-traffic Surfaces:

1. Latex System MPI INT 3.1A:
   a. Prime Coat: Primer, alkali resistant, water based, MPI #3.
   b. Intermediate Coat: Latex, interior, matching topcoat.
   c. Topcoat: Latex, interior, semi-gloss (MPI Gloss Level 5), MPI #54.

B. Concrete Substrates, Traffic Surfaces:

1. Latex Floor Enamel System MPI INT 3.2A:
   a. Prime Coat: Floor paint, latex, matching topcoat.
   b. Intermediate Coat: Floor paint, latex, matching topcoat.
   c. Topcoat: Floor paint, latex, low gloss (maximum MPI Gloss Level 3), MPI #60.

2. Concrete Stain System MPI INT 3.2E:
   a. First Coat: Stain, interior, for concrete floors, matching topcoat.
   b. Topcoat: Stain, interior, for concrete floors, MPI #58.
   c. Color to be selected by Architect from manufacturer’s full range of colors.

3. Water-Based Concrete Floor Sealer System MPI INT 3.2G:
   a. First Coat: Sealer, water based, for concrete floors, matching topcoat.
   b. Topcoat: Sealer, water based, for concrete floors, MPI #99.

C. Cement Board Substrates:

1. Latex System MPI INT 3.3A:
   a. Prime Coat: Primer, alkali resistant, water based, MPI #3.
   b. Intermediate Coat: Latex, interior, matching topcoat.
   c. Topcoat: Latex, interior (MPI Gloss Level 3), MPI #52.

D. CMU Substrates:

1. Latex System MPI INT 4.2A:
   a. Block Filler: Block filler, latex, interior/exterior, MPI #4.
   b. Intermediate Coat: Latex, interior, matching topcoat.
   c. Topcoat: Latex, interior, semi-gloss (MPI Gloss Level 5), MPI #54.

E. Steel and Iron Substrates:

1. Latex System, Alkyd Primer MPI INT 5.1Q:
   a. Prime Coat: Primer, alkyd, anti-corrosive, for metal, MPI #79.
   b. Intermediate Coat: Latex, interior, matching topcoat.
   c. Topcoat: Latex, interior, semi-gloss (MPI Gloss Level 5), MPI #54.

2. Aluminum Paint System MPI INT 5.1M:
   a. Prime Coat: Primer, alkyd, quick dry, for metal, MPI #76.
   b. Intermediate Coat: Aluminum paint, matching topcoat.
   c. Topcoat: Aluminum paint, MPI #1.

F. Galvanized-Metal Substrates:

1. Latex System MPI INT 5.3A:
   a. Prime Coat: Primer, galvanized, water based, MPI #134.
   b. Intermediate Coat: Latex, interior, matching topcoat.
   c. Topcoat: Latex, interior, semi-gloss (MIP Gloss Level 5) MPI #54.

G. Aluminum Substrates:

1. Latex System MPI INT 5.4H:
   a. Prime Coat: Primer, quick dry, for aluminum, MPI #95.
   b. Intermediate Coat: Latex, interior, matching topcoat.
   c. Topcoat: Latex, interior (MIP Gloss Level 4) MPI #43.

H. Wood Substrates: Exposed framing.

1. Latex over Latex Primer System MPI INT 6.2D:
   a. Prime Coat: Primer, latex, for interior wood, MPI #39.
   b. Intermediate Coat: Latex, interior, matching topcoat.
   c. Topcoat: Latex, interior (MPI Gloss Level 3), MPI #52.

I. Wood Substrates: Architectural woodwork.

1. Latex over Latex Primer System MPI INT 6.3T:
   a. Prime Coat: Primer, latex, for interior wood, MPI #39.
   b. Intermediate Coat: Latex, interior, matching topcoat.
   c. Topcoat: Latex, interior, semi-gloss (MPI Gloss Level 5), MPI #54.

J. Gypsum Board Substrates:

1. Latex over Latex Sealer System MPI INT 9.2A:
   a. Prime Coat: Primer sealer, latex, interior, MPI #50.
   b. Intermediate Coat: Latex, interior, matching topcoat.
   c. Topcoat: Latex, interior (MPI Gloss Level 4), MPI #43.

K. Plastic Trim Fabrication Substrates:

1. Latex System MPI INT 6.8E:
   a. Prime Coat: Primer, bonding, solvent based, MPI #69.
   b. Intermediate Coat: Latex, interior, matching topcoat.
   c. Topcoat: Latex, interior, flat (MPI Gloss Level 1), MPI #53.

END OF SECTION

PART 1 GENERAL

1.01 SUBMITTALS

A. 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.

B. 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 Architect at least 2 months prior to start of fabrication; upon request, submit preliminary schedule.
   3. Submit for approval by Owner through Architect prior to fabrication.

C. Samples: Submit one sample of each type of sign, of size similar to that required for project, illustrating sign style, font, and method of attachment.

D. Selection Samples: Where colors are not specified, submit two sets of color selection charts or chips.

E. Manufacturer's Installation Instructions: Include installation templates and attachment devices.

1.02 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum 5 years of documented experience.

1.03 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.

1.04 WARRANTY

A. Provide manufacturer’s warranty against defect in materials. Warranty shall provide material and labor to repair or replace defective materials. Damage caused by physical or chemical abuse or damage from excessive heat will not be warranted. Removal and reinstallation of existing signage is not warranted.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Interior Signs:
   1. 2/90 Sign Systems: www290signs.com.
   2. APCO Sign
   3. Vista System: www.vistasystem.com.

B. Sign components are to be by a single manufacturer, including necessary mounting options, fittings and fastenings.

2.02 SIGNAGE APPLICATIONS

A. Accessibility Compliance: All signs are required to comply with ADAAG and ANSI/ICC A 117.1

and applicable building codes, unless otherwise indicated; in the event of conflicting requirements, comply with the most comprehensive and specific requirements.

B. Room and Door Signs: Provide a sign for every doorway, as indicated on drawings.
   1. Provide "tactile" signage, with letters raised minimum 1/32 inch and Grade II braille.
   2. Character Height: 1 inch.
   3. Office Doors: Identify with the room names and numbers shown on the drawings; in addition, provide "window" section for replaceable occupant name.
   4. Conference and Interview Rooms: Identify with the room names and numbers shown on the drawings; in addition, provide "window" section with sliding "In Use/Vacant" indicator.
   5. Service Rooms: Identify with the room names and numbers shown on the drawings.
   6. Rest Rooms: Identify with pictograms, the names "MEN" and "WOMEN", room numbers shown on the drawings, and braille.

2.03 SIGN TYPES

A. Interior Signage: Provide interior signage to match elevations and descriptions as indicated on drawings. Signage to provide the following:

   1. Sign Type A: 2/90 Modular (Basis of design)
      a. Size: 6” x 6”
      b. Finish: Color’s #1 and #2 to be selected by Architect from manufacturer’s standard color selection.
      c. Sign Orientation: Vertical.
      d. Body Thickness: Thin profile (9/32”)
      e. End Caps: Square corner, aluminum caps.
      f. Mounting: Mechanical anchorage (screw).
      g. Provide window with printable, removable insert for room name.

   2. Sign Type B: 2/90 Modular (Basis of design)
      a. Size: 6” x 6”
      b. Finish: Color’s #1 and #2 to be selected by Architect from manufacturer’s standard color selection.
      c. Sign Orientation: Horizontal.
      d. Body Thickness: Thin profile (9/32”)
      e. End Caps: Square corner, aluminum caps.
      f. Mounting: Mechanical anchorage (screw).
      g. Provide room name in raised letters.

   3. Sign Type C: 2/90 Modular (Basis of design)
      a. Size: 6” x 10”
      b. Finish: Color’s #1 and #2 to be selected by Architect from manufacturer’s standard color selection.
      c. Sign Orientation: Horizontal.
      d. Body Thickness: Thin profile (9/32”)
      e. End Caps: Square corner, aluminum caps.
      f. Mounting: Mechanical anchorage (screw).
      g. Provide window with printable, removable insert for room name.
      h. Provide sliding “Vacant” / “In-Use” insert.

   4. Sign Type D1: 2/90 Modular (Basis of design)
      a. Size: 8” x 6”
      b. Finish: Color’s #1 and #2 to be selected by Architect from manufacturer’s standard color selection.
      c. Sign Orientation: Vertical.
      d. Body Thickness: Thin profile (9/32”)
      e. End Caps: Square corner, aluminum caps.
      f. Mounting: Mechanical anchorage (screw).

g. Provide text “MEN” in raised letters.

5. Sign Type D.2: 2/90 Modular (Basis of design)
   a. Size: 8” x 6”
   b. Finish: Color’s #1 and #2 to be selected by Architect from manufacturer’s standard color selection.
   c. Sign Orientation: Vertical.
   d. Body Thickness: Thin profile (9/32”)
   e. End Caps: Square corner, aluminum caps.
   f. Mounting: Mechanical anchorage (screw).
   g. Provide text “WOMEN” in raised letters.
6. Sign Type D.3: 2/90 Modular (Basis of design)
   a. Size: 8” x 6”
   b. Finish: Color’s #1 and #2 to be selected by Architect from manufacturer’s standard color selection.
   c. Sign Orientation: Vertical.
   d. Body Thickness: Thin profile (9/32”)
   e. End Caps: Square corner, aluminum caps.
   f. Mounting: Mechanical anchorage (screw).
   g. Provide text “RESTROOM” in raised letters.

B. Font: Unless otherwise indicated:
   1. Character Font: Helvetica, Arial, or other sans serif font
   2. Character Case: Upper and lower case (title case).

2.04 TACTILE SIGNAGE MEDIA

A. Applied Character Panels: Aluminum base, with applied acrylic plastic letters and braille.
   1. Total Thickness: 1/8 inch.
   2. Letter Thickness: 1/32 inch.
   3. Letter Edges: Radiused.

2.05 ACCESSORIES

A. Concealed Screws: Stainless steel.

B. Tape Adhesive: Double sided tape, permanent adhesive.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install neatly, with horizontal edges level.

C. Locate signs where indicated:
   1. Room and Door Signs: Locate on wall at latch side of door with centerline of sign at 60 inches above finished floor.
   2. If no location is indicated obtain Architect's instructions.

D. Protect from damage until Substantial Completion; repair or replace damage items.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Accessories for toilet rooms and utility rooms.

B. Grab bars.

1.02 RELATED SECTIONS

A. Section 06100 - Rough Carpentry.

B. Section 08800 - Glazing.

1.03 REFERENCES

A. ASTM A 123/A 123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2002.

B. ASTM A 269 - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service; 2004.

C. ASTM A 653/A 653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2005a.

D. ASTM A 666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2003.

E. ASTM C 1036 - Standard Specification for Flat Glass; 2001.

F. GSA CID A-A-3002 - Mirrors, Glass; U.S. General Services Administration; 1996.

1.04 SUBMITTALS

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

B. Product Data: Provide data on accessories describing size, finish, details of function, attachment methods.

C. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention.

D. If providing manufacturer different than basis of design, submit manufacturer’s interchange sheets from American Specialties, Inc. to provided manufacturer.

1.05 COORDINATION

A. Coordinate the work with the placement of internal wall reinforcement, concealed ceiling supports, and reinforcement of toilet partitions to receive anchor attachments.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Toilet Accessories:
   1. Bobrick: www.bobrick.com.
   2. American Specialties, Inc: www.americanspecialties.com.
   3. Bradley Corporation: www.bradleycorp.com.
   4. Substitutions: Section 01600 - Product Requirements.

B. All items of each type to be made by the same manufacturer.

2.02 MATERIALS

A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.
   1. Grind welded joints smooth.
   2. Fabricate units made of metal sheet of seamless sheets, with flat surfaces.

B. Keys: Provide two keys for each accessory to Owner; master key all lockable accessories.

C. Stainless Steel Sheet: ASTM A 666, Type 304.

D. Stainless Steel Tubing: ASTM A 269, Type 304 or 316.

E. Galvanized Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A 653/A 653M, with G90/Z275 coating.

F. Mirror Glass: Float glass, ASTM C 1036 Type I, Class 1, Quality Q2, with silvering, copper coating, and suitable protective organic coating to copper backing in accordance with GSA CID A-A-3002.

G. Fasteners, Screws, and Bolts: Stainless steel, tamper-proof, security type.

H. Expansion Shields: Fiber, lead, or rubber as recommended by accessory manufacturer for component and substrate.

2.03 FINISHES

A. Stainless Steel: No. 4 satin brushed finish, unless otherwise noted.

B. Baked Enamel: Pretreat to clean condition, apply one coat primer and minimum two coats epoxy baked enamel.

C. Galvanizing for Items Other than Sheet: Comply with ASTM A 123/A 123M; galvanize ferrous metal and fastening devices.

D. Shop Primed Ferrous Metals: Pretreat and clean, spray apply one coat primer and bake.

E. Back paint components where contact is made with building finishes to prevent electrolysis.

2.04 TOILET ROOM ACCESSORIES

A. Paper Toilet Dispenser (PTD)

   1. Model No. B-369, Bobrick (Basis of design)
   2. Type: Recessed
   3. Material: Type 304, stainless steel
   4. Operation: 350C-fold or 475 multi-fold towels
   5. Location: Toilets 119, 139.

B. Toilet Tissue Dispenser (TTD)

   1. Model No. B-685, Bobrick (Basis of design)
   2. Type: Single roll dispenser
   3. Material: Type 304, stainless steel (no. 4 satin finish)
   4. Operation: continuous delivery
   5. Capacity: One (1) roll up to 5-1/2” diameter

C. Grab bar (36” GB)

   1. Model No. B-5806 x 36 Bobrick (Basis of design)
   2. Type: 01, concealed mounting with snap-on flange covers.
   3. Material: Type 304, stainless steel (no. 4 satin finish)
   4. Tube Diameter: 1-1/2” outside diameter

5. Gripping Surface: peened surface
6. Length: 36”

D. Grab bar (42” GB)

1. Model No. B-5806 x 42 Bobrick (Basis of design)
2. Type: 01, concealed mounting with snap-on flange covers.
3. Material: Type 304, stainless steel (no. 4 satin finish)
4. Tube Diameter: 1-1/2” outside diameter
5. Gripping Surface: peened surface
6. Length: 42”

E. Mirror (M)

1. Model No. B-165 2436, Bobrick (Basis of design)
2. Type: Stainless steel frame, welded and polished
3. Mounting: concealed hanger (surface mounted)
4. Glazing: No. 1 quality, ¼” float glass
5. Size: 24” wide x 36” height

F. Mirror (M2)

1. Model No. B-165 2460, Bobrick (Basis of design)
2. Type: Stainless steel frame, welded and polished
3. Mounting: concealed hanger (surface mounted)
4. Glazing: No. 1 quality, ¼” float glass
5. Size: 24” wide x 60” height

G. Hand Dryer (HD)

1. Model No. B-7128 (115V AC), Bobrick (Basis of design)
2. Cover: 22 Ga., Stainless steel
3. Mounting: concealed hanger (surface mounted)
4. Power: 115V AC
5. Location: Toilets 123, 124, 156A, 157A.

H. Soap Dispenser (SD)

1. Model No. B-2111, Bobrick (Basis of design)
2. Type: Type 304 Stainless Steel, One piece, seamless drawn body (No. 4 satin finish).
3. Mounting: concealed hanger (surface mounted)
4. Capacity: 40fl oz (1.2. L)

I. Coat Hook (CH)

1. Model No. B-2116, Bobrick (Basis of design)
2. Type: Type 304 Stainless Steel, One piece, seamless drawn body (No. 4 satin finish).
3. Mounting: Concealed; secured to concealed wall plate with three stainless steel setscrews.
4. Wall Plate: 12 gauge (2.8mm) case hardened steel.
4. Performance: Hook shall withstand 300-lb (136-kg) downward pull when properly installed.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify conditions before starting work.

B. Verify exact location of accessories for installation.

C. Verify that field measurements are as indicated on drawings.

D. See Section 06 1000 for installation of blocking, reinforcing plates, and concealed anchors in

walls, and ceilings.

3.02 PREPARATION

A. Deliver inserts and rough-in frames to site for timely installation.

B. Provide templates and rough-in measurements as required.

3.03 INSTALLATION

A. Install products in strict compliance with manufacturer's written instructions and recommendations, including the following:
   1. Verify blocking has been installed properly.
   2. Verify location does not interfere with door swings or use of fixtures.
   3. Comply with manufacturer's recommendations for backing and proper support.
   4. Use fasteners and anchors suitable for substrate and project conditions
   5. Install units rigid, straight, plumb, and level, in accordance with manufacturer's installation instructions and approved shop drawings.
   6. Conceal evidence of drilling, cutting, and fitting to room finish.
   7. Test for proper operation.

B. Mounting Heights and Locations: As required by accessibility regulations and as indicated on drawings

3.04 CLEANING AND PROTECTION

A. Clean exposed surfaces of compartments, hardware, and fittings using methods acceptable to the manufacturer.

B. Touch-up, repair or replace damaged products until Substantial Completion.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fire-protection cabinets for portable fire extinguishers.

1.02 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: For each type of product. Show door hardware, cabinet type, trim style, and panel style. Include roughing-in dimensions and details showing recessed, semi-recessed, or surface mounting method and relationships of box and trim to surrounding construction.

C. Product Schedule: For fire-protection cabinets. Indicate whether recessed, semi-recessed, or surface mounted. Coordinate final fire-protection cabinet schedule with fire-extinguisher schedule to ensure proper fit and function.

1. Identify locations using room designations indicated on drawings.

1.03 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.04 COORDINATION OF INSTALLATION

A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

B. Coordinate sizes and locations of fire-protection cabinets with wall depths.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Fire-Rated Fire-Protection Cabinets: Listed and labeled to comply with requirements in ASTM E 814 for fire-resistance rating of walls where they are installed.

2.02 FIRE EXTINGUISHER CABINET (FE-1)

A. Cabinet Type: Suitable for fire extinguisher.

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

a. American Specialties, Inc.
b. Guardian Fire Equipment, Inc.
c. JL Industries, Inc.; a division of the Activar Construction Products Group.
d. Larsens Manufacturing Company.
e. Nystrom, Inc.

B. Cabinet Construction: Nonrated and 1-hour fire rated.

1. Fire-Rated Cabinets: Construct fire-rated cabinets with double walls fabricated from

0.043-inch- (1.09-mm-) thick cold-rolled steel sheet lined with minimum 5/8-inch- (16-mm-) thick fire-barrier material. Provide factory-drilled mounting holes.

C. Cabinet Material: Cold-rolled steel sheet.
   1. Shelf: Same metal and finish as cabinet.

D. Semi-recessed Cabinet: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).

   1. Square-Edge Trim: 1-1/4- to 1-1/2-inch (32- to 38-mm) backbend depth.
   2. Rolled-Edge Trim: 2-1/2-inch (64-mm) backbend depth.

E. Cabinet Trim Material: Steel sheet.

F. Door Material: Steel sheet.

G. Door Style: Fully glazed panel with frame.

H. Door Glazing: Tempered float glass (clear).

I. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.

   1. Provide recessed door pull and friction latch.
   2. Provide manufacturer's standard hinge permitting door to open 180 degrees.

J. Accessories:

   1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire-protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
   2. Door Lock: Cam lock that allows door to be opened during emergency by pulling sharply on door handle.
   3. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location.
      a. Identify fire extinguisher in fire-protection cabinet with the words "FIRE EXTINGUISHER."
         a.1. Location: Applied to cabinet door.
         a.2. Application Process: Pressure-sensitive vinyl letters.
         a.3. Lettering Color: Red.
         a.4. Orientation: Vertical.

K. Materials:

   1. Cold-Rolled Steel: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.
      a. Finish: Baked enamel or powder coat.
      b. Color: Match color of existing classroom building fire extinguisher cabinets.
   2. Aluminum: ASTM B 221 (ASTM B 221M), with strength and durability characteristics of not less than Alloy 6063-T5 for aluminum sheet. ASTM B 221 (ASTM B 221M) for extruded shapes.
      a. Finish**:** Baked enamel or powder coat.
      b. Color: Match color of existing classroom building fire extinguisher cabinets
   3. Stainless Steel: ASTM A 666, Type 304.
      a. Finish: No. 4 directional satin finish.

   4. Tempered Float Glass: ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, 3 mm

thick, Class 1 (clear).

2.03 FABRICATION

A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.

1. Weld joints and grind smooth.
2. Provide factory-drilled mounting holes.
3. Prepare doors and frames to receive locks.
4. Install door locks at factory.

B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles.

1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch (13 mm) thick.
2. Fabricate door frames of one-piece construction with edges flanged.
3. Miter and weld perimeter door frames.

C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.04 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's AMP 500, "Metal Finishes Manual for Architectural and Metal Products," for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces of fire-protection cabinets from damage by applying a strippable, temporary protective covering before shipping.

C. Finish fire-protection cabinets after assembly.

D. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine walls and partitions for suitable framing depth and blocking where semi-recessed cabinets are to be installed.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Prepare recesses for semi-recessed fire extinguisher cabinets as required by type and size of cabinet and trim style.

3.03 INSTALLATION

A. General: Install fire-protection cabinets in locations and at mounting heights indicated at heights acceptable to authorities having jurisdiction.

B. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.

1. Unless otherwise indicated, provide recessed fire-protection cabinets. If wall thickness is inadequate for recessed cabinets, provide semi-recessed fire-protection cabinets.
2. Provide inside latch and lock for break-glass panels.
3. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.

C. Identification: Apply vinyl lettering at locations indicated.

3.04 ADJUSTING AND CLEANING

A. Remove temporary protective coverings and strippable films, if any, as fire-protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.

B. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.

C. On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.

D. Touch up marred finishes, or replace fire-protection cabinets that cannot be restored to factory finished appearance. Use only materials and procedures recommended or furnished by fire extinguisher cabinet and mounting bracket manufacturers.

E. Replace fire-protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.

1.02 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: For each type of product.

1.03 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.04 COORDINATION OF INSTALLATION

A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

1.05 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Six years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

2.02 PORTABLE FIRE EXTINGUISHER (FE-2)

A. Fire Extinguishers: Type, size, and capacity for each fire-protection cabinet and mounting bracket indicated.

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. Amerex Corporation.
b. Guardian Fire Equipment, Inc.
c. JL Industries, Inc.; a division of the Activar Construction Products Group.
d. Larsens Manufacturing Company.
e. Nystrom, Inc.

2. Instruction Labels: Include pictorial marking system complying with NFPA 10,

Appendix B**,** and bar coding for documenting fire-extinguisher location, inspections, maintenance, and recharging.

B. Multipurpose Dry-Chemical Type A, B, C: UL-rated 10-lb nominal capacity, with monoammonium phosphate-based dry chemical in manufacturer's standard enameled container.

2.03 MOUNTING BRACKETS

A. Mounting Brackets: Manufacturer's standard steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or red baked-enamel finish.

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. Amerex Corporation.
b. Guardian Fire Equipment, Inc.
c. JL Industries, Inc.; a division of the Activar Construction Products Group.
d. Larsens Manufacturing Company.
e. Nystrom, Inc.

B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.

1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.

a. Orientation: Vertical.

PART 3 EXECUTION

3.01 INSTALLATION

A. Examine fire extinguishers for proper charging and tagging.

1. Remove and replace damaged, defective, or undercharged fire extinguishers.

B. Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.

C. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated. Provide solid wood blocking in wall for support of fire extinguishers on brackets.

END OF SECTION

PART 1 GENERAL

1.01 SUMMARY

A. Section includes pre-engineered, pre-finished extruded aluminum canopies.

1. Wall mounted, aluminum walkway cover

1.02 REFERENCES

A. American Architectural Manufacturers Association (AAMA):

B. AAMA 603 - Voluntary Performance Requirements and Test Procedures for Pigmented Organic Coatings on Extruded Aluminum.

C. AAMA 605 - Voluntary Specification for High Performance Organic Coatings on Architectural Extrusions and Panels.

D. AAMA 607.1 - Voluntary Guide Specification and Inspection Methods for Clear Anodic Finishes for Architectural Aluminum.

E. AAMA 608.1 - Voluntary Guide Specification and Inspection Methods for Electrolytically Deposited Color Anodic Finishes for Architectural Aluminum.

1.03 DESIGN REQUIREMENTS

A. Columns, Beam, Deck and Trim: Aluminum extrusions.

B. Structural Framing: Interlocking deck sections secured by screws.

1. Heli-arc welded, one piece rigid bents.
2. Mechanically fastened bents using internally concealed bolted connections.

C. Canopy: Self-draining from deck through bents to discharge point in columns at ground level.

D. Design Loads:

1. Comply with Building Code for site location.
2. Collateral Loads: Additional loads imposed by other materials or systems identified in contract documents.

E. Structural Design: Prepare complete structural design calculations for canopy members including footings. Structural design to be performed by structural engineer licensed to practice in the state of Georgia.

1.04 SUBMITTALS

A. Product Data: Provide manufacturer’s product data, including detail sheets for specified items.

B. Shop Drawings: Provide canopy layout and erection shop drawings showing roof framing, deck panels, cross sections, and trim details. Shop drawings should clearly indicate proper assembly.

C. Samples: Submit color selection samples consisting of actual coating material or anodizing process on aluminum extrusions.

D. Calculations: Submit structural design calculations for each canopy system type, including footing design calculations.

1.05 QUALITY ASSURANCE

A. Overall Standard: Structural engineering design documents stamped by a structural engineer registered to practice in the state of Georgia.

B. Manufacturer Qualifications: Minimum five (5) years experience in producing canopies with welded bents and of the type specified.

C. Installer Qualifications: Minimum two (2) years experience in erecting canopies of the type specified.

1.06 DELIVERY, STORAGE AND HANDLING

A. Follow manufacturer's recommendations for storing and handling of materials.

1.07 WARRANTY

A. Aluminum protective cover, including material and workmanship, shall be warranted from defects for a period of one year from date of completion of aluminum protective cover installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

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

1. Mitchell Metals, LLC
2. Dittmer Architectural Aluminum
3. Perfection Architectural Systems

B. Provide specified protective covers from single manufacturer.

2.02 MATERIALS

A. Aluminum Extrusions: 6063 alloy; T-6 temper.

B. Grout: 1 part Portland cement, 3 parts masonry sand, 2,000 psi compressive strength.

C. Foam Block-Outs: Rigid foam blocks sized as required for column embedment depth and shape.

2.03 COMPONENTS

A. Columns:

1. Size and profile: Provide 6"x6", radius-cornered, internal drained, aluminum tubular extrusion, unless structural engineer design calculations require larger size.
2. Grout Key: Provide two (2) 1-1/2 inch (38mm) diameter holes in column base, one each in opposite sides.
3. Provide clear acrylic protection coat on surfaces in contact with grout.

B. Beams: Open top aluminum tubular extrusions.

1. Size: As required by structural engineering design.

C. Deck: Rigid-roll-lock extruded aluminum, self-flashing, interlocking sections.

1. Size and profile: As required by structural engineering design.
2. Provide welded endplate water dams where sections terminate at locations other than drainage channels.

D. Fascia: Manufacturer's standard extruded aluminum fascia sections as shown on drawings, and as required to complete the installation resulting in a neat finished appearance.

1. Include manufacturer's standard extruded aluminum gutters.

E. Flashing: Flashing shall be made of aluminum sheet painted to match the color of the canopy. Minimum flashing thickness shall be 0.040" thick.

2.04 ACCESSORIES

A. Fasteners:

1. Deck Screws: No.14 by 1 inch (25mm), self-tapping Type 18-8 stainless steel with neoprene washers.
2. Trim Screws: No.10 by 1/2 inch)13mm), self-tapping Type 18-8 stainless steel.
3. Trim Rivets: Aluminum, size recommended by manufacturer for specific condition.
4. Other Fasteners: Type 18-8 stainless steel, type recommended by manufacturer for specific condition.

2.05 FABRICATION

A. Shop Assembly: Fabricate cross beams and columns into one-piece rigid bents with corners mitered and heli-arc welded to the extent that completed bents can be shipped on local, state, and federal highways without special permit. Provide bolted connections for bents required to be shipped unassembled.

2.06 FINISHES

A. Bents:

1. Clear Anodized: AA-M-10C-22A-31, Architectural Class II, comply with AAMA 607.1.

B. Deck:

1. Clear Anodized: AA-M-10C-22A-31, Architectural Class II, comply with AAMA 607.1.

C. Fascia/Gutter:

1. Clear Anodized: AA-M-10C-22A-31, Architectural Class II, comply with AAMA 607.1.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine footings in which bents will be set. Verify footing locations and elevations comply with shop drawings.

B. Exam building surfaces to which canopy will connect.

C. Coordinate with responsible trade to perform corrective work on unsatisfactory footings or surfaces.

D. Commencement of work by installer is acceptance of existing conditions.

3.02 ERECTION

A. Canopies are to be installed according to approved shop drawings and plans.

B. The entire structure shall be installed straight, true, and plumb according to standard construction procedures.

C. Canopies shall be installed with minimal slope to allow water flow from top of canopy to draining columns and eliminate ponding.

D. Non-draining columns shall have weep holes installed at top of concrete to remove condensation from post. Minimum weep hole size shall be ¼" in diameter.

E. All joints, corners, and connections shall be tight and clean.

F. All exposed fasteners are to be painted to match the canopy color.

G. Decking is to be aligned and secured to aluminum frame structure.

3.03 CLEANING

A. Clean surfaces soiled by work as recommended by manufacturer.

B. Remove surplus material and debris from project site.

3.05 PROTECTION

A. Protect finished aluminum surfaces from damage due to subsequent construction operations.

END OF SECTION

PART 1 GENERAL

1.01 SUMMARY

A. Section includes:

1. Electrically operated projection screens and controls.

1.02 SUBMITTALS

A. Submit under provisions of Section 01 3300 – Submittal Procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation methods.

C. Shop Drawings: For projection screens. Show layouts and types of projection screens. Include the following:

1. For electrically operated projection screens and controls:
a. Location of screen centerline relative to ends of screen case.
b. Location of wiring connections.
c. Seams and viewing surfaces.
d. Detailed drawings for concealed mounting.
e. Connections to suspension systems.
f. Anchorage details.
g. Accessories.
h. Frame details.
i. Wiring diagrams.

1.03 QUALITY ASSURANCE

A. Single Source Responsibility: Obtain each type of projection screen required from a single manufacturer as a complete unit, including necessary mounting hardware and accessories.

B. Coordination of Work: Coordinate layout and installation of projection screens with other construction supported by, or penetrating through, ceilings, including light fixtures, HVAC equipment, fire-suppression system, and partitions.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver projection screens until building is enclosed and other construction where screens will be installed is substantially complete.

B. Store products in manufacturer's unopened packaging until ready for installation.

C. Protect screens from damage during delivery, handling, storage, and installation.

1.05 COORDINATION

A. Coordinate work with installation of ceilings, walls, electric service power characteristics, and location.

PART 2 PRODUCTS

2.01 MOTORIZED, CEILING RECESSED, FRONT PROJECTION SCREENS

A. General: Manufacturer's standard units consisting of case, screen, motor, controls, mounting accessories, and other components necessary for a complete installation.

1. Controls: Remote, three-position control switch.
2. Motor in Roller: Instant-reversing motor with permanently lubricated ball bearings, automatic thermal-overload protection, preset limit switches, and positive-stop action to prevent coasting.
3. Tab Tensioning: Provide units that have a durable low-stretch cord, such as braided polyester, on each side of screen connected to edge of screen by tabs to pull screen flat horizontally.

B. Electric motor operated, metal case, independently motorized closure, tab tensioned. Ceiling-recessed, metal headbox, UL approved "Suitable for use in environmental air space." Bottom of case consists of an independently motorized trap door that opens up inside the screen case. The trap door and the access door both hinge downward to allow access to inside of screen case. The doors remain attached to the screen case via a concealed full-length hinge. Releasing one latch at each end of screen case allows the doors to hinge downward and a prop arm at each end may be pivoted to engage with endcaps, keeping the door assembly in its fully open position. Symmetrical case allows for viewing surface to unroll from the back or front of the roller. The screen is attached to roller with roller brackets. Metal roller mounted on rubber isolation mounts.

1. Metal Headbox:
   a. Size: 10 inches (254 mm) high and 8 inches (229 mm) deep.
   b. Color: White.

2. Provide screen case with trim flange to receive ceiling finish.

3. Motor screen control: UL Certified, Single station control rated 115V AC, 60 Hz with 3-position rocker switch with cover plate to stop or reverse screen at any point.

2.02 FRONT-PROJECTION SCREEN MATERIAL

A. Matte-White Viewing Surface: Peak gain not less than 0.9, and gain not less than 0.8 at an angle of 50 degrees from the axis of the screen surface.

B. Seamless Construction: Provide screens, in sizes indicated, without seams.

C. Edge Treatment: Black masking borders.

D. Size of Viewing Surface: 16:10 format; 72-1/2 inches by 116 inches, 137 inch diagonal.

E. Provide an extra screen drop with an overall screen drop of 12 inches with a black masking top border.

F. Tab-Tensioning System: Viewing surface with integrated tabs and cable on each side of fabric to provide tension and ensure flat viewing surface. Viewing surface and tabs CNC cut as a single piece. Tabs RF welded to the back of viewing surface to prevent tab separation. Tab adhesives are not acceptable. Viewing surface inserted into aluminum bottom dowel. Warranted for 5 years against tab separation.

PART 3 EXECUTION

3.01 FRONT-PROJECTION SCREEN INSTALLATION

A. Install front-projection screens at locations indicated to comply with screen manufacturer's written instructions.

B. Install front-projection screens with screen cases in position and in relation to adjoining construction indicated. Securely anchor to supporting substrate in a manner that produces a smoothly operating screen with vertical edges plumb and viewing surface flat when screen is lowered.

1. Test electrically operated units to verify that screen controls, limit switches, closures, and other operating components are in optimum functioning condition.

3.02 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Horizontal louver blinds with aluminum slats.

1.02 SUBMITTALS

A. See Section 01 3300 - Administrative Requirements, for submittal procedures.

B. Product Data: For each type of product.

C. Shop Drawings: Show fabrication and installation details for horizontal louver blinds.

D. Samples: For each exposed product and for each color and texture specified, 12 inches (300 mm) long.

E. Window-Treatment Schedule: For horizontal louver blinds.

1.03 CLOSEOUT SUBMITTALS

A. Maintenance Data: For horizontal louver blinds to include in maintenance manuals.

1.04 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Quantity: Full-size units equal to 5 percent of quantity installed for each size, color, texture, pattern, and gloss indicated, but no fewer than two units.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver horizontal louver blinds in factory packages, marked with manufacturer, product name, and location of installation using same designations indicated on Drawings.

1.06 FIELD CONDITIONS

A. Environmental Limitations: Do not install horizontal louver blinds until construction and wet and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Field Measurements: Where horizontal louver blinds are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operating hardware of operable glazed units through entire operating range. Notify Design Professional of installation conditions that vary from Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Source Limitations: Obtain horizontal louver blinds from single source from single manufacturer.

2.02 HORIZONTAL LOUVER BLINDS, ALUMINUM SLATS

A. Manufacturers: Subject to compliance with requirements, [provide products by one of the following:

1. Hunter Douglas Contract.
2. Levolor Contract; a Newell Rubbermaid company.
3. Springs Window Fashions.

B. Slats: Aluminum; alloy and temper recommended by producer for type of use and finish indicated; with crowned profile and radius corners.

1. Width: 1 inch (25 mm).
2. Thickness: Not less than 0.008 inch (0.20 mm).
3. Spacing: Manufacturer's standard.
4. Finish: Ionized antistatic, dust-repellent, baked polyester finish.
5. Features:

a. Lift-Cord Rout Holes: Minimum size required for lift cord and located near back (outside) edge of slat to maximize slat overlap and minimize light gaps between slats.

C. Headrail: Formed steel or extruded aluminum; long edges returned or rolled. Headrails fully enclose operating mechanisms on three sides.

1. Capacity: One blind per headrail unless otherwise indicated.
2. Ends: Capped or plugged.
3. Manual Lift Mechanism:

a. Lift-Cord Lock: Variable; stops lift cord at user-selected position within blind full operating range; equipped with ring pull not more than 4 inches (100 mm) long].
b. Operator: Extension of lift cord(s) through lift-cord lock mechanism to form cord pull.

4. Manual Tilt Mechanism: Enclosed worm-gear mechanism and linkage rod that adjusts ladders.

a. Tilt: Full.
b. Operator: Clear-plastic wand.
c. Over-Rotation Protection: Manufacturer's detachable operator or slip clutch to prevent over rotation of gear.

5. Manual Lift-Operator and Tilt-Operator Lengths: Length required to extend to 48 inches (1219 mm) above floor level when blind is fully closed.

6. Manual Lift-Operator and Tilt-Operator Locations: Manufacturer's standard unless otherwise indicated.

7.Integrated Headrail/Valance: Curved face.

D. Bottom Rail: Formed-steel or extruded-aluminum tube that secures and protects ends of ladders and lift cords and has plastic- or metal-capped ends.
1. Type: Manufacturer's standard.

E. Lift Cords: Manufacturer's standard braided cord.

F. Ladders: Evenly spaced across headrail at spacing that prevents long-term slat sag.

1. Type: Braided cord.

G. Mounting Brackets: With spacers and shims required for blind placement and alignment indicated.

1. Type: Overhead.
2. Intermediate Support: Provide intermediate support brackets to produce support spacing recommended by blind manufacturer for weight and size of blind.

H. Hold-Down Brackets and Hooks or Pins: Manufacturer's standard.

I. Side Channels and Perimeter Light Gap Seals: Manufacturer's standard.

J. Colors, Textures, Patterns, and Gloss:

1. Slats: As selected by Design Professional from manufacturer's full range.
2. Components: Provide rails, cords, ladders, and materials exposed to view matching or coordinating with slat color unless otherwise indicated.

2.03 HORIZONTAL LOUVER BLIND FABRICATION

A. Product Safety Standard: Fabricate horizontal louver blinds to comply with WCMA A 100.1 including requirements for corded, flexible, looped devices; lead content of components; and warning labels.

B. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 74 deg F (23 deg C):

1. Between (Inside) Jamb Installation: Width equal to jamb-to-jamb dimension of opening in which blind is installed less 1/4 inch (6 mm) per side or 1/2 inch (13 mm) total, plus or minus 1/8 inch (3.1 mm). Length equal to head-to-sill dimension of opening in which blind is installed less 1/4 inch (6 mm), plus or minus 1/8 inch (3.1 mm).

C. Concealed Components: Non-corrodible or corrosion-resistant-coated materials.

1. Lift-and-Tilt Mechanisms: With permanently lubricated moving parts.

D. Mounting and Intermediate Brackets: Designed for removal and reinstallation of blind without damaging blind and adjacent surfaces, for supporting blind components, and for bracket positions and blind placement indicated.

E. Installation Fasteners: No fewer than two fasteners per bracket, fabricated from metal noncorrosive to brackets and adjoining construction; type designed for securing to supporting substrate; and supporting blinds and accessories under conditions of normal use.

F. Color-Coated Finish:

1. Metal: For components exposed to view, apply manufacturer's standard baked finish complying with manufacturer's written instructions for surface preparation including pretreatment, application, baking, and minimum dry film thickness.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install horizontal louver blinds level and plumb, aligned and centered on openings, and aligned with adjacent units according to manufacturer's written instructions.

1. Locate so exterior slat edges are not closer than 1 inch (25 mm) from interior faces of glass and not closer than 1/2 inch (13 mm) from interior faces of glazing frames through full operating ranges of blinds.
2. Install mounting and intermediate brackets to prevent deflection of headrails.
3. Install with clearances that prevent interference with adjacent blinds, adjacent construction, and operating hardware of glazed openings, other window treatments, and similar building components and furnishings.

3.03 ADJUSTING

A. Adjust horizontal louver blinds to operate free of binding or malfunction through full operating ranges.

3.04 CLEANING AND PROTECTION

A. Clean horizontal louver blind surfaces after installation according to manufacturer's written instructions.

B. Provide final protection and maintain conditions in a manner acceptable to manufacturer and Installer and that ensures that horizontal louver blinds are without damage or deterioration at time of Material Completion.

C. Replace damaged horizontal louver blinds that cannot be repaired in a manner approved by Design Professional before time of Material Completion.

END OF SECTION

SECTION 22 0510
GENERAL PLUMBING REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Definitions
B. Assurance Requirements and Installer Qualifications.
C. Submittal Procedures Supplementing Section 01 3000.
D. Operating and Maintenance Manuals
E. Execution Requirements common to Division 22 systems
F. Pipe Sleeves within building
G. Pipe Sleeves in footings and foundations
H. Piping Pressure Tests.
I. Equipment bases and housekeeping pads
J. Training Requirements
K. Cleaning Requirements.
L. Finishing Requirements

1.02 RELATED SECTIONS

A. Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Section 01 7700 - Closeout Procedures, for additional submittal and warranty requirements.
C. Section 03 3000 - Cast-in-Place Concrete.
D. Section 07 8400 - Firestopping.
E. Section 07 9200 - Joint Sealants
F. Section 09 9100 - Painting.

1.03 DEFINITIONS

A. Manufacturer's Representatives: Wherever MANUFACTURER'S REPRESENTATIVE is referred to in this division, said representative shall be regularly employed by the manufacturer to perform similar activities to those called for herein, which indicates his competence in that field of work.

B. Concealed: Where the word concealed is used in this Division, it shall mean items above ceilings, in attics, in crawl spaces, in chases, in tunnels, in cabinet work, and under counters or equipment so as to be not visible from an elevation of 5 feet at a horizontal distance of 10 feet.

C. Finished Spaces or Areas: Where finished spaces or areas are referred to in this Division, it shall mean all spaces except concealed spaces, mechanical rooms, or boiler rooms unless otherwise noted.

D. Provide: Furnish and install.

E. Control and Interlock Wiring: All wiring, both line voltage and low voltage, other than power wiring from an electrical distribution panel, through the primary control device, to the item of equipment.

F. Primary Control Device: That ONE device for any item of equipment which interrupts power flow during normal operation. Where magnetic starters are provided, they are the primary control. For items not switches by starters, the primary control device will be that ONE thermostat, time clock, manual switch, aquastat, or relay performing the primary switching.

G. Diagrammatic: A drawing that shows arrangement and relations (as of parts).i.e.: A diagrammatic drawing uses symbols rather than pictorial representation of pipes and other items shown and is not necessarily to scale. Arrangement, location, and sizes shown are firm.

H. Readily Accessible: Equipment, valves and other items requiring service shall be installed to be readily accessible. These items shall be available for maintenance or use in a space, through an access door from floor elevation, or above a lay-in ceiling by maintenance staff standing on a ladder no taller than the ceiling.

I. Noted, Indicated or Shown: Where the terms "Noted", "Indicated" or "Shown" are used in these specifications, the words "in the specifications or on the plans" shall be inferred.

J. Detail: Where reference is made to a Detail, the Detail shall be on the plans unless otherwise noted.

K. Specifications: Where reference is made to these specifications, it shall be inferred in this Division of specifications.

L. Notification by the Contractor, and Instructions to the Contractor: Where reference is made in these specifications to notification by or instructions given to the Contractor, it shall be inferred that Architect shall be the instructor or shall be notified, as the case exists.

M. Division or Section Reference: Where reference is made to another Division or Section within this Division, refer to specifications table of contents for Division, Section, or Page Number.

N. Flow Diagram: A single-line, two-dimension, non-scaled drawing depicting arrangement and sequence of equipment, valves, controls, thermometers, gauges, and other specialty devices in a pipe system.

1.04 REGULATORY REQUIREMENTS

A. Where requirements of these specifications exceed specified codes and ordinances, conform to these specifications.

B. Materials and equipment included in Underwriters Label Service shall bear that label. Electrical equipment shall be U.L. approved as installed.

C. Jurisdiction: Where codes or guides refer jurisdiction to local governing code officials, such official in this procedure shall be the City Building Official.

D. Permits: Obtain all permits, paying all fees in connection therewith. At completion, have work inspected by proper authorities and furnish Architect for Owner an inspection certificate showing approval of installation.

E. Plumbing: Conform to the Georgia State Minimum Standard Plumbing Code (International Plumbing Code), 2012 Edition, with all Georgia State Amendments.

F. Fire Prevention Precautions in Cutting and Welding Areas: Conform to Article 2605 Fire Prevention Precautions, Georgia State Minimum Standard Fire Prevention Code (International Fire Code), 2012 Edition, with all Georgia State Amendments, for all work involving cutting and welding.

G. Energy: Conform to the Georgia State Energy Code for Buildings (International Energy Conservation Code), 2009 Edition, with all Georgia State Amendments.

H. All Work: Conform to State of Georgia Chapter 120-3-3 "Rules of Safety Fire Commissioner, Rules and Regulations, January 1st, 2018", and ADA.

I. Electrical: Refer to Division 26. Conform to the National Electrical Code, NFPA 70, 2017.

J. Building Code: Conform to the Georgia State Minimum Standard Building Code (International Building Code), 2012 Edition with all Georgia State Amendments.

1.05 PERFORMANCE REQUIREMENTS

A. Requirements specified herein are minimum. All equipment, when installed, shall perform equal to or exceed specified requirements.

1.06 SUBMITTALS

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

B. Supplementing Division 1 requirements; Contractor shall:

1. Review the submittal data and check to ensure compliance with specifications prior to submitting.
    a. The Contractor agrees that submittals of equipment and material and shop drawings of equipment and material layouts required under provisions of these specifications and processed by Architect are not Change Orders. The purpose of submittals is to demonstrate that Contractor understands the design concept of the project by indicating the equipment and materials he intends to furnish and install, and by detailing the installation he intends to achieve.
    b. The Contractor shall conform to the requirements of the Contract Documents unless a change order is issued. The Contractor shall identify on each submittal and letter form to the Design Professional any and all deviations from the Contract Documents.
    c. Any submittal or shop drawing not conforming to the Contract Documents without this identification and notification shall be assumed to be marked "Revise and Resubmit" (acknowledges this by the submission), and Contractor shall promptly resubmit said submittal so as to be in full compliance with the Contract Documents.
    d. Failure of Contractor to provide this information during the shop drawing phase shall make Contractor responsible for all changes to achieve compliance with the Contract Documents without additional compensation.
2. Assemble the submittal data in compete sets in hard back three-ring binders, separate binders, and bound with numbered index sheets and tabs. All submittal data shall be submitted at one time unless unavailable data would delay project progress. Data shall include capacities, complete installation instructions, dimensional data and electrical data, BHP, motor HP, operating weights and load distribution at mounting points. Any submittals sent in pieces or not secured in a three ring binder will be marked not reviewed and will be returned to the contractor.
3. Identify all submittals by a cover sheet showing project name, specification sections, drawing or detail number, room number, date, revision date, contractor and subcontractor's organization and project manager with phone number, the model, style and size of item being submitted with manufacturers' representative, salesman (or a preparer who can answer questions), and Preparer's phone number.
4. Manufacturers' standard drawings shall be modified by deletions or additions to show only items applicable to this project.
5. Prepare a master list of submittal proposed to be submitted on the project. This list shall be updated for each submission and shall be the first sheet(s) of the submission in the quantity that is submitted for review. The information and general format shall contain an Tab number, Item Description, Item Status and any comment.
6. Provide a Letter stating that all submittals have been checked for compliance with specifications.
7. Deliver submittals to the Design Professional at the business address.
8. Electronic Delivery of Submittals:
    a. Submittal data may be posted to the NBP Engineers FTP site when agreed upon by the Design Professional and the Owner during the preconstruction phase. The Construction Manager will be provided with a project folder and password.
    b. Prepare the submittals as described above in Sections 1.7.A.1-7. Provide one pdf file for each specification section including all submittal data for that specification section. Provide labels identifying each piece of equipment, piping, or accessory to match the listed item in the specification. Take steps to reduce submittal file size.
    c. Do not scan in color or high resolution unless needed for clarity.
    d. Ensure any reproductions are legible.
    e. Send an email to submittal@nbpengineers.com with a copy to the Plumbing Design Professional and the Architectural Design Professional (if applicable) identified during the preconstruction phase.
    f. Provide a submittal index and identify the submittal in the email subject line using the official project title, specification section and submitted item. I.E. Project No. G-xxx.

Addition to Administrative Building - Section 22 0519 - Meters and Gages for Plumbing Piping.

g. Each pdf should include bookmarks to each product, and specification section to easily navigate the pdf file.
h. Ensure the submittal posted to the FTP site has the same identification.
i. NBP Design Professionals will not process or react to submittals which are not properly transmitted, indexed, and identified.

C. Product Data:
1. Provide data specific to the Product proposed indicating capacity data, all standard and optional features to be supplied and all accessories and options available for that product.
2. Manufacturer's standard drawings shall be modified by deletions or additions to show only items applicable to this project.

1.07 OPERATING AND MAINTENANCE MANUALS

A. Operating and Maintenance Manuals shall be prepared by the Contractor for all equipment and be submitted for review a minimum of two months prior to the request for Material Completion.

B. Digital delivery of Operating and Maintenance Manuals:
1. Operating and Maintenance Manuals may be delivered digitally and posted to the NBP Engineers FTP site when agreed upon by the Design Professional and the Owner during the preconstruction phase. The Contractor will be provided with a project folder and password.
2. Prepare the Operating and Maintenance Manuals as described above. Take steps to reduce submittal file size.
3. Do not scan in color or high resolution unless required for clarity.
4. Ensure any reproductions are legible.
5. Send an email to submittal@nbpengineers.com with a copy to the Plumbing Design Professional and the Architectural Design Professional (if applicable) identified during the preconstruction phase.
6. Identify the manuals in the email subject line using the official project title, specification section and submitted item. I.E. Project No. G-xxx, Addition to Administrative Building.
7. Table of Contents(Index) sheets shall be included in the order listed with identifications typed in capital letters.
8. Ensure the manuals posted to the FTP site has the same identification.
9. The O&M Pdf should contain bookmarks to each section of the manual, and bookmarks to each product.
10. NBP Design Professionals will not process or react to manuals which are not properly transmitted, indexed, and identified.

C. Each Manual shall contain the following information, data and drawings:
1. Copies of submittals (with Design Professional's review comments and stamp), equipment and materials.
2. Manufacturer's installation, operating and maintenance instructions for each item of equipment with moving parts including recommended frequency of inspections and maintenance for one year of facility operation.
3. Manufacturer's list of renewal parts for each item of equipment with recommended stock items and quantities indicated.
4. Copies of as-built shop drawings showing layouts and construction details.

1.08 QUALITY ASSURANCE

A. Plumbing Installer Qualifications:
1. Wherever the word "company" or "firm" is used in these subparagraphs, it shall mean the contractor/subcontractor of record for the installations used for proficiency qualification.
2. Refer to the individual sections within this division for additional installer qualification requirements.

3. The Contractor expressly warrants that the company performing the installation of the plumbing systems has demonstrated proficiency in the installation and adjustment of such systems by the successful performance of work of the nature specified herein on at least three commercial or institutional buildings, each containing water heating systems, pumping systems(i.e. hot water recirculation, sump pumps, or pressure booster pumps), and a minimum of 10 plumbing fixtures.
4. The Contractor also warrants that the aforesaid installer, if any, has been in business performing services of the nature specified herein for at least five (5) years.

1.09 PRODUCT DELIVERY, STORAGE, AND PROTECTION

A. Accept all products on site in factory-fabricated protective containers. Inspect for damage.

B. Store products in a clean dry place and protect from weather and construction traffic.

C. Handle products carefully to avoid damage to components, enclosures, and finish.

D. After placement, protect products from damage during construction, by all trade contractors.

E. Protect equipment nameplates and labels from damage, being painted, scaring, etc.

1.10 WARRANTY

A. Refer to Section 01 7700 - Execution and Closeout Procedure, for additional warranty requirements.

B. Where extended warranties beyond Contractor's one (1) year warranty are specified, the additional warranty time shall start at the end of Contractor's warranty.

C. Correct defective Work within a one year period after Date of the Final Inspection.

PART 2 PRODUCTS-NOT USED

PART 3 EXECUTION

3.01 EXAMINATION

A. Refer to the specifications and Architectural and Structural drawings for additional requirements pertaining to work under this discipline. Notify Architect for clarification in the event of conflict.

B. All materials of systems installation exposed in hollow spaces that are used as ducts or plenums shall have a flame spread rating of 25 or less and a smoke development rating of 50 or less.

3.02 PREPARATION

A. Drawings are diagrammatic and show the general proximity of the equipment and pipes. They are not to be scaled, and do not include all required changes in direction or offsets necessary in coordinating the installation of various materials either between trades or within the same trade. All dimensions shall be verified at the building site. Prefabrication and/or installation of work from drawings shall be at Contractor's risk. Refer to Architectural plans for exact building dimensions and details.

B. Space Conditions:
1. All apparatus shall fit into the available spaces in the building and must be introduced into the building so as not to cause damage to the structure. Equipment larger than access to equipment spaces shall be disassembled into sub-assemblies for installation.
2. Where deviations from the plans are required in order to conform to the space limitations, such changes shall be made at no additional cost to Owner and shall be subject to approval.
3. All equipment requiring service shall be made accessible. Coordinate piping installation to avoid conflict with other trades.

3.03 INSTALLATION

A. Clearance above and in front of electrical switchgear, electrical power panels or control panels shall be maintained by mechanical systems so that no pipes, vents, or equipment is routed above or across the space directly above this equipment in conformance with the National Electrical Code.

B. All equipment shall be installed in accordance with manufacturers' published installation instructions shipped with the equipment. In the event there is a discrepancy between these specifications or Drawings and the manufacturers' instructions, no work shall be performed until additional instructions are received.

C. Install and connect all appliances, equipment, and appurtenances as specified, indicated or required in accordance with the manufacturer's instructions and recommendations. Furnish and install complete auxiliary piping, water seals, valves, electric connections, and similar items, recommended by the manufacturer or as required for proper operation.

D. Provide equipment coupling guards shielding the perimeter and face of all new shafts and couplings. Provide openings opposite drive shafts to permit use of revolution counter.

E. Route piping to avoid skylights, translucent, and transparent ceilings.

F. Pipe Sleeves in Slabs, Masonry Walls and Partitions:
   1. Provide sleeves in all slabs and walls/partitions unless otherwise noted.
   2. Omit sleeves on cast iron pipe through slabs on grade.
   3. Elevated Slabs: Schedule 40 black steel pipe: Sleeves shall be sized to include the insulation with minimum gap around insulation. Install, without developing a break in the pipe insulation, according to the fire sealant manufacturer's installation instructions for a U.L. Listed assembly for a rated pipe penetration through a slab. Provide 4" high concrete curb around piping penetrating mechanical penthouse floor slabs.
   4. Masonry Partitions: Schedule 40 black steel pipe: Sleeves shall be sized to include the insulation with minimum gap around insulation. Install, without developing a break in the pipe insulation, according to the fire sealant manufacturer's installation instructions for a U.L. Listed assembly for a rated pipe penetration through a rated masonry wall/partition.
   5. Omit sleeves in openings core drilled in masonry partitions.
   6. Rated Drywall Partitions: Schedule 40 black steel pipe. Sleeves shall be sized to include the insulation with minimum gap around the insulation. Install, without developing a break in the pipe insulation, according to the fire sealant manufacturer's installation instructions for a U.L. Listed assembly for a rated pipe penetration through a rated drywall wall/partition.
   7. Non-Rated Drywall Partitions: Omit sleeves.

G. Pipe sleeves in footings and foundation walls:
   1. Schedule 40 black steel pipe.
   2. Water pipe, distribution piping, soil or waste pipe or building drain passing under a footing or through a foundation wall shall be installed in a pipe sleeve, two pipe sizes larger than the pipe passing through.

H. Seal sleeves and openings in mechanical room walls, fire rated partitions, and floors above grade vaportight, watertight, or for smoke/fire protection as applicable. Refer to Section 07 8400 - Firestopping.

I. Seal sleeves and openings in exterior walls vaportight or watertight as applicable. Refer to Section 07 9200.

J. Equipment and pipe support upper attachments shall be 3" x 3" x 1/4" galvanized steel angles, minimum, spanning structural members unless noted otherwise. Provide inserts and bolts for supporting pipes and equipment from structural members.

K. Saw cut or core drill openings in existing work for the installation of the plumbing system. Patching shall be performed by the trade whose work is cut. Contractor shall lay out and install his work ahead of the work of other trades wherever possible.

3.04 PIPING PRESSURE TESTS

A. General:
   1. Provide 48 hours notification to Architect in advance of any test.
   2. Complete tests prior to insulating.
   3. Leaks shall be repaired, defective materials replaced, and system shall be retested.

4. Strike all joints in copper and steel piping under a pressure test.
5. Conduct tests prior to connecting to equipment or isolate equipment from system.
6. No water pressure test shall be conducted in freezing weather where subject to freezing.
7. Test shall be maintained at conditions specified until approved but, in no event, for less than eight (8) hours minimum duration, unless otherwise noted.
8. Hydrostatic pressure tests shall maintain pressure without change, except that due to temperature change.

B. Domestic Water System: Hydrostatic test; 150 PSIG.

C. Soil, Waste and Vent System: Static test; 10 feet minimum head. Test system in its entirety or in sections. Plug all openings except highest opening above the roof. Water shall be kept in the system, or in the portion under test, for a minimum of one (1) hour. Inspect the system, or the portion under test, after one (1) hour, the system shall be tight at all points.

3.05 EQUIPMENT BASES and HOUSEKEEPING PADS

A. Provide housekeeping and equipment bases as shown or listed below. Rough up slab under bases before pouring concrete.

B. Materials: Refer to Section 03 3000 - Cast-in-Place Concrete. Omit test cylinders for concrete poured under this section.

C. Bases/Pads shall be rectangular with vertical sides 2 inches from edges of equipment, unless otherwise noted.

D. Height:
1. Water Heater: 4-inches.
2. Concrete curb at all pipe penetrations of floors in mechanical rooms above grade: 4-inches or as shown on plans.
3. Housekeeping Pads for Other Equipment: 4-inches or as shown on plans.

E. Chamfer: 3/4-inch on edges and corners.

F. Reinforcing: 6"x 6" 10/10 WWF at mid-depth of slab. (4 inch thick pads.)

3.06 STARTING EQUIPMENT AND SYSTEMS

A. Adjust equipment for proper operation within manufacturers' published tolerances.

B. Demonstrate proper operation of equipment to Owner 's designated representative.

3.07 DEMONSTRATION, TRAINING AND INSTRUCTIONS

A. Instruct operating personnel designated by the Using Agency in operation and maintenance of system prior to request for final inspection. Provide signed statement certifying instructions have been received.

3.08 CLEANING and PROTECTION

A. All materials, equipment and mechanical rooms shall be cleaned prior to Material Completion.

B. Wash down and scrub clean all mechanical room floors, walls, equipment bases and equipment.

C. Paint equipment where finish has been damaged requiring retouching of finish to match factory finish.

D. Chipped or scraped paint shall be retouched to match original finish.

E. Clean and polish all equipment nameplates. All nameplate information shall be legible.

F. All dents and sags in equipment casings shall be straightened.

G. All insulation, equipment, pipe, pipe fittings and appurtenances shall be free of dust, rust and stains prior to Material Completion.

3.09 FINISHING PLUMBING EQUIPMENT AND MATERIAL

A. Use paint systems specified in Division 9 for the substrates to be finished.

B. Paint shop-primed equipment.

C. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

D. Paint all exposed pipes , unless otherwise indicated.

E. All ferrous fasteners and hanger supports not having a corrosion resistant plated finish shall be painted to prevent rust.

F. Paint all exposed un-insulated ferrous metals.

END OF SECTION

SECTION 22 0519

METERS AND GAUGES FOR PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pressure gauges and pressure gauge tappings.

B. Thermometers and thermometer supports.

C. Test plugs.

1.02 RELATED REQUIREMENTS

A. Section 22 0510 - General Plumbing Requirements.

B. Section 22 0719 - Plumbing Piping Insulation.

1.03 SUBMITTALS

A. Refer to Section - 22 0510 General Plumbing Requirements, for submittal procedures.

B. Product Data: Provide list that indicates use, operating range, total range and location for manufactured components.

PART 2 PRODUCTS

2.01 PRESSURE GAUGES

A. Manufacturer: Trerice Model 500X.

B. Other acceptable manufacturers offering equivalent products: Duro 102, Marsh 103, Palmer 40SPDLH, Weksler BM1, Weiss AG-1.

C. Gauge: ASME B40.1, UL 393 case, bourdon tube, rotary brass movement, brass socket, with front recalibration adjustment, black scale on white background and pulsation snubber.
   1. Size: 4-1/2 inch diameter.
   2. Mid-Scale Accuracy: One percent.
   3. Scale: Psi.

2.02 PRESSURE GAUGE TAPPINGS

A. Ball Valve: 1/4 inch, 400 psig WOG, Bronze two piece body, standard port, chrome plated brass ball, reinforced teflon seats and stuffing box ring, blow-out proof stem design, adjustable packing gland, zinc coated steel lever handle with vinyl hand grip, threaded ends.

2.03 STEM TYPE THERMOMETERS

A. Manufacturer: Trerice Model AX9.

B. Other acceptable manufacturers offering equivalent products: Ashcroft 200-36E, Duro 7EZ3-6, Moeller 706AW, Palmer 9FLA, Weiss 7VS6, Weksler AA5.

C. Thermometers - Adjustable Angle: Red- or blue-appearing non-toxic liquid in glass; ASTM E 1; lens front tube, cast aluminum case with enamel finish, cast aluminum adjustable joint with positive locking device; adjustable 360 degrees in horizontal plane, 180 degrees in vertical plane.
   1. Size: 7 inch scale.
   2. Window: Clear Lexan.
   3. Accuracy: 2 percent, per ASTM E 77.
   4. Calibration: Degrees F.

2.04 THERMOMETER SUPPORTS

A. Socket: Brass or stainless steel separable sockets for thermometer stems. Provide cap and chain where not used to mount permanent instrument or control sensor. Provide lagging extension when mounted on insulated pipe.

2.05 TEST PLUGS

A. Manufacturer: FDI Model Super Seal.

B. Other acceptable manufacturers offering equivalent products: MG Piping Products Co., Sisco, Trerice, Texas Fairfax, Universal Lancaster.

C. Test Plug: 1/4 inch or 1/2 inch brass fitting and retained cap for receiving 1/8 inch outside diameter pressure or temperature probe with neoprene core for temperatures up to 200 degrees F. Provide extra-long shaft when mounted on insulated pipe.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide one pressure gauge on incoming side of pressure regulating stations. Provide one pressure gauge downstream from each pressure reducing valve in accordance with details and notes.

C. Install pressure tappings on piping where specified or shown on details. Provide ball valve to isolate each tapping connection to system. Extend nipples to allow clearance from insulation.

D. Install gauges and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical. Fill sockets with SAE 10W oil for conduction.

E. Adjust gauges and thermometers to final angle, clean windows and lenses, and calibrate to zero.

F. Locate test plugs adjacent to thermometers, temperature wells, pressure gauges, and where shown. Install in 1/2 inch pipe opening(minimum), with bushing.

G. Install test plugs vertical to horizontal. Do not install pointing down.

3.02 SCHEDULES

A. Pressure Gauges, Location and Scale Range:
   1. Pressure reducing valves, 0 to 160 psi.

B. Stem Pipe Type Thermometers Scale Range:
   1. Provide thermometers where shown on details and specified.

END OF SECTION

SECTION 22 0553

IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nameplates

B. Tags

C. Pipe Markers

1.02 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems; The American Society of Mechanical Engineers; 2007 (ANSI/ASME A13.1).

B. ASTM D709 - Standard Specification for Laminated Thermosetting Materials; 2013.

1.03 SUBMITTALS

A. Refer to Section 22 0510- General Plumbing Requirements, for submittal procedures.

B. List: Submit list of wording, symbols, letter size, and color coding for plumbing identification.

C. Product Data: Provide manufacturers catalog literature for each product required.

PART 2 PRODUCTS

2.01 NAMEPLATES

A. Description: Laminated three-layer plastic with engraved letters.

B. Description: Laminated three-layer plastic with engraved black letters on light contrasting background color.

C. Size:1/2 inch high letters unless otherwise noted.

D. Size when located on ceiling grid: 3/8 inch high letters unless otherwise noted.

2.02 TAGS

A. Manufacturers: Brimar, Kolbi, Seton.

B. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.

2.03 PIPE MARKERS

A. Manufacturers: Brimar, Seton Name Plate Co Setmark, Kolbi Industries Style A thru E(5 inch and smaller) else Style F thru H, Marking Services.

B. Pipe Markers for Indoor Use: Seton Setmark; media indicator with direction-of-flow arrows on calendared vinyl sheet; snap-around type for pipe sizes to 5-7/8 inches diameter, strap around type with nylon ties for pipe sizes 6 inches diameter and larger.

C. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.

PART 3 EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.02 INSTALLATION

A. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install tags with corrosion resistant chain.

C. Identify equipment such as pumps, water heaters, tanks, compressors and enclosed motor controllers with plastic nameplates.

D. Identify small devices, such as in-line pumps, with tags.

E. Where equipment is located above ceilings; Apply nameplate to ceiling grid for equipment located above accessible ceilings or to access panel for non-accessible ceilings.

F. Identify control panels and major control components outside panels with plastic nameplates.

G. Install Pipe Markers on all piping systems at the following Locations:
   1. Mechanical Equipment Rooms:
      a. Within 18 inches of each valve.
      b. Within 36 inches of each 90 elbow, tee, connection to equipment or vessel and point where pipe exits room.
      c. At not over 20 feet intervals along all exposed piping.
   2. Above Suspended Ceilings:
      a. Within 18 inches of each valve or valve assembly.
      b. At tees, identify both main and branch within 36 inches of tee.
      c. Within 36 inches of each 90 elbow.
      d. At not over 15 feet intervals along all concealed piping.
   3. Piping Exposed in Rooms Other Than Mechanical Equipment Areas:
      a. Omit identification on piping, 1 inch exterior diameter or smaller(insulated or uninsulated) or exposed at connections to equipment or plumbing fixtures.
      b. With the above exception, identify at not less than one point each piping run visible in each room, with identification on not over 20 feet intervals.

END OF SECTION

SECTION 22 0719
PLUMBING PIPING INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Piping insulation

B. Jackets and accessories

1.02 RELATED REQUIREMENTS

A. Section 22 0510 - General Plumbing Requirements

B. Section 22 0553- Identification For Plumbing Piping and Equipment

1.03 REFERENCE STANDARDS

A. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2013.

B. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement; 2007 (Reapproved 2013).

C. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2014.

D. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation; 2015.

E. ASTM C591 - Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation; 2015.

F. ASTM D1056 - Standard Specification for Flexible Cellular Materials--Sponge or Expanded Rubber; 2014.

G. ASTM D2842 - Standard Test Method for Water Absorption of Rigid Cellular Plastics; 2012.

H. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

I. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials; National Fire Protection Association 2007.

J. UL 910 - Standard for Test for Surface Burning Characteristics of Building Materials; Underwriters Laboratories Inc.; 2003.

K. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 22 0510 - General Plumbing Requirements, for submittal procedures.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

C. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

1.05 QUALITY ASSURANCE

A. All insulation, mastics, coatings, sealants, and adhesives shall be certified by the manufacturer to be Asbestos-free.

B. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum three years of experience.

1.06 REGULATORY REQUIREMENTS

A. Conform to maximum flame spread/smoke developed rating of 25/50 in accordance with ASTM E 84.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

1.08 FIELD CONDITIONS

A. Maintain ambient conditions required by manufacturers of each product.

B. Maintain temperature before, during, and after installation for minimum of 24 hours.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 GLASS FIBER (RIGID)

A. Manufacturers:
   1. Knauf Insulation: www.knaufusa.com.
   2. Johns Manville Corporation: www.jm.com.
   3. Owens Corning Corp: www.owenscorning.com.
   4. CertainTeed Corporation: www.certainteed.com.

B. Insulation: ASTM C 547; semi-rigid, noncombustible, end grain adhered to jacket.
   1. 'K' value: ASTM C 177, 0.24 at 75 degrees F (0.035 at 24 degrees C).
   2. Maximum service temperature: 650 degrees F.
   3. Maximum moisture absorption: 0.2 percent by volume.

C. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.

D. Vapor Barrier Lap Adhesive: Compatible with insulation.

E. Insulating Cement/Mastic: ASTM C195 & C449; hydraulic setting on mineral wool.

2.03 PHENOLIC

A. Manufacturers:
   1. ITW; Model Trymer-Green
   2. Dyplast DyTherm

B. Insulation Material: ASTM C 591, closed cell rigid molded foam, 2# density, minimum .
   1. Dimension: Comply with requirements of ASTM C 585.
   2. 'K' value: 0.19 at 75 degrees F, when tested in accordance with ASTM C 518.
   3. Minimum Service Temperature: -70 degrees F.
   4. Maximum Service Temperature: 248 degrees F.
   5. Water Absorption: 0.5 percent by volume, maximum, when tested in accordance with ASTM D 2842..
   6. Moisture Vapor Transmission: 1.0 perm in.
   7. Connection: Waterproof vapor barrier adhesive.

2.04 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Manufacturers:
   1. Armacell International; Model AP: www.armacell.com.
   2. Aerocel; Tube.
   3. K-Flex USA; Insul-Tube.

B. Insulation: Preformed flexible closed-cell elastomeric rubber insulation complying with ASTM C534 Grade 1; use molded tubular material wherever possible.
   1. 'K' ('Ksi') value: ASTM C 177; 0.25 at 75 degrees F (0.04 at 24 degrees C).
   2. Maximum moisture absorption: < 1.0 percent (pipe) by volume, when tested in accordance with ASTM C 209.
   3. Water Vapor Permeability: 0.05 perm-inches, when tested in accordance with ASTM E 96.

4. Flame spread/smoke developed rating of 25/50 maximum when tested in accordance with ASTM E84 .
5. Minimum Service Temperature: -40 degrees F.
6. Maximum Service Temperature: 220 degrees F.
7. Connection: Waterproof vapor barrier adhesive.

C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

2.05 JACKETS

A. ASJ (All Service Jacket): Factory applied white kraft and foil laminate, reinforced, fire retardant jacket (ASJ) with self-sealing lap and butt strips. Jackets shall meet the requirements of ASTM C1136.

B. Glass Fabric Vapor Barrier Finish;
1. Cloth: Untreated 9 oz./sq. yd. weight.
2. Blanket: 1.0 lb./cu ft. density.
3. Weave: 5x5.
4. Lagging Adhesive: Fire resistant compatible with insulation.
5. Finish: Vinyl emulsion type acrylic, compatible with insulation, grey color.

2.06 STAPLES, BANDS, AND WIRES

A. Bands shall be galvanized steel, aluminum, brass, or nickel copper alloy, of 3/4 inch nominal width. The band thickness exclusive of coating shall be not less than 30 gauge for steel and nickel copper alloy.

B. Wire shall be 18-gauge stainless steel.

2.07 ADHESIVES, COATINGS, SEALING COMPOUNDS AND PROTECTIVE FINISHES

A. Lagging Adhesive and Coating for Glass Cloth Jackets and Other Facings - MIL-A-3316 B, Class 1.

B. Lap Adhesive for Vapor Barrier Jacket - MIL-A-3316 B, Class 2.

C. Bonding Adhesives - for securing insulation to metal surfaces - MIL-A-3316 B, Class 2 for temperature up to 200 degree F.

D. Contact Type Adhesive - For installing flexible unicellular insulation - MIL-A-24179, Type II, Class 1.

E. Bedding Compound and Joint Sealers - MIL-B-19564A.

F. Coating Compound - Vapor Barrier Treatment - MIL-C-19565B, Type 1 or II.

G. Protective Finish Outside of Buildings - Coating Compound MIL-C-19565 B, Type I.

H. Manufacturers: Childers, Foster, Armstrong, Mon-Eco.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that piping has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with North American Insulation Manufacturers Association (NAIMA) National Insulation Standards.

C. Exposed Piping: Locate insulation and cover seams in least visible locations. Exterior of insulation shall be uniform in appearance.

D. Insulation jacket shall fit snug to insulation.

E. Fixture Supply Piping Exposed and in Cabinets: Do not insulate.

F. Domestic Cold Water Piping in Plumbing Chases and Concealed in Non-exterior Walls: Do not insulate.

G. Floor Drain Primer: All horizontal piping and vertical piping up to 6" above the finished floor shall be insulated. Insulate same as Domestic Cold Water where located above slab on grade. Where located below grade, provide 1-inch thick flexible elastomeric cellular insulation.

H. Valves and fittings:
   1. Insulate pipe and all valves and fittings including valve bonnets on domestic cold water, domestic hot water, and horizontal insulated waste piping. Leave only valve stems, open ends of wells and gauge cocks exposed.
   2. All Other Piping: Insulate pipe and fittings, but omit insulation on unions and valves. Taper insulation ends and cover with coating reinforced with glass cloth.

I. Insulation at Hangers: Hangers for condensate drain, horizontal insulated waste piping, domestic water, and trapeze supports shall be outside of insulation with saddles as specified herein.

J. Saddles: Provide galvanized steel saddles at each point where pipe insulation passes through a hanger or rests on a support. Saddles shall be 180 arc for horizontal piping, 360 arch for vertical piping. Length and gauge of saddle shall be as follows:
   1. 2 inch pipe size and smaller: 18 Gauge saddle, 8 inch long, minimum.
   2. 2-1/2 & 3 inch pipe size: 18 Gauge saddle, 12 inch long, minimum.
   3. 4 inch pipe size:16 Gauge saddle,16 inch long, minimum.

K. Flexible elastomeric cellular rubber insulation: Install without splitting and under compression during pipe fabrication. Seal Joints with adhesive. Paint exposed insulation with two coats of vinyl insulation paint after adhesive has dried for twelve hours, minimum. Allow two hours, minimum, between coats.

L. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, refer to Section 22 0510.

3.03 CLEANING

A. Clean adjacent surfaces, valves, valve handles, etc. of jacketing materials.

3.04 SCHEDULES

A. Plumbing Systems:
   1. Domestic Water:
      a. All Concealed Piping and Exposed Piping Above 10ft Above Finished Floor Domestic Hot, Tempered, Cold, and Circulating Piping:1 inch thick rigid glass fiber with factory ASJ jacket.
      b. Exposed Piping Below 10ft Above Finished Floor Domestic Hot, Tempered, Cold, and Circulating Piping:1 inch thick rigid glass fiber with glass fabric vapor barrier jacket.
   2. Concealed Waste piping handling HVAC Condensate Above Grade:1 inch thick phenolic foam with Saran vapor jacket. Insulate fittings with pipe insulation mitered to fit.
   3. Exposed Waste piping handling HVAC Condensate Above Grade: 1 inch thick phenolic foam with Saran vapor jacket and PVC finish jacket. Insulate fittings with pipe insulation mitered to fit.

END OF SECTION

SECTION 22 1005
PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pipe, pipe fittings, specialties, and connections for piping systems.
   1. Sanitary sewer
   2. Domestic water
   3. Pipe hangers and supports.
   4. Valves

1.02 RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.

B. Section 22 0510 - General Plumbing Requirements.

C. Section 22 0553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT.

D. Section 22 0719 - PLUMBING PIPING INSULATION.

1.03 REFERENCE STANDARDS

A. NSF/ANSI 372 - American National Standard for procedures in evaluating product compliance with the 0.25% maximum weighted average lead content requirement.

B. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250; 2010.

C. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2012.

D. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2013.

E. ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV; 2012.

F. ASME B31.9 - Building Services Piping; 2014.

G. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Welding, Brazing, and Fusing Qualifications; 2015.

H. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.

I. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings; 2015.

J. ASTM A 888 - Hubless Cast Iron Pipe and Fittings.

K. ASTM B32 - Standard Specification for Solder Metal; 2008 (Reapproved 2014).

L. ASTM B42 - Standard Specification for Seamless Copper Pipe, Standard Sizes; 2015a.

M. ASTM B75/B75M - Standard Specification for Seamless Copper Tube; 2011.

N. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2014.

O. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2013.

P. ASTM B302 - Standard Specification for Threadless Copper Pipe, Standard Sizes; 2012.

Q. ASTM B306 - Standard Specification for Copper Drainage Tube (DWV); 2013.

R. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings; 2014.

S. ASTM C 1540-04- Standard Specification for Heavy Duty Shielded Couplings joining Hubless Cast Iron Soil Pipe and Fittings.

T. ASTM C 1563- Standard test method for Gaskets for use in Connection with Hub and Spigot Cast Iron Soil Pipe and Fittings for Sanitary Drain, Waste, Vent and Storm Piping Applications.

U. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120; 2015.

V. ASTM D2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40; 2013.

W. ASTM D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems; 2012.

X. ASTM D2665 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings; 2014.

Y. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings; 1996 (Reapproved 2010).

Z. ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 2015.

AA. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings; 2012.

AB. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast; 2009.

AC. AWWA C651 - Disinfecting Water Mains; 2005.

AD. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste and Vent Piping Applications; 2009.

AE. CISPI 310 - Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications; 2011.

AF. MSS SP-69 - Pipe Hangers and Supports - Selection and Application; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 2003.

AG. MSS SP-80 - Bronze Gate, Globe, Angle and Check Valves; 2013.

AH. MSS SP-89 - Pipe Hangers and Supports - Fabrication and Installation Practices; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 2003.

AI. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; 2010.

AJ. NSF 61 - Drinking Water System Components - Health Effects; 2014 (Errata 2015).

AK. NSF 372 - Drinking Water System Components - Lead Content; 2011.

1.04 SUBMITTALS

A. Refer to Section 22 0510 - General Plumbing Requirements, for submittal procedures.

B. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.

C. Project Record Documents: Record actual locations of valves.

1.05 QUALITY ASSURANCE

A. Products specified this section to be installed in a potable water system anticipated for human consumption shall be in compliance with the amended Safe Drinking Water Act S.3874, to reduce lead in drinking water. "Reduction of Lead in Drinking Water Act". 0.25% allowable lead content.

B. Refer to Section 22 0510 - General Plumbing Requirements for installer requirements.

C. All cast iron pipe and fittings shall be marked with the Collective Trademark of the Cast Iron Soil Pipe Institute.

D. All buried thermoplastic pipe and fittings shall be installed in accordance with ASTM D 2321.

E. Perform Work in accordance with State of Georgia, standards.

F. Valves: Manufacturer's name and pressure rating marked on valve body.

G. Welding Materials and Procedures: Conform to ASME BPVC-IX and applicable state labor regulations.

H. Identify pipe with marking including size, ASTM material classification, ASTM specification, potable water certification, water pressure rating.

I. Perform Work in accordance with State of Georgia plumbing code.

J. Conform to applicable code for installation of backflow prevention devices.

K. Disinfection shall be in accordance with Environmental Protection Division, Georgia Department of Natural Resources "Rules for Safe Drinking Water".

L. Domestic water piping system shall be sterilized, complying with Federal Specifications BB-C-120. Work shall be performed by licensed operator.

M. Water Sample Certification: Water samples from the sterilized domestic water piping system shall be tested and approved by the local Health Department.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary protective coating on cast iron and steel valves.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.07 FIELD CONDITIONS

A. Do not install underground piping when bedding is wet or frozen.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Potable Water Supply Systems: Provide piping, pipe fittings, and solder and flux (if used), that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

2.02 SANITARY SEWER PIPING, BURIED AND WITHIN 5 FEET OF BUILDING

A. PVC Pipe: ASTM D2665, Schedule 40.
   1. Fittings: PVC.
   2. Joints: Solvent welded, with ASTM D2564 solvent cement.

2.03 SANITARY SEWER PIPING, ABOVE SLAB ON GRADE:

A. Cast Iron Pipe: CISPI 301 or ASTM A888, hubless.
   1. Fittings: Cast iron.
   2. Joints: Shielded Couplings ASTM C 1277 Assembly: CISPI 310 and ASTM C 1540-04, with stainless steel shield, stainless steel clamp and tightening devices, and ASTM C 564 rubber sleeve.
      a. Manufacturers - 1½" thru 3": Medium Duty: Mission Heavyweight, Husky HD 2000; Clamp-ALL-80, Tyler Wide Body, Ideal HD.
      b. Manufacturers - 4" thru 10": Heavy Duty: Husky SD 4000; Clamp-ALL-121.

2.04 WATER PIPING, ABOVE SLAB ON GRADE:

A. Copper Tube: ASTM B 88 (ASTM B 88M), Type L (B), Drawn (H).
   1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
   2. Joints: ASTM B 32, alloy Sn95 solder.

2.05 UNIONS, FLANGES AND COUPLINGS

A. Unions for Pipe Sizes 3 Inches and Under:
   1. Copper tube and pipe: Class 150 bronze unions with soldered joints.

B. Flanges for Pipe Size Over 1 Inch:
   1. Copper Tube and Pipe: Class 150 slip-on bronze flanges; preformed neoprene gaskets.

C. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier. Provide where connecting ferrous and non-ferrous piping.

2.06 PIPE HANGERS AND SUPPORTS

A. Manufacturers: Anvil, B-Line, Grinnell, Globe or Michigan. Figure numbers are for Michigan.

B. Plumbing Piping - Drain, Waste, and Vent:
   1. Hangers for Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis. Figure 400.
   2. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
   3. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
   4. Wall Support for Pipe Sizes 4 Inches and Over: Welded steel bracket and wrought steel clamp.
   5. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
   6. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

C. Plumbing Piping - Water:
   1. Hangers for Pipe Sizes 1/2 Inch to 1-1/2 Inches: Carbon steel, adjustable swivel, loop. Figure 100.
   2. Hangers for Cold Pipe Sizes 2 Inches and Over: Copper electroplated carbon steel , adjustable, clevis. Figure 402.
   3. Multiple or Trapeze Hangers(Up to 2 inch: Green epoxy coated, cold formed, lipped steel channels, sized for pipe load and span, 1-5/8" x 1-5/8" x 12 gauge minimum, with pipe/tubing clamps, elastomer cushion, spring held, hardened steel nuts and hanger rods.
   4. Multiple or Trapeze Hangers: Steel channels with welded supports or spacers and hanger rods.
   5. Vertical Support: Steel riser clamp.
   6. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
   7. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

2.07 BALL VALVES

A. Up To and Including 2-1/2 Inches:
   1. Manufacturers:
      a. Apollo; Model 77CLF2 Series
      b. Crane; Model LF9202
      c. Ferguson; Model X421
      d. Hammond; Model UP8911
      e. Milwaukee; Model UPBA485B
      f. Red & White Valve comp. Model
      g. Watts; Model LFFBVS-3C
      h. American Valve; Model G100S
   2. MSS SP-110, NSF-61, 150 WSP, 600 WOG, Brass or Bronze two piece body, Full port, chrome plated brass ball, reinforced teflon seats and stuffing box ring, blow-out proof stem design, adjustable packing gland, zinc coated steel lever handle with vinyl hand grip , Solder ends.

2.08 CAST IRON BALL VALVES

A. 3 Inches and Larger:
   1. Manufacturers:
      a. American Valve; Model 3700.
      b. Watts; Model G4000M1, epoxy coated.
      c. Apollo; Model 6PLF.
   2. MSS SP-72, NSF-61, NSF-372, 125 WSP, 200 WOG, Cast Iron body, Full port, stainless steel or teflon infused cast iron ball, Buna-N or PTFE seats, blow-out proof stem design, adjustable packing gland, cast iron or steel lever handle with vinyl hand grip , Flanged ends .

2.09 FLOW INDICATOR-BALANCER CONTROLS

A. Manufacturers:

1. AAF:
2. ITT Bell & Gossett:
3. Armstrong.
4. Taco.
5. Tour & Anderson; Model IMI-TA
6. Watts.

B. Balancer: Calibrated bronze screwed balance valve with indicating pointer, memory stop, and with pressure taps for connecting differential pressure meter. Pressure taps shall be equipped with caps and integral check valves. Each valve shall have preformed, removable insulation cover. Locate to provide unrestricted flow up and down-stream in accordance with manufacturer's recommendations. Valves shall be ANSI/NSF-61 Annex G Compliant

C. Meter: Portable differential pressure gauge with flexible tubing, shut-off valves and case. Deliver gauge to Operating Personnel upon completion of testing and balancing. B&G RO-2, AAF PG-1, Taco Circuit Setter meter, Flow Set 300.5, TA Scope.

D. Balance Valve shall be ANSI/NSF-61 Annex G Compliant.

2.10 SWING CHECK VALVES

A. 2-Inches and smaller
   1. Manufacturers:
      a. Apollo; Model 161SLF
      b. Crane; Model LF1340
      c. Hammond Valve; Model UP912
      d. Red & White Valve Comp.
      e. Milwaukee Valve; Model UP1509
      f. Nibco, Inc: Model S-413-Y-LF
      g. Stockham; Model LFB-309Y
   2. MSS SP-80, NSF-61, Class 125, bronze body and cap, bronze swing disc with rubber seat, solder ends.

2.11 Water Pressure Reducing Valves:

A. Manufacturers:
   1. Apollo; Model 36LF-H
   2. Watts Regulator Company; Model LF223-S-B
   3. Wilkins; Model 500XLYSBR

B. Up to 2 Inches:
   1. MSS SP-80, bronze body, stainless steel and thermoplastic internal parts, fabric reinforced diaphragm, strainer, threaded single union ends. Made in the USA with corrosion resistant materials. Valve shall be made in the USA with corrosion resistant components and materials.

2.12 STRAINERS

A. Y-type with removable screen; 2 1/2-inch and larger, flanged; 2-inch and smaller, threaded. Rating 125 PSIG.

B. Manufacturers:
   1. Armstrong;
   2. Conbraco/Apollo; Model 59 Series
   3. Crane;
   4. Flow Design YC/YW
   5. Hammond; Model 3010 thrd/ 3030 flanged
   6. Keckley;
   7. Muessco;
   8. Mueller;
   9. Wheatley "YF"

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that excavations are to required grade, dry, and not over-excavated.

3.02 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.03 INSTALLATION

A. Each type of pipe installed shall be by the same manufacturer throughout the building.

B. Each type of fittings installed shall be by the same manufacturer throughout the building.

C. Install in accordance with manufacturer's instructions.

D. Equipment and pipe support upper attachments shall be 3" x 3" x 1/4" steel angles, minimum, spanning structural members unless noted otherwise. Provide inserts and bolts for supporting pipes and equipment from structural members. Attachments shall be to top cord of bar joists. Attach to beams with beam clamps. DO NOT support from roof deck.

E. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

F. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

G. Install piping to maintain headroom, conserve space, and not interfere with use of space.

H. Maintain 4 inch clearance between pipe and fittings after insulation.

I. Group piping whenever practical at common elevations.

J. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

K. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

L. Provide access where valves and fittings are not exposed.

M. Establish elevations of buried piping outside the building to ensure not less than 3 ft. of cover.

N. Install vent piping penetrating roofed areas to maintain integrity of roof assembly.

O. Flush all debris and pipe compound from domestic water system.

P. Excavate in accordance with Section 31 2316.

Q. Backfill in accordance with Section 31 2323.

R. Install valves in a readily accessible location.

S. Install valves with stems upright or horizontal, not inverted.

T. Install water piping to ASME B31.9.

U. PVC Pipe: Make solvent-welded joints in accordance with ASTM D2855.

V. Sleeve pipes passing through partitions, walls and floors. Where pipes pass thru exterior walls, seal opening between sleeve and pipe.

W. Pipe Hangers and Supports:
   1. Install in accordance with ASME B31.9.
   2. Support horizontal piping as indicated.
   3. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
   4. Place hangers within 12 inches of each horizontal elbow.
   5. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.

6. Support vertical piping at every floor. Support riser piping independently of connected horizontal piping.
7. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
8. Use double nuts and lock washers on threaded rod supports.
9. Provide copper plated hangers and supports for copper piping where hanger is in contact with tubing.
10. Prime coat concealed steel hangers and supports not provided with a corrosion resistant finish. Refer to Section 09 9000.
11. Support drainage piping within 12 inches of every joint.

3.04 APPLICATION

A. Install unions downstream of valves and at equipment or apparatus connections.

B. Install gate or ball valves for shut-off and to isolate equipment, part of systems, or vertical risers as shown on drawings.

C. Provide flow controls in water recirculating systems where indicated.

3.05 TOLERANCES

A. Drainage Piping: Establish invert elevations within 1/2 inch vertically of location indicated and slope to drain at minimum of 1/8 inch per foot slope.

B. Interior Water Piping: Maintain top of piping level with concentric reducers. Arrange to drain at low points.

3.06 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Prior to starting work, verify system is complete, flushed and clean.

B. Ensure acidity (pH) of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).

C. Inject disinfectant, free chlorine in liquid, powder, tablet or gas form, throughout system to obtain 50 to 80 mg/L residual.

D. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15 percent of outlets.

E. Maintain disinfectant in system for 24 hours.

F. If final disinfectant residual tests less than 25 mg/L, repeat treatment.

G. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.

H. Take samples no sooner than 24 hours after flushing, from 10 percent of outlets and from water entry, and analyze in accordance with AWWA C651.

3.07 SERVICE CONNECTIONS

A. General: Prior to excavation for or installation of any piping, determine location, invert and size at connection. Advise Architect of any discrepancies discovered.

B. Provide new water service complete with, pressure reducing valve, and sand strainer.

C. Utilities Impact Fees: Contractor shall pay utility(s) impact fees, if any, relating to this project.

D. Provide new sanitary sewer services. Before commencing work check invert elevations required for sewer connections, confirm inverts and ensure that these can be properly connected with slope for drainage and cover to avoid freezing.

3.08 SCHEDULES

A. Hanger spacing indicated as maximum span based on pipe material and size. Conform to structural spacing and load capacity of structural support points and provide closer spacing as required.

B. Pipe Hanger Spacing:
   1. Metal Piping:

a. Copper Pipe size: 1/2 inches to 1-1/4 inches:
   1) Maximum hanger spacing: 5 ft.
   2) Hanger rod diameter: 3/8 inches.
b. Copper Pipe size: 1-1/2 inches to 4 inches:
   1) Maximum hanger spacing: 8 ft.
   2) Hanger rod diameter: 3/8 inch.
c. Waste/Vent Pipe size: 2 inches to 3 inches:
   1) Maximum hanger spacing: 8 ft.
   2) Hanger rod diameter: 1/2 inch.
d. Waste/Vent Pipe size: 4 inches to 6 inches:
   1) Maximum hanger spacing: 8 ft.
   2) Hanger rod diameter: 5/8 inch.

END OF SECTION

SECTION 22 1006
PLUMBING PIPING SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Floor Drains
B. Cleanouts
C. Hose Bibbs
D. Hydrants
E. Water hammer arrestors
F. Thermostatic Mixing Valve
G. Trap Primers
H. Flashing
I. Valve Box

1.02 RELATED REQUIREMENTS

A. Section 22 0510 - General Plumbing Requirements
B. Section 0519 - Meters and Gages for Plumbing Piping
C. Section 22 1005 - Plumbing Piping

1.03 REFERENCE STANDARDS

A. NSF/ANSI 372 - American National Standard for procedures in evaluating product compliance with the 0.25% maximum weighted average lead content requirement.
B. ASME A112.6.3 - Floor and Trench Drains; 2001 (R2007).
C. ASSE 1011 - Hose Connection Vacuum Breakers; 2004.
D. ASSE 1012 - Backflow Preventer with Intermediate Atmospheric Vent; 2009.
E. ASSE 1019 - Performance Requirements for Wall Hydrant with Backflow Protection and Freeze Resistance; 2011.
F. NSF 61 - Drinking Water System Components - Health Effects; 2014 (Errata 2015).
G. NSF 372 - Drinking Water System Components - Lead Content; 2011.
H. PDI-WH 201 - Water Hammer Arresters; 2010.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Refer to Section 22 0510 - General Plumbing Requirements, for submittal requirements.
C. Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.
D. Manufacturer's Instructions: Indicate Manufacturer's Installation Instructions: Indicate assembly and support requirements.
E. Project Record Documents: Record actual locations of equipment, cleanouts, backflow preventers, piping and valves.

1.05 QUALITY ASSURANCE

A. Products specified this section to be installed in a potable water system anticipated for human consumption shall be in compliance with the amended Safe Drinking Water Act S.3874, to reduce lead in drinking water. "Reduction of Lead in Drinking Water Act". 0.25% allowable lead content.
B. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept specialties on site in original factory packaging. Inspect for damage.
   1. Two loose keys for outside hose bibs.
   2. Two hose end vacuum breakers for hose bibs.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Specialties in Potable Water Supply Systems: Provide products that comply with NSF 61 and NSF 372 for maximum lead content.

2.02 FLOOR DRAINS

A. Floor Drain (FD-A): In Finished Spaces
   1. Manufacturers:
      a. Josam; Model 30000-S-Y
      b. Mifab; Model F1100C-S(P)-1
      c. J. R. Smith; Model 2005L(B)
      d. Wade; Model 1100G(TY)
      e. Watts; Model FD-100-M-P
      f. Zurn; Model ZN415S(NL)
   2. ASME A112.6.3; lacquered cast iron two piece body with double drainage flange, weep holes, reversible clamping collar, square, adjustable nickel-bronze strainer and trap primer connection.

B. Floor Drain (FD-B): In Mechanical Spaces
   1. Manufacturers:
      a. Josam; Model 32300V-50-69-1
      b. Mifab; Model F1340-Y-14
      c. J. R. Smith; Model 2131L-P050-B-NB
      d. Wade; Model 1210(TY)-1-27
      e. Watts; Model FD-340-Y-P
      f. Zurn
   2. ASME A112.6.3; lacquered cast iron two piece body with double drainage flange, weep holes, reversible clamping collar, and adjustable round nickel bronze strainer with removable perforated sediment bucket and trap primer connection.

C. Floor Drain (FD-C): In Mechanical Spaces above grade
   1. Manufacturers:
      a. Josam 49280A-31-45
      b. Mifab FS1760-FL-1-5
      c. J. R. Smith; Model 3061-12
      d. Wade
      e. Zurn ZN-1950-K
   2. ASME A112.6.3; lacquered cast iron two piece body with double drainage flange, weep holes, reversible clamping collar, and adjustable round nickel bronze strainer with 1/2 grate. Removable perforated sediment bucket and trap primer connection.

D. Floor Drain (FD-D): Serving
   1. Manufacturers:
      a. Josam; Model 49000X
      b. Mifab; Model FS1520-FL-1
      c. J. R. Smith; Model 3100C
      d. Watts; Model FS710-F-1
      e. Zurn; Model ZN-1910-K
   2. ASME A112.6.3; lacquered cast iron flanged receptor with seepage holes, 6 - inches deep acid resistant coated interior and 8 1/2 - inch square nickel bronze rim with full grate and dome strainer.

2.03 CLEANOUTS

A. General Cleanouts at Exterior Unsurfaced Areas (GCO):
   1. Manufacturers:
      a. Josam; Model 58190-22
      b. Mifab; Model C-1230
      c. J.R. Smith; Model 4283S
      d. Watts; Model CO-200
      e. Zurn; Model Z1449
      f. Wade; Model 8550-75
   2. Line type cast iron cleanout with spigot outlet.

B. General Cleanouts at Exterior Surfaced Areas (GCO):
   1. Manufacturers:
      a. Josam; Model 55000-22
      b. Mifab; Model C1100-XR
      c. J.R. Smith; Model 4232L
      d. Watts; Model CO-200-XR-4
      e. Zurn; Model Z1400-NL-BP
      f. Wade; Model 6000-12-75
   2. Round cast iron cleanout with adjustable scoriated top, and bronze plug.

C. Cleanouts at Interior Finished Floor Areas (FCO):
   1. Manufacturers:
      a. Josam; Model 55000
      b. Mifab; Model C-1100P-R
      c. J.R. Smith; Model 4032L
      d. Watts; Model
      e. Zurn; Model ZN1400-NL-BP
      f. Wade; Model 6000-1-75
   2. Lacquered cast iron body with anchor flange, flashing clamp and round adjustable secured Nickel Bronze top assembly with bronze plug and round gasketed scored cover in service areas and round gasketed depressed cover to accept floor finish in finished floor areas.

D. Cleanouts at Interior Finished Wall Areas (WCO):
   1. Manufacturers:
      a. Josam; Model 58600
      b. Mifab; Model C-1430-RD
      c. J.R. Smith; Model 4472
      d. Watts; Model CO-590-RD
      e. Zurn; Model Z-1468
      f. Wade; Model 8590/8304
   2. Line type with cast bronze taper threaded plug with round stainless steel access cover secured with machine screw.

2.04 HOSE BIBBS

A. Interior Hose Bibbs:
   1. Manufacturers:
      a. Nibco; Model 763VB-LS
      b. Woodford; Model 24P
      c. T&S Brass; Model B-0736
      d. Prier; Model C255CP
   2. Brass body with integral mounting flange, replaceable hexagonal disc, hose thread spout, chrome plated where exposed with lockshield and removable key, integral vacuum breaker in conformance with ASSE 1011. Rough brass finish in mechanical spaces.

2.05 HYDRANTS

A. Wall Hydrants: Fully recessed in flush mounting box. Box and door shall be cast bronze.
   1. Manufacturers:
      a. J.R. Smith; Model 5509QT-15
      b. Josam; Model 71000
      c. Prier; Model C634N-BX1
      d. Wade; Model W-8625
      e. Watts; Model HY-42B
      f. Woodford; Model B65
      g. Zurn; Model Z-1320
   2. ASSE 1019; freeze resistant, self-draining type with chrome plated wall plate, hose thread spout, handwheel, and integral vacuum breaker.

2.06 WATER HAMMER ARRESTORS

A. Manufacturers: Unit Size: 'A'
   1. Jay R. Smith; Model 5205-SC Series
   2. Watts; Model LF15M2 Series
   3. Mifab; Model MWH-A
   4. Sioux Chief; Model 650 Series
   5. Josam; Model 75001-S
   6. Wade; Model 5P
   7. Wilkins; Model 1250XL-A
   8. Zurn; Model WH2950-A-XL

B. Manufacturers: Unit Size: 'B'
   1. Jay R. Smith; Model 5210-SC Series
   2. Watts; Model LF15M2 Series
   3. Mifab; Model MWH-B
   4. Sioux Chief; Model 650 Series
   5. Josam; Model 75002-S
   6. Wade; Model 10P
   7. Wilkins; Model 1250XL-B
   8. Zurn; Model WH2950-B-XL

C. Manufacturers: Unit Size: 'C'
   1. Jay R. Smith; Model 5220-SC Series
   2. Watts; Model LF15M2 Series
   3. Sioux Chief; Model 650 Series
   4. Josam; Model 75003-S
   5. Wade; Model 20P
   6. Wilkins; Model 1250XL-C
   7. Zurn; Model WH2950-C-XL

D. Manufacturers: Unit Size: 'D'
   1. Jay R. Smith; Model 5230-SC Series
   2. Watts; Model LF15M2 Series
   3. Sioux Chief; Model 650 Series
   4. Josam; Model 75004-S
   5. Wade; Model 50P
   6. Wilkins; Model 1250XL-D
   7. Zurn; Model WH2950-D-XL

E. Water Hammer Arrestors:
   1. ANSI A112.26.1M Copper construction, piston type sized in accordance with PDI-WH 201, precharged suitable for operation in temperature range 33 to 180 degrees F and maximum 150 psi working pressure. Locate valve(s) above ceiling height of adjacent space.

2.07 THERMOSTATIC MIXING VALVES

A. Thermostatic Mixing Valves (Pre-Piped with Circulation Pump):
   1. Manufacturers:
      a. Bradley;
      b. Lawler.
      c. Leonard; Model MEGATRON TM26LF.
      d. Power.
   2. Pre-Piped Assembly: The entire assembly shall be pre-piped mounted on an enamel coated unistrut system. Assembly shall include thermostatic mixing valve with shut off valves and thermometers on the hot and cold water inlets, temperature gauge and shut off valve on the outlet. Hot water return system including aquastat, balancing valve, check valves, and circulation pump. A GFCI power outlet shall be included on the assembly. The entire assembly shall be fully assembled and test in the factory.
   3. Thermostatic Mixing Valve: Rough cast brass body, bi-metal or liquid filled thermostat, color coded dials, adjustable limit stop set for 120°F, factory assembled and tested.
      a. Capacity: 10 gpm at 10 psi differential.
      b. Accessories:
         1) Inlet Check Stops.
         2) Volume control shut-off valve on outlet.
         3) Dial thermometer on outlet.
         4) Test Connection on outlet.
   4. Circulation Pump
      a. Manufacturers:
         1) Armstrong Pumps Inc: www.armstrongpumps.com.
         2) Grundfoss.
         3) ITT Bell & Gossett: www.bellgossett.com.
         4) TACO.
      b. Casing: Bronze or Stainless Steel, rated for 125 psig working pressure, with stainless steel rotor assembly.
      c. Impeller: Non-Metallic or Noryl
      d. Shaft: Ceramic or Carbon Steel, self-lubricating or permanently lubricated with steel ball bearings.
      e. O-Ring and Gaskets: EPDM.
      f. Drive: Direct Drive.
      g. Performance:
         1) Flow: 3 gpm, at 10 feet head.
         2) Electrical Characteristics:
            (a) 1/25 hp.
            (b) 120 volts, single phase, 60 Hz, 15 minimum circuit ampacity.

2.08 TRAP PRIMERS

A. Single Primer:
   1. Cast brass unit with built-in air gap/backflow preventer, 1/2 inch inlet and 1/2 inch outlets.
   2. Manufacturers: Precision Plumbing Products (PPP) PR-500, Mifab M-500-NPB w/MI-GAP, Watts LFTP300T-DR.
   3. See detail on plans.

B. Multiple Trap Primer:
   1. Trap Primer Valve: Brass trap primer valve with O-ring seals and integral vacuum breaker. Adjustable from 2 oz. to 5 oz. flow rate.
   2. Distribution Unit: Brass body with clear plastic inspection cover top and 4 distribution opening(s) in the bottom.
   3. Manufacturers: Precision Plumbing Products, Inc. (PPP) PR-500 w/DU-2/3/4, Mifab M-500-NPB w/MI-GAP and MI-DU, and Watts LFTP300T-DR with LFTP300-DU-DR. Pipe per manufacturer's instructions.

4. See detail on plans.

2.09 TRAP SEALER ASSEMBLY

A. Manufacturers:
   1. Sure Seal
   2. Proset
   3. J.R. Smith

B. Inline elastomeric material waterless trap protection. Size to match drain.

C. Ten year warranty

2.10 FLASHING

A. Cast Iron Vents Thru Roof Unless Otherwise Noted: Flashing provided by roof manufacturer.

B. Other Pipe Vents Thru Roof Unless Otherwise Noted: Flashing provided by roof manufacturer.

C. Pipes Thru Roof : See Details.

D. Workmanship: Flashing materials shall be free of holes and splits, and all joints and seams shall be sealed watertight with solder.

2.11 VALVE BOX

A. Two piece, plastic, rectangular box with removable locking lid and identification of service on cover. Oldcastle Enclosures, Bingham and Taylor, NDS, or Approved Equal.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install plumbing specialties in a readily accessible location.

C. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.

D. Encase exterior cleanouts in 6-inch concrete pad flush with grade. See detail.

E. Install 2-way cleanouts at all sanitary sewer and storm drain pipes exiting the building. Refer to detail on drawings.

F. Install floor cleanouts at elevation to accommodate finished floor.

G. Floor drains shall be set at 1/8-inch below finish floor elevation. Refer to Architectural for sloping of floor.

H. Install approved potable water protection devices on plumbing lines where contamination of domestic water may occur; on boiler feed water lines, fire sprinkler systems, and irrigation systems.

I. Install water hammer arrestors complete with accessible isolation valve on hot and cold water supply piping to , , all fixtures and toilet batteries. Size and install in accordance with the (Plumbing and Drainage Institute Standard) PDI WH-201.

END OF SECTION

SECTION 22 3000
PLUMBING EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Water Heaters:
   1. Commercial electric.

B. Diaphragm-type compression tanks.

C. In-line circulator pumps.

1.02 RELATED REQUIREMENTS

A. Section 0519 - Meters and Gages For Plumbing Piping.

1.03 REFERENCE STANDARDS

A. NSF/ANSI 372 - American National Standard for procedures in evaluating product compliance with the 0.25% maximum weighted average lead content requirement.

B. ASME BPVC-VIII-1 - Boiler and Pressure Vessel Code, Section VIII, Division 1 - Rules for Construction of Pressure Vessels; The American Society of Mechanical Engineers; 2015.

C. NFPA 70 - National Electrical Code; 2017.

1.04 SUBMITTALS

A. Refer to Section 22 0510 - General Plumbing Requirements for submittal procedures.

B. Product Data:
   1. Provide dimension drawings of water heaters indicating components and connections to other equipment and piping.
   2. Indicate pump type, capacity, power requirements.
   3. Provide certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable.
   4. Provide electrical characteristics and connection requirements.

C. Operation and Maintenance Data: Include operation, maintenance, and inspection data, replacement part numbers and availability, and service depot location and telephone number.

D. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

E. Certificate: Provide Manufacturer's start-up certificate certifying the unit is installed in accordance with the manufacturer's recommendations.

1.05 QUALITY ASSURANCE

A. Products specified this section to be installed in a potable water system anticipated for human consumption shall be in compliance with the amended Safe Drinking Water Act S.3874, to reduce lead in drinking water. "Reduction of Lead in Drinking Water Act". 0.25% allowable lead content.

B. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

C. Identification: Provide pumps with manufacturer's name, model number, and rating/capacity identified by permanently attached label.

D. Standards: Ensure products and installation of specified products are in conformance with recommendations and requirements of the following organizations:
   1. American Society of Mechanical Engineers (ASME).
   2. National Electrical Manufacturers' Association (NEMA).
   3. Underwriters Laboratories (UL).

E. Performance: Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, operate within 25 percent of midpoint of published maximum efficiency curve.

1.06 CERTIFICATIONS

A. Water Heaters: NSF approved.

B. Electric Water Heaters: UL listed and labeled to UL 1453.

C. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

1.08 WARRANTY

A. Provide warranties from date of Final Completion.

B. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

C. Provide five year manufacturer warranty for domestic water heaters.

PART 2 PRODUCTS

2.01 COMMERCIAL ELECTRIC WATER HEATERS

A. STORAGE TYPE WATER HEATER (WH-1)
   1. Manufacturers:
      a. A.O. Smith
      b. Bradford White
      c. Lochinvar
   2. Type: Automatic, electric, vertical storage, Tall
   3. Performance: (WH-1)
      a. Storage capacity: 50 gal.
      b. Heating element size: 3 kW
      c. Number of heating elements: 3
      d. Minimum recovery rate: 37 gph with 100 degrees F temperature rise.
      e. Maximum working pressure: 150 psig.
   4. Electrical Characteristics:
      a. See Electrical. Three Phase Non-Simultaneous
   5. Tank: Glass lined welded steel, thermally insulated with foam insulation; encased in corrosion-resistant steel jacket; baked-on enamel finish.
   6. Controls: Automatic water thermostat with externally adjustable temperature range from 110 to 170 degrees F for single element, medium watt density zinc plated copper elements. Factory installed manual reset high temperature cutoff and factory installed junction box where required.
   7. Accessories: Provide:
      a. Top Water Connections: Brass.
      b. Dip tube: Brass.
      c. Drain Valve.
      d. Anode: Magnesium
      e. ASME Rated Temperature and Pressure Relief Valve
      f. See detail on drawing.

B. Point - Of - Use Type Water Heater (WH-2)
   1. Manufacturers:
      a. Eemax
      b. Precision
      c. A.O. Smith
   2. Type: Self- contained, wall hung assembly encased in aluminum housing, with nichrome heater elements. Assembly provided with faucet flow controls.

3. Performance:
    a. Heating element size: 3.5 kW
    b. Flow rate/temperature rise 0.5 gpm / 48 degree F.
4. Electrical Characteristics:
    a. 120 Volt single phase

2.02 TIME CLOCKS

A. Manufacturers:
1. Honeywell; Model ST7009
2. Intermatic; Model FM1D50

B. Electronic Programmable Timer with universal 24-hour or 7-day programming. Multiple on-off daily programs, holiday programming, day savings time changeover, and 7 day battery reserve. LCD display with manual 3 way override.

C. Clock programmed to turn circulation pump off at 8:00PM and turn on at 6:00AM seven days of the week.

2.03 THERMAL EXPANSION TANKS

A. Manufacturers:
1. Amtrol Inc
2. ITT Bell & Gossett
3. Taco, Inc
4. Watts;
5. Zilmet;

B. Construction: Welded steel, tested and stamped in accordance with ASME BPVC-VIII-1; supplied with National Board Form U-1, rated for working pressure of 125 psig, with heavy duty butyl diaphragm sealed into tank, and steel legs or saddles.

C. Accessories: Pressure gage and air-charging fitting with purge valve, tank drain; precharge to 55 psig.

2.04 PUMPS

A. IN-LINE CIRCULATOR PUMPS
1. Included with Thermostatic Mixing Valve Assembly; Refer to Specification Section 22 1006.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install plumbing equipment in accordance with manufacturer's instructions, as required by code, and complying with conditions of certification, if any.

B. Provide dielectric unions between the distribution piping and the cold and hot water connection piping provided with the water heater.

C. Coordinate with plumbing piping and related electrical work to achieve operating system.

D. Domestic Water Heaters:
1. Install water heater on concrete housekeeping base, sized minimum 4 inches larger than heater base. Refer to Section 22 0510.
2. Pipe relief valves to floor.
3. Pipe drains to nearest floor drain.
4. Provide piping connections and accessories as indicated.
5. Install circulator and blenders as detailed on Drawings.
6. Provide for connection to electrical service. Refer to Section 26 2717.

E. Pumps:
1. Provide line sized isolating valve and strainer on suction and line sized soft seated check valve and balancing valve on discharge.

2. Decrease from line size with long radius reducing elbows or reducers. Support piping adjacent to pump such that no weight is carried on pump casings. Provide supports under elbows on pump suction and discharge line sizes 4 inches and over.
3. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

3.02 STARTING EQUIPMENT.

A. Provide start-up certificate for water heater.

END OF SECTION

SECTION 22 4010
PLUMBING FIXTURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Water closets (WC)

B. Urinals (UR)

C. Wall Hung Lavatories (LV)

D. Counter Mounted Lavatories (LV)

E. Sinks (SK)

F. Mop Basins (MB)

G. Ice Maker Supply Box (IB)

H. Electric Water Coolers (EWC)

I. Plumbing Fixtures' Fittings, Accessories, and Supplies

1.02 RELATED SECTIONS

A. Section 01 3000 - Administrative Requirements for submittal procedures

B. Section 07 9200 - Joint Sealants: Seal fixtures to walls and floors.

C. Section 22 0510 - General Plumbing Requirements

D. Section 26 2717 - Equipment Wiring.

1.03 REFERENCES

A. NSF/ANSI 372 - American National Standard for procedures in evaluating product compliance with the 0.25% maximum weighted average lead content requirement.

B. ARI 1010 - Self-Contained, Mechanically-Refrigerated Drinking-Water Coolers; Air-Conditioning and Refrigeration Institute; 1994.

C. ASME A112.6.1M - Supports for Off-the-Floor Plumbing Fixtures for Public Use; The American Society of Mechanical Engineers; 1997.

D. ASME A112.18.1 - Plumbing Fixture Fittings; The American Society of Mechanical Engineers; 2000.

E. ASME A112.19.2M - Vitreous China Plumbing Fixtures; The American Society of Mechanical Engineers; 1998.

F. ASME A112.19.5 - Trim for Water-Closet Bowls, Tanks and Urinals; The American Society of Mechanical Engineers; 1999.

1.04 SUBMITTALS

A. Refer to Section 01 3000 - Administrative Requirements for submittal procedures

B. Refer to Section 22 0510 - General Plumbing Requirements for submittal procedures.

C. Product Data: Provide catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.

D. Manufacturer's Instructions: Indicate installation methods and procedures.

E. Maintenance Data: Include fixture trim exploded view and replacement parts lists.

F. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Products specified this section to be installed in a potable water system anticipated for human consumption shall be in compliance with the amended Safe Drinking Water Act S.3874, to

reduce lead in drinking water. "Reduction of Lead in Drinking Water Act". 0.25% allowable lead content.

B. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.06 REGULATORY REQUIREMENTS

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.07 DELIVERY, STORAGE, AND PROTECTION

A. Accept fixtures on site in factory packaging. Inspect for damage.

B. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

1.08 WARRANTY

A. See Section 01 7700 - Closeout Procedures for additional submittal and warranty

B. Provide five year manufacturer warranty for electric water cooler from Final Observation.

PART 2 PRODUCTS

2.01 FLUSH VALVE WATER CLOSETS

A. FIXTURE 'WC1'; WATER CLOSET (FM, FV (1.28 gpf), STD)
   1. Bowl:
      a. Manufacturers:
         1) American Standard Inc: Model 2234.001
         2) Crane Plumbing: Model 3325
         3) Kohler Company: Model K-4406
         4) Toto: Model CT705EN
         5) Sloan: Model ST-2000-A-1.28
         6) Zurn: Model Z5655
      b. ASME A112.19.2M; 1.28 gpf, floor mounted vitreous china closet bowl with elongated rim, 1-1/2 inch top spud, china bolt caps; standard accessible.
   2. Fixture Accessories:
      a. Seat: Type 1St; See SEATS.
      b. Flush Valve (1.28gpf): Type 10FV; See FLUSH VALVES.

B. FIXTURE 'WC2'; WATER CLOSET (FM, FV(1.28 gpf), ADA)
   1. Bowl:
      a. Manufacturers:
         1) American Standard Inc: Model 3043.001
         2) Crane Plumbing: Model 3H701
         3) Kohler Company: Model K-4405
         4) Toto: Model CT705ELN
         5) Sloan: Model ST-2020-A-1.28
         6) Zurn: Model Z5665
      b. ASME A112.19.2M; 1.28 gpf, floor mounted vitreous china closet bowl with elongated rim, 1-1/2 inch top spud, china bolt caps; disabled accessible.
   2. Fixture Accessories:
      a. Seat: Type 1St; See SEATS.
      b. Flush Valve (1.28gpf): Type 10FV; See FLUSH VALVES.

2.02 URINALS

A. FIXTURE 'UR1'; URINAL (WH, FV (0.5 gpf), ADA)
   1. Urinal:
      a. Manufacturers:
         1) American Standard Inc; Model 6590.001

2) Sloan; Model SU-1009-0.5
3) Zurn; Model Z-5750
4) Toto; Model UT447E
5) Kohler Company; Model K-4904-ET
6) Crane Plumbing; Model 7399

b. ASME A112.19.2M; 0.5gpf, vitreous china, wall hung wash-out urinal fixture with integral trap, 3/4" top spud, disabled accessible.

2. Flush Valve (0.5gpf): Type 16FV.
3. Urinal Carrier: See CARRIERS.

2.03 WALL HUNG LAVATORIES

A. FIXTURE 'LV1'; LAVATORY (WH, VC, ADA)
1. Lavatory Basin:
a. Manufacturers:
1) American Standard; Model 0355.012
2) Crane; Model 1-412-V
3) Kohler; Model K-2005
4) Sloan; Model SS-3003
5) Toto; Model LT307.4
6) Zurn; Model Z5344

b. ASME A112.19.2M; vitreous china, wall hung, 21" x 18" fixture with drillings on 4-inch centers, front overflow, soap depression, drilled for concealed arm carrier, disabled accessible.

2. Accessories:
a. Faucet: Type 4bF; See FAUCETS
b. Drain: Type 2D; See DRAINS.
c. Supplies: See SUPPLY STOPS.
d. Trap: Type 1T; See TRAPS.
e. Carrier: See CARRIERS; Concealed Arm Type.
f. Insulation: See FIXTURE INSULATION.

2.04 COUNTER MOUNTED LAVATORIES

A. FIXTURE 'LV2'; LAVATORY (CT, VC, ADA)
1. Lavatory Basin:
a. Manufacturers:
1) American Standard; Model 0476.028
2) Crane; Model 1280V
3) Kohler; Model K-2196-4
4) Sloan; Model SS-3002
5) Toto; Model LT501.4
6) Zurn; Model Z5114

b. ASME A112.19.2M; counter mounted, vitreous china, 20" x 17" oval with drillings on 4-inch centers, front overflow, soap depression, disabled accessible.

2. Accessories:
a. Faucet: Type 4bF; See FAUCETS.
b. Drain: Type 2D; See DRAINS.
c. Supplies: See SUPPLY STOPS.
d. Trap: Type 1T; See TRAPS.
e. Insulation: See FIXTURE INSULATION.

B. FIXTURE 'LV3'; LAVATORY (CT, VC, ADA)
1. Lavatory Basin:
a. Manufacturers:
1) American Standard; Model 0497.221
2) Crane; Model 1981

3) Kohler; Model K-2211
4) Toto; Model LT501.8
5) Zurn; Model Z5118

b. ASME A112.19.2M; undercounter mounted, vitreous china, front overflow, disabled accessible.

2. Accessories:
a. Faucet: Type 4bF; See FAUCETS.
b. Drain: Type 2D; See DRAINS.
c. Supplies: See SUPPLY STOPS.
d. Trap: Type 1T; See TRAPS.
e. Insulation: See FIXTURE INSULATION.

2.05 COUNTER MOUNTED SINKS

A. FIXTURE 'SK1'; SINK (SS, CT, 33" x 22" DC, ADA)
1. Sink:
a. Manufacturers:
1) Elkay; Model LRAD-3322
2) Just; Model DL-ADA-2233-A-GR
3) Advance-Tabco; Model SS-2-3322-ADA

b. ASME A112.19.3M; 18 gauge, type 304 stainless steel, double compartment 33 x 22 x 6.5 -inches overall with 4 -hole drilling for faucet, two 3-inch drain openings.

2. Accessories:
a. Faucet: Type 8F; See FAUCETS.
b. Drain: Type 4D; See DRAINS. 2 Required.
c. Supplies: Type SS5. See SUPPLIES.
d. Trap: Type 2T; See TRAPS.
e. Cont. Drain: Type 7D; See DRAINS.
f. Insulation: See FIXTURE INSULATION.

2.06 MOP BASINS and SERVICE SINKS

A. FIXTURE 'MB1; MOP BASIN (FM, 36" x 24" x 10")
1. Mop Basin:
a. Manufacturers:
1) Aquaglass; Model AM-3624
2) Fiat; Model MSB-3624
3) Stern-Williams; Model MTB-3624
4) Zurn; Model Z1996-36

b. ASME A112.19.1M one piece homogenous molded basin, 36" x 24" x 10" overall, white, with integral stainless steel grate with quick connect drain.

2. Accessories:
a. Faucet: Type 11F; See FAUCETS.
b. Hose & Bracket: Type 12F; See FAUCETS.

2.07 MISCELLANEOUS FIXTURES

A. FIXTURE 'IB1'; ICEMAKER SUPPLY BOX
1. Icemaker Box Assembly
a. Manufacturers:
1) Guy-Gray; Model BIM 875AB
2) Water-Tite; Model AB9700

b. 20-gauge steel with powder-coated white finish or polystyrene plastic; 1/2"-inch FIP inlet by 1/4"-inch outlet compression angle valve with 1/2"-inch MPT connection. Angle valve to be low-lead to comply with NSF-61.

2.08 ELECTRIC WATER COOLERS

A. FIXTURE 'EWC1'; ELECTRIC WATER COOLER (HI-LO w/Bottle Filling Station)

1. Water Cooler
   a. Manufacturers:
      1) Elkay; Model LZSTL8WSLK
      2) Haws; Model
      3) Halsey-Taylor; Model
      4) Oasis; Model P8SBFSL
   b. ARI-1010; Bi-level, with ADA unit on the right, wall mounted electric water cooler assembly with stainless steel water surfaces, heavy duty galvanized steel wall mounting frame, 'sandstone' paint or vinyl finish cabinet, elevated anti-squirt bubblers with stream guard, automatic stream regulators; front and side push button actuators; high efficiency cooling tank and air cooled coil delivering 8.0 gph 50-degree water at 90-degree ambient air temperature; with ADA compliant bottle filling station. Bottle filling station to have no touch sensor activation with 30 second shut-off timer, filter, and 1.1 gpm flow rate.
2. Accessories:
   a. Supply: See SUPPLY STOPS
   b. Trap: Type 1T; See TRAPS
   c. Carriers: See CARRIERS

2.09 FIXTURE ACCESSORIES

A. FLUSH VALVES
1. Type 10FV (Standard & ADA Electronic Water Closet Valve- Diaphragm Type)
   a. Manufacturers:
      1) Sloan; Regal Optima 111-1.28-SMO-YBYC-YK-XL
      2) Zurn 'Aqua Vantage-Aqua Sense'; Model ZER6000AV-HET-CPM-YK
   b. ASME A112.18.1; Exposed chrome plated diaphragm type with 6VDC-4AA battery powered infrared sensor operated flush valve with heavy duty cast escutcheon with set screw, integral screwdriver stop, vacuum breaker; 1 1/2 inch top spud, 11 1/2-inches high; 1 solid-ring support; 1.28gpf maximum flush.
2. Type 16FV (Standard & ADA Electronic Urinal Valve- Diaphragm Type)
   a. Manufacturers:
      1) Sloan; Regal Optima 186-0.5-SMO-YBYC-YK-XL
      2) Zurn 'Aqua Vantage-Aqua Sense'; Model ZER6003AV-WWS-CPM-YK
   b. ASME A112.18.1; Exposed chrome plated diaphragm type with 6VDC-4AA battery powered infrared sensor operated flush valve with heavy duty cast escutcheon with set screw, integral screwdriver stop, vacuum breaker; 3/4 inch top spud, 11 1/2-inches high; 1 solid-ring support; 0.5gpf maximum flush.

B. SEATS
1. Type 1St.; Seat (Elongated, open front, less lid, white)
   a. Manufacturers:
      1) Bemis; Model 1655SSC
      2) Plumbtech; Model 431SSC
      3) Kohler; Model K-4666-S-C
      4) Church; Model 9500SSC
      5) Centoco; Model 1500 series
      6) Zurn; Model Z-5955-SS-EL
   b. Extra heavy weight, injection molded solid plastic, open-front, less lid, molded bumpers, external check hinges and stainless steel posts.

C. FAUCETS
1. Type 4bF (Electronic with standard spout - Lavatories w/ 4" centers)
   a. Manufacturers:
      1) American Standard; Model 6055.205 w/ 605XTMV and 605P.400
      2) Delta; Model 590T1250 w/ R3070-MIXLF
      3) Speakman; Model S-8711-BO w/G20-1968

4) Symmons; Model S-6080-0.5 w/S-210-CK
5) Zurn; Model Z6913-XL-TMV-CP4
6) Toto; Model TEL5DAC-10
7) Sloan; SF-2450-4 w/MIX-135
8) T&S Brass; EC-3102-VF05-TMV-013434-40

b. ASME A112.18.1M; Chrome plated brass electronic supply fitting with integral thermostatic mixing valve, Battery powered solenoid operator and infrared sensor, laminar flow spout end, 0.5 gpm; less cover plate; less grid drain.

2. Type 8F (8-inch spread single lever w/spray - Sinks)
   a. Manufacturers:
      1) American Standard; Model 4205.001
      2) Delta; Model 400LF-HDF
      3) Elkay; Model LK-4101-F
      4) Encore; Model KN81-2010-TE1
      5) Just; Model J-901
      6) Kohler; Model K-15072-CP
      7) Speakman; Model S-3762-HS
      8) T&S Brass; Model B-2730
      9) Zurn; Model Z82300-XL-CP8-HS
   b. ASME A112.18.1M; Chrome plated brass double service, 8-inch widespread, single lever w/hose spray, swivel spout with laminar flow spout end; 1.5 gpm.
3. Type 11F (w/ integral check stops and vacuum breaker - Mop Basin)
   a. Manufacturers:
      1) American Standard; Model 8354.112.004
      2) Delta; Model 28C8183
      3) Speakman; Model SC-5812-RCP-CK
      4) Symmons; S-2490
      5) T&S Brass; B-0665-BSTR
      6) Zurn; Model Z843M1--XL-CS
   b. ASME A112.18.1M; Rough Chrome plated brass exposed yoke wall-mount utility faucet assembly with integral stops and vacuum breaker, bucket hook, and threaded hose end, rough chrome finish.
4. Type 12F (Mop Basin Hose and Bracket)
   a. Manufacturers:
      1) Acorn-Terrazzo; Model KH36
      2) Aquaglass AT-2452
      3) Fiat 832-AA
      4) Stern-Williams T-35
      5) Zurn; Model Z-1996 HH

D. DRAINS
1. Type 2D (Flat grid off-set drain - Lavatories)
   a. Manufacturers:
      1) Dearborn; Model 760W
      2) EBC; Model SG7WC
      3) Kohler; Model K-13885
      4) McGuire; Model 155-WC
      5) Sanitary-Dash; Model R7308
      6) Zurn; Model Z-8746
   b. ASME A112.18.1M; 1 1/4" inch diameter chrome plated brass flat grid type drain with offset 17-gauge tailpiece.
2. Type 4D (Basket off-set drain - Sinks)
   a. Manufacturers:
      1) EBC; Model SB8CWC
      2) Elkay; Model LKAD-35

3) Just; Model J-ADA-35
4) McGuire; Model 1151AWC
5) Zurn; Model Z-8749

b. ASME A112.18.1M; 1 1/2" inch diameter chrome plated brass removable stainless steel strainer/drain assembly with offset 20-gauge tailpiece.

3. Type 7D (Continuous Drain - 1 1/2"-inch)
   a. Manufacturers:
      1) EBC; Model WE-150L Series
      2) Elkay; Model LK35
      3) Just; Model J-53-S
      4) McGuire; Model 111C16G Series
      5) Zurn; Model Z-8750 Series
   b. ASME A112.18.1M; 1 1/2" inch diameter chrome plated brass, 17-gauge drain assembly for double compartment sinks, complete with slip fit connections.

E. SUPPLY STOPS
   1. Type SS5 (3/8"-inch, 1/4 turn; Loose Key; Lavatories/Sinks/Electric Water Coolers)
      a. Manufacturers:
         1) Brasscraft; Model KTSR17XC
         2) Chicago; Model 1006-MMABCP
         3) McGuire; Model LFHST02LK
         4) Zurn; Model ZH8822-XL-LR-LK-PC
      b. ASME A112.18.1M; Chrome plated brass angle heavy duty stop or ball stop, removable actuator key; supply tubing and escutcheon plate.

F. TRAPS
   1. Type 1T (1 1/4"-inch Adj. 'P')
      a. Manufacturers:
         1) EBC; Model TA-125-CF
         2) Dearborn; Model 707 DFBN
         3) Kohler; Model K-9000
         4) McGuire; Model 8872
         5) Zurn; Model Z-8700
      b. ASME A112.18.1M; Chrome plated cast brass, 17-gauge P-trap assembly with cast brass nuts, cleanout plug and heavy duty escutcheon.
   2. Type 2T (1 1/2"-inch Adj. 'P')
      a. Manufacturers:
         1) EBC; Model TA-150-CF
         2) Dearborn; Model 710 GDFBN
         3) Kohler; Model K-9000
         4) McGuire; Model 8912
         5) Zurn; Model Z-8702
      b. ASME A112.18.1M; Chrome plated cast brass, 17-gauge P-trap assembly with cast brass nuts, cleanout plug and heavy duty escutcheon.

G. CARRIERS
   1. Urinals
      a. Type C9
         1) Manufacturers:
            (a) Josam; Model 17800-63
            (b) JR Smith; Model 636
            (c) Mifab; Model MC-31
            (d) Wade; Model W-400-M36
            (e) Watts; Model CA-311-Std.
            (f) Zurn; Model Z-1221
   2. Lavatories

a. Type C10 'Single'
1) Manufacturers:
(a) Josam; Model 17100-63
(b) JR Smith; Model 700-M31
(c) Mifab; Model MC-41
(d) Wade; Model 520-36
(e) Watts; Model CA-411-Std.
(f) Zurn; Model Z-1231-D

3. Electric Water Coolers
a. Type C13 'Bi-Level'
1) Manufacturers:
(a) Josam; Model 17560-WCBL
(b) JR Smith; Model 834LR-M31
(c) Mifab; Model MC-33
(d) Wade; Model 440
(e) Watts; Model CA-431-1
(f) Zurn; Model ZR-1225-BL

4. Carrier Notes:
a. Carriers shall be manufactured in accordance with ASME A112.18.2 standards.
b. All carriers shall be bolted to the floor with lag bolts.
c. All lavatory, urinal and water cooler supports shall have heavy duty rectangular supports.
d. Carriers shall be provided where fixture is mounted on chase wall or mechanical room wall.

H. FIXTURE INSULATION
1. Manufacturers:
a. EBC; Model IK Series
b. McGuire; Model 'Pro-Wrap' Series
c. Plumberex; Model Pro Extreme Series
d. Proflo; Model PF200 Series
e. True-Bro; Model 'Lav Guard' Series
f. Zurn; Model 'Trap Wrap' Series
2. Insulation assembly shall be for supply stops & tubing; drains (including off-sets) and P-traps under all ADA lavatories and counter sinks.
3. ANSI A117.1, ADA4.19.4; Fully molded, anti-bacterial flexible vinyl insulation assembly, minimum 1/8"-inch wall thickness, white in color, self-extinguishing meeting ASTM D635, and have a K-value of 1.17.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that walls and floor finishes are prepared and ready for installation of fixtures.

B. Verify that electric power is available and of the correct characteristics.

C. Confirm that millwork is constructed with adequate provision for the installation of counter top lavatories and sinks.

3.02 PREPARATION

A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

3.03 INSTALLATION

A. Install each fixture with trap, easily removable for servicing and cleaning.

B. Provide chrome plated rigid or flexible supplies to fixtures with loose key stops, reducers, and escutcheons, as specified in Fixture Accessories.

C. Install components level and plumb.

D. Install and secure fixtures in place with wall supports and bolts.

E. Seal wall and floor mounted fixtures to wall and floor surfaces with silicon latex tile grout. Joints shall be finished smooth and flush, not depressed. Color to match fixture.

F. Solidly attach water closets to closet flange with solid brass bolts, washers and nuts. Provide wax ring sealant on closet flange. Lead flashing shall not be used.

G. Pipe runout from urinal to waste stack shall be Brass or Schedule 40 PVC piping. Copper piping shall not be used.

3.04 INTERFACE WITH WORK OF OTHER SECTIONS

A. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

3.05 ADJUSTING

A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

3.06 CLEANING AND PROTECTION

A. Clean plumbing fixtures and equipment.

B. Do not permit use of fixtures.

3.07 SCHEDULES

A. Refer to Fixture Schedule on plans for mounting heights and piping connections.

END OF SECTION

SECTION 23 0510
GENERAL MECHANICAL REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Definitions.
B. Quality Assurance Requirements and Installer Qualifications.
C. General Product Delivery and Storage.
D. Installer Warranty.
E. Submittal Procedures Supplementing Section 01 3000.
F. Operating and Maintenance Manuals.
G. Execution Requirements common to Division 23 systems.
H. Pipe Sleeves within building.
I. Pipe Sleeves in footings and foundations.
J. Space Conditioning during Construction.
K. Piping Pressure Tests.
L. Equipment Bases and Housekeeping Pads.
M. Equipment backboards.
N. Starting equipment and Systems-General Requirements.
O. Training Requirements.
P. Cleaning Requirements.
Q. Finishing Requirements.

1.02 RELATED SECTIONS

A. Section 01 3300 - Submittal Procedures, for submittal procedures.
B. Section 01 7000 - Execution Requirements, for additional submittal and warranty requirements.
C. Section 03 3000 - Cast-in-Place Concrete.
D. Section 07 8413 - Penetration Firestopping.
E. Section 9200 - Joint Sealants.
F. Section 09900 - Painting and Coatings.

1.03 DEFINITIONS

A. Manufacturer's Representatives: Wherever MANUFACTURER'S REPRESENTATIVE is referred to in this division, said representative shall be regularly employed by the manufacturer to perform similar activities to those called for herein, which indicates his competence in that field of work.
B. Concealed: Where the word concealed is used in this Division, it shall mean items above ceilings, in attics, in crawl spaces, in chases, in tunnels, in cabinet work, and under counters or equipment so as to be not visible from an elevation of 5 feet at a horizontal distance of 10 feet.
C. Finished Spaces or Areas: Where finished spaces or areas are referred to in this Division, it shall mean all spaces except concealed spaces, mechanical rooms, or boiler rooms unless otherwise noted.
D. Provide: Furnish and install.
E. Control and Interlock Wiring: All wiring, both line voltage and low voltage, other than power wiring from an electrical distribution panel, through the primary control device, to the item of equipment.

F. Primary Control Device: That ONE device for any item of equipment which interrupts power flow during normal operation. Where magnetic starters are provided, they are the primary control. For items not switches by starters, the primary control device will be that ONE thermostat, time clock, manual switch, aquastat, P.E. switch, or relay performing the primary switching.

G. Diagrammatic: A drawing that shows arrangement and relations (as of parts).i.e.: A diagrammatic drawing uses symbols rather than pictorial representation of pipes, ducts, conduit and other items shown and is not necessarily to scale. Arrangement, location, and sizes shown are firm.

H. Readily Accessible: Items requiring maintenance shall be available for close approach for maintenance or use in a space, through an access door from floor elevation, or above a lay-in ceiling though an access point by maintenance staff safely standing on a ladder no taller than the ceiling.

I. Noted, Indicated or Shown: Where the terms "Noted", "Indicated" or "Shown" are used in these specifications, the words "in the specifications or on the plans" shall be inferred.

J. Detail: Where reference is made to a Detail, the Detail shall be on the plans unless otherwise noted.

K. Specifications: Where reference is made to these specifications, it shall be inferred in this Division of specifications.

L. Notification by the Contractor, and Instructions to the Contractor: Where reference is made in these specifications to notification by or instructions given to the Contractor, it shall be inferred that Architect shall be the instructor or shall be notified, as the case exists.

M. Division or Section Reference: Where reference is made to another Division or Section within this Division, refer to specifications table of contents for Division, Section, or Page Number.

N. Flow Diagram: A single-line, two-dimension, non-scaled drawing depicting arrangement and sequence of equipment, valves, controls, thermometers, gauges, and other specialty devices in a pipe or duct system.

1.04 REGULATORY REQUIREMENTS

A. Where requirements of these specifications exceed specified codes and ordinances, conform to these specifications.

B. Materials and equipment included in Underwriters Label Service shall bear that label. Electrical equipment shall be U.L. approved as installed.

C. Permits and Codes: Refer to the General Conditions.

D. Fire Prevention Precautions in Cutting and Welding Areas: Conform to Article 2605 Fire Prevention Precautions, Georgia State Minimum Standard Fire Prevention Code (International Fire Code), 2012 Edition, with all Georgia State Amendments, for all work involving cutting and welding.

E. HVAC: Conform to the Georgia State Minimum Standard Mechanical Code, International Mechanical Code, 2012 Edition with all Georgia State Amendments.

F. Energy: Conform to the Georgia State Energy Code for Buildings, International Energy Conservation Code, 2009 Edition, with all Georgia State Amendments.

G. All Work: Conform to State of Georgia Chapter 120-3-3 "Rules of Safety Fire Commissioner, Rules and Regulations, January 30, 2014", and ADA.

H. Electrical: Refer to Division 26. Conform to the National Electrical Code, NFPA 70, 2014 Edition.

I. Building Code: Conform to the Georgia State Minimum Standard Building Code, International Building Code, 2012 Edition with all Georgia State Amendments.

1.05 SUBMITTALS

A. Supplementing Division 1 Administrative Requirements; Contractor shall:

1. Identify all submittals by a cover sheet showing project name, specification section, drawing or detail number, room number, date, revision date, contractor and subcontractor's organization and project manager with phone number, the model, style and size of item being submitted with manufacturers' representative, salesman (or a preparer who can answer questions), and Preparer's phone number.
2. Prepare a master list of submittal proposed to be submitted on the project. This list shall be updated for each submission and shall be the first sheet(s) of the submission in the quantity that is submitted for review. The information and general format of the master list shall contain a Specification Section, Section Title, Item Description, Item Status and any comment.
3. Review the submittal data and check to ensure compliance with specifications prior to submitting.
    a. The Contractor agrees that submittals of equipment and material and shop drawings of equipment and material layouts required under provisions of these specifications and processed by the Design Professional are not Change Orders. The purpose of submittals is to demonstrate that the Contractor understands the design concept of the project by indicating the equipment and materials he intends to furnish and install, and by detailing the installation he intends to achieve.
    b. The Contractor shall conform to the requirements of the Contract Documents unless a change order is issued. The Contractor shall identify on each submittal that the submittal contains no deviations or the Contractor shall identify any proposed deviations.
    c. Any submittal or shop drawing not conforming to the Contract Documents without this identification and notification shall be assumed to be marked "Revise and Resubmit" (the contractor acknowledges this by the submission), and the Contractor shall promptly resubmit said submittal so as to be in full compliance with the Contract Documents.
    d. Failure of the Contractor to provide this information during the shop drawing phase shall make the Contractor responsible for all changes to achieve compliance with the Contract Documents without additional compensation.
4. Provide a Letter from the HVAC Contractor stating that they have checked all submittals for compliance with specifications.
5. Product Data:
    a. Provide data specific to the product proposed indicating capacity data, all standard and optional features to be supplied and all accessories and options available for that product.
    b. Manufacturers' standard drawings shall be modified by deletions or additions to show only items applicable to this project.

B. Deliver submittals to Architect at the business address.

C. Digital Delivery of Submittals:
1. Submittal data may be posted to the NBP Engineers FTP site when agreed upon by Architect and Owner during the preconstruction phase. The Contractor will be provided with a project folder and a password.
2. Prepare the submittals as described above. Take steps to reduce submittal file size.
3. Do not scan in color or high resolution unless required for clarity.
4. Optimize any scans to help control file size.
5. Ensure any reproductions are legible.
6. Organize Submittal files individually by specification section with file name format as Follows; "*CSISection# - Section Title* - any further identifier required such as *control drawings*"
7. Send an email to submittal@nbpengineers.com with a copy to the HVAC Design Professional and any Architectural Design Professional identified during the preconstruction phase.

8. Identify the submittal using the official project title, specification section and submitted item. i.e. Project No. G-xxx, Addition to Administrative Building-Section 230548-Vibration and Seismic Controls. Include drawing or detail number, room number, date, revision date(s), contractor and subcontractor's organization as applicable
9. Include the project manager's and manufacturers' representatives, salesman's (or a preparer who can answer questions) contact information, email and phone number.
10. Identify the submittal in the email subject line using the same information listed above.
11. Provide a submittal index.
12. Ensure any submittal posted to NBP's or other FTP site has the same identification.
13. NBP Design Professionals will not process or react to submittals which are not properly transmitted, indexed, and identified.

D. Tabulation of Power Wiring Requirements: Within 60 Days of the Notice to Proceed, provide a Tabulation of Power Wiring Requirements of all proposed equipment, including H.P., amps, voltage, phase and KW, tabulated on a separate sheet. A copy of the tabulation shall be transmitted independently to the Contractor, Architect and to all affected trades. (Refer to Electrical Drawings for electrical provisions for equipment.)

E. Warranty: Submit the HVAC installer's warranty letter addressed to Owner stating the correct project name and number, if applicable, the warranty period and ensure that form has the correct date of the Material Completion.

1.06 OPERATING AND MAINTENANCE MANUALS

A. Operating and Maintenance Manuals shall be prepared by Contractor for all equipment and be submitted for review a minimum of prior to the request for Material Completion.

B. Digital delivery of Operating and Maintenance Manuals:
1. Operating and Maintenance Manuals may be delivered digitally and posted to the NBP Engineers FTP site when agreed upon by the Design Professional and the Owner during the preconstruction phase. The Contractor will be provided with a project folder and password.
2. Prepare the Operating and Maintenance Manuals as described above. Take steps to reduce submittal file size.
3. Do not scan in color or high resolution unless required for clarity.
4. Ensure any reproductions are legible.
5. Send an email to submittal@nbpengineers.com with a copy to the HVAC Design Professional and the Architectural Design Professional identified during the preconstruction phase.
6. Identify the manuals in the email subject line using the official project title, specification section and submitted item. I.E. Project No. G-xxx, Addition to Administrative Building.
7. Table of Contents(Index) sheets shall be included in the order listed with identifications typed in capital letters.
8. Ensure the manuals posted to the FTP site has the same identification.
9. NBP Design Professionals will not process or react to manuals which are not properly transmitted, indexed, and identified.

C. Each Manual shall contain the following information, data and drawings:
1. Copies of submittals (with Design Professional's review comments and stamp), equipment and materials.
2. Manufacturer's installation, operating and maintenance instructions for each item of equipment with moving parts including recommended frequency of inspections and maintenance for one year of facility operation.
3. Manufacturer's list of renewal parts for each item of equipment with recommended stock items and quantities indicated.
4. Control diagrams, electrical interlock diagrams, and control valve lists.
5. Copies of as-built shop drawings showing layouts and construction details.
6. Copies of Test and Balance Reports including list of instruments and description of methods employed.

1.07 QUALITY ASSURANCE

A. HVAC Installer Qualifications:
   1. Wherever the word "company" or "firm" is used in these subparagraphs, it shall mean the contractor/subcontractor of record for the installations used for proficiency qualification.
   2. Refer to the individual sections within this division for additional installer qualification requirements.
   3. The Contractor expressly warrants that the company performing the installation of the air conditioning systems has demonstrated proficiency in the installation, start-up and adjustment of such systems by the successful performance of work of the nature specified herein on at least three commercial or institutional buildings, each containing minimum of 100 tons capacity or greater with ducted air distribution and chilled water, PTAC or wall hung units excluded.
   4. The Contractor further warrants that the aforesaid subcontractor, if any, has trained personnel, instruments, tools, and equipment to perform the installation, start-up, instruction and maintenance service specified.
   5. The Contractor also warrants that the aforesaid installer, if any, has been in business performing services of the nature specified herein for at least five years.

B. Testing and Balancing Qualifications: Refer to Section 23 0593.

1.08 WARRANTY

A. Refer to Section 01 7000 - Contract Closeout, for additional warranty requirements.

B. Submit manufacturers' warranties prior to final inspection. Refer to the General Conditions.

C. Correct any defective Work within a one year period after Date of Material Completion. Provide HVAC Installer's warranty letter dated the date of the Material Completion

D. Where warranties beyond Contractor's one (1) year warranty are specified, the additional warranty time shall start on the same date as Contractor's warranty.

PART 2 PRODUCTS-NOT USED

PART 3 EXECUTION

3.01 EXAMINATION

A. Refer to the specifications and Architectural and Structural drawings for additional requirements pertaining to work under this discipline. Notify Architect for clarification in the event of conflict.

B. All materials of systems installation exposed in hollow spaces that are used as ducts or plenums shall have a flame spread rating of 25 or less and a smoke development rating of 50 or less.

3.02 PREPARATION

A. Drawings are diagrammatic and show the general proximity of the equipment, ducts, and pipes, etc., are not to be scaled, and do not include all required changes in direction or offsets necessary in coordinating the installation of various materials either between trades or within the same trade. All dimensions shall be verified at the building site. Prefabrication and/or installation of work from drawings shall be at Contractor's risk. Refer to Architectural plans for exact building dimensions and details.

B. Space Conditions:
   1. All apparatus shall fit into the available spaces in the building and must be introduced into the building so as not to cause damage to the structure. Equipment larger than access to equipment spaces shall be disassembled into sub-assemblies for installation.
   2. Where deviations from the plans are required in order to conform to the space limitations, such changes shall be made at no additional cost to Owner and shall be subject to approval.
   3. All equipment requiring service shall be made accessible. Coordinate piping and ductwork installation to avoid conflict with other trades.

3.03 INSTALLATION

A. Clearance above and in front of electrical switchgear, electrical power panels or control panels shall be maintained by mechanical systems so that no mechanical ducts, pipes, vents or equipment is routed above or across the space directly above this equipment in conformance with the National Electrical Code.

B. All equipment shall be installed in accordance with manufacturers' published installation instructions shipped with the equipment. In the event there is a discrepancy between these specifications or Drawings and the manufacturers' instructions, no work shall be performed until additional instructions are received.

C. Install and connect all appliances, equipment, and appurtenances as specified, indicated or required in accordance with the manufacturer's instructions and recommendations. Furnish and install complete auxiliary piping, water seals, valves, electric connections, and similar items, recommended by the manufacturer or as required for proper operation.

D. Equipment, valves and other items installed under this division requiring service shall be installed to be readily accessible. Refer to definitions in this section.

E. Coordinate with Contractor and monitor the progress of the work so that other trades do not obstruct items requiring access for service.

F. After final balancing, equipment with belt drives shall have their belts operating in the mid-80% position of the adjustable sheave.

G. Provide equipment belt and coupling guards shielding the perimeter and face of all new belt drives, shafts and couplings. Provide openings opposite drive and driven shafts to permit use of revolution counter. Guards for fans shall be supported from the fan and mounting base, independent of the floor or housekeeping pad.

H. Route piping and ductwork to avoid skylights, translucent, and transparent ceilings.

I. Pipe Sleeves in Slabs, Masonry Walls and Partitions:
   1. Provide sleeves in all slabs and walls/partitions unless otherwise noted.
   2. Omit sleeves on cast iron pipe through slabs on grade.
   3. Elevated Slabs: Schedule 40 black steel pipe: Sleeves shall be sized to include the insulation with minimum gap around insulation. Install, without developing a break in the pipe insulation, according to the fire sealant manufacturer's installation instructions for a U.L. Listed assembly for a rated pipe penetration through a slab.
   4. Masonry Partitions: Schedule 40 black steel pipe: Sleeves shall be sized to include the insulation with minimum gap around insulation. Install, without developing a break in the pipe insulation, according to the fire sealant manufacturer's installation instructions for a U.L. Listed assembly for a rated pipe penetration through a rated masonry wall/partition.
   5. Omit sleeves in openings core drilled in masonry partitions.
   6. Rated Drywall Partitions: Twenty gage galvanized steel. Sleeves shall be sized to include the insulation with minimum gap around the insulation. Install, without developing a break in the pipe insulation, according to the fire sealant manufacturer's installation instructions for a U.L. Listed assembly for a rated pipe penetration through a rated drywall wall/partition.
   7. Non-Rated Drywall Partitions: Omit sleeves.

J. Pipe sleeves in footings and foundation walls:
   1. Schedule 40 black steel pipe.
   2. Chilled water, heating water, condenser water, refrigerant, or process piping passing under a footing or through a foundation wall shall be installed in a pipe sleeve, two pipe sizes larger than the pipe passing through.
   3. Sleeves in walls to spaces below grade shall be provided with 10 gauge leak plates.

K. Seal sleeves and openings in mechanical room walls, fire rated partitions, and floors above grade vaportight, watertight, or for smoke/fire protection as applicable. Refer to Section 07 8400

L. Seal sleeves and openings in exterior walls vaportight or watertight as applicable.

M. Equipment and pipe support upper attachments shall be 3" x 3" x 1/4" steel angles, minimum, spanning structural members unless noted otherwise. Provide inserts and bolts for supporting pipes and equipment from structural members.

N. Saw cut or core drill openings in existing work for the installation of the mechanical system. Patching shall be performed by the trade whose work is cut. Contractor shall lay out and install his work ahead of the work of other trades wherever possible.

3.04 SPACE CONDITIONING DURING CONSTRUCTION

A. Coordinate with Contractor regarding the limits of space conditions specified or requested by other trade sections.

B. Assist Contractor in the preparation of the construction schedule and determine to what extent the project's HVAC system can be operated within the restrictions listed below to help maintain those conditions.

C. Ducted air handling systems shall not be placed into operation for testing or for temporary space conditioning until all walls in areas served by the system have been prepared for painting and the building is broom clean.

D. The building's HVAC system shall be kept clean during the entire construction process. Protect equipment, motor, ducts, pipes from dirt and debris.

E. Filters during construction:
   1. Provide and maintain filters on all air handling equipment and terminal units used for space conditioning during construction.
   2. Provide and maintain filters on all return air grilles once ceilings are installed when air handling equipment or terminal units are used for space conditioning during construction.
   3. Provide filters with a minimum MERV rating of 8.

F. Heating Terminal units such as unit heaters, cabinet heaters and finned radiation may be used for temporary heat during construction. Clean to new condition.

3.05 PIPING PRESSURE TESTS

A. General:
   1. Provide 48 hours notification to Architect in advance of any test.
   2. Complete tests prior to insulating.
   3. Leaks shall be repaired, defective materials replaced, and system shall be retested.
   4. Strike all joints in copper and steel piping under a pressure test.
   5. Conduct tests prior to connecting to equipment or isolate equipment from system.
   6. No water pressure test shall be conducted in freezing weather where subject to freezing.
   7. Test shall be maintained at conditions specified until approved but, in no event, for less than eight (8) hours minimum duration, unless otherwise noted.

B. Refrigerant Piping: Refer to Section 23 2300.

3.06 EQUIPMENT BASES and HOUSEKEEPING PADS

A. Provide housekeeping and equipment bases as shown or listed below. Rough up slab under bases before pouring concrete.

B. Materials: Refer to Section 03 3000 - Cast-in-Place Concrete. Omit test cylinders for concrete poured under this section.

C. Bases/Pads shall be rectangular with vertical sides 4-inches from centerline of anchor bolts or 2 inches from edges of equipment supports, whichever provides the larger dimension, side of equipment or base edge, unless otherwise noted.

D. Height:
   1. Small split system fan coil units: 4-inches
   2. Condensing Unit (7 Tons and Smaller): Concrete pad, refer to detail.

E. Chamfer: 3/4-inch on edges and corners.

F. Reinforcing: 6"x 6" 10/10 WWF at mid-depth of slab. (4 inch thick pads.)

3.07 EQUIPMENT BACKBOARDS

A. General: Provide wood backboards for installation of surface mounted control panels, enclosed motor controllers, variable frequency controllers, and where shown.

B. Type: 3/4-inch thick grade 1 fire retardant treated plywood supported by 3/4" x 3/4" x 1/8" aluminum angle frame attached to wall with 1/4-inch toggle bolts for hollow masonry, expansion shields for solid masonry.

C. Finish: Frame and board with two coats light gray enamel paint.

3.08 STARTING EQUIPMENT AND SYSTEMS

A. Adjust equipment for proper operation within manufacturers' published tolerances.

B. Demonstrate proper operation of systems and equipment to Owner 's designated representative.

3.09 DEMONSTRATION, TRAINING AND INSTRUCTIONS

A. A manufacturer's service representative shall provide the instructions for each piece of equipment on system when specified in other Sections of this Division. A manufacturer's sales representative is not acceptable. (The instructor shall not be a sales person, but shall have service experience on a continuing basis and be knowledgeable about the subject equipment.)

3.10 CLEANING and PROTECTION

A. All materials, equipment and mechanical rooms shall be cleaned prior to Material Completion.

B. Wash down and scrub clean all mechanical room floors, walls, equipment bases and equipment.

C. Paint equipment where finish has been damaged requiring retouching of finish to match factory finish.

D. All air handling equipment shall be cleaned internally prior to Material Completion. Clean unit casing externally and internally. Seal/replace all damaged duct liner.

E. Chipped or scraped paint shall be retouched to match original finish.

F. Clean and polish all equipment nameplates. All nameplate information shall be legible.

G. All dents and sags in ductwork and equipment casings shall be straightened.

H. All ductwork, insulation, equipment, pipe, pipe fittings and appurtenances shall be free of dust, rust and stains prior to Material Completion.

3.11 FINISHING EQUIPMENT AND MATERIAL

A. Use paint systems specified in Division 9 for the substrates to be finished.

B. Paint shop-primed equipment.

C. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

D. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

E. All ferrous fasteners and hanger supports not having a corrosion resistant plated finish shall be painted to prevent rust.

F. Paint all exposed un-insulated ferrous metals, flat black.

G. Paint interior surfaces of air ducts that are visible through grilles and louvers with one coat of flat black paint to visible surfaces.

END OF SECTION

SECTION 23 0513
MOTORS FOR HVAC EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Single phase electric motors.

1.02 RELATED REQUIREMENTS

A. Section 26 2717 - Equipment Wiring: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

A. NEMA MG 1 - Motors and Generators; 2014.

B. NFPA 70 - National Electrical Code, 2014 Edition; National Fire Protection Association.

1.04 QUALITY ASSURANCE

A. Conform to NFPA 70.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect motors stored on site from weather and moisture by maintaining factory covers and suitable weather-proof covering. For extended outdoor storage, remove motors from equipment and store separately.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Baldor,Century,Lincoln,Marathon,Magnetec,Toshiba

2.02 GENERAL CONSTRUCTION AND REQUIREMENTS

A. Electrical Service:
   1. Motors 1/2 HP and Smaller: 115 volts, single phase, 60 Hz.
   2. Refer to Electrical drawings for voltage and phase required.

B. Overload Protection: Single phase motors shall be furnished with built-in automatic reset overload protection.

C. Brake Horsepower: All motors shall have rated horsepower at least 10 percent above the indicated brake horsepower of equipment including belt losses and inlet vane losses.

D. Construction:
   1. Open drip-proof type except where specifically noted otherwise.
   2. Design for continuous operation in 40 degrees C environment.
   3. Design for temperature rise in accordance with NEMA MG 1 limits for insulation class, service factor, and motor enclosure type.
   4. All copper windings and leads.
   5. Motors for belt driven equipment and base mounted pumps shall have cast iron yoke and bearing housings.

E. Visible Nameplate: Indicating motor horsepower, voltage, phase, cycles, RPM, full load amps, locked rotor amps, frame size, manufacturer's name and model number, service factor, power factor, efficiency.

F. Wiring Terminations:
   1. Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70, threaded for conduit.
   2. For fractional horsepower motors where connection is made directly, provide threaded conduit connection in end frame.

2.03 APPLICATIONS

A. Exception: Motors less than 250 watts, for intermittent service may be the equipment manufacturer's standard and need not conform to these specifications.

B. Single phase motors for shaft mounted fans or blowers: Permanent split capacitor type.

C. Single phase motors for fans: Capacitor start, capacitor run type.

2.04 SINGLE PHASE POWER - PERMANENT-SPLIT CAPACITOR MOTORS

A. Starting Torque: Exceeding one fourth of full load torque.

B. Starting Current: Up to six times full load current.

C. Multiple Speed: Through tapped windings.

D. Open Drip-proof or Enclosed Air Over Enclosure: Class A (50 degrees C temperature rise) insulation, minimum 1.0 Service Factor, prelubricated sleeve or ball bearings, automatic reset overload protector.

2.05 SINGLE PHASE POWER - CAPACITOR START MOTORS

A. Starting Torque: Three times full load torque.

B. Starting Current: Less than five times full load current.

C. Pull-up Torque: Up to 350 percent of full load torque.

D. Breakdown Torque: Approximately 250 percent of full load torque.

E. Motors: Capacitor in series with starting winding; provide capacitor-start/capacitor-run motors with two capacitors in parallel with run capacitor remaining in circuit at operating speeds.

F. Drip-proof Enclosure: Class A (50 degrees C temperature rise) insulation, NEMA Service Factor, prelubricated sleeve bearings.

G. Enclosed Motors: Class A (50 degrees C temperature rise) insulation, 1.0 Service Factor, prelubricated ball bearings.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install securely on firm foundation. Mount ball bearing motors with shaft in any position.

C. Check line voltage and phase and ensure agreement with nameplate.

END OF SECTION

SECTION 23 0548

VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Vibration isolators.

1.02 REFERENCE STANDARDS

A. ASHRAE (HVACA) - ASHRAE Handbook - HVAC Applications; 2015.

1.03 SUBMITTALS

A. Refer to Section 23 0510 - General HVAC Requirements, for submittal procedures.

B. Product Data:
   1. Provide manufacturer's product literature documenting compliance with PART 2 PRODUCTS.

C. Shop Drawings:
   1. Provide schedule of vibration isolator type with location and load on each.

D. Manufacturer's Instructions: Indicate installation instructions with special procedures and setting dimensions.

1.04 QUALITY ASSURANCE

A. Perform design and installation in accordance with applicable codes.

B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Amber Booth: www.amberbooth.com.

B. Isolation Technology, Inc.: www.isolationtech.com

C. Kinetics Noise Control, Inc.: www.kineticsnoise.com.

D. Korfund Dynamics: www.thevmcgroup.com.

E. Mason Industries: www.mason-ind.com.

F. Vibration Eliminator Company, Inc.; _____: www.veco-nyc.com/#sle.

G. Vibration Mounting and Control: www.vmc-kdc.com.

H. Vibro-Acoustics: http://www.vibro-acoustics.com.

2.02 PERFORMANCE REQUIREMENTS

A. General:
   1. All vibration isolators, base frames and inertia bases to conform to all uniform deflection and stability requirements under all operating loads.
   2. Steel springs to function without undue stress or overloading.

2.03 VIBRATION ISOLATORS

A. Non-Seismic Type:
   1. Neoprene Rubber Mount or Hanger: Molded rubber designed for 0.4 inch deflection with threaded insert.
   2. Neoprene Pad Isolators:
      a. Rubber or neoprene waffle pads.
         1) Hardness: 30 durometer.
         2) Thickness: Minimum 1/2 inch.
         3) Maximum Loading: 50 psi.
         4) Rib Height: Maximum 0.7 times width.

b. Configuration: 1/2 inch thick waffle pads bonded each side of 1/4 inch thick steel plate.

PART 3 EXECUTION

3.01 INSTALLATION - GENERAL

A. Install in accordance with manufacturer's instructions.

B. Vibration isolation hangers shall be positioned as close as possible to the structure without coming in contact with any object (including the structure).
   1. Hanger rods shall not contact any object which would short circuit the isolator.

3.02 SCHEDULE

A. Equipment Isolation Schedule.
   1. Suspended fan coil units:
      a. Isolator Type: Rubber Mount or Hanger.
      b. Isolator Deflection:.75 inches.
   2. Air Cooled Condensing Units, 7-1/2 tons capacity and less. Refer to Detail on Drawings.
      a. Isolator Type: Neoprene Pad.
      b. Isolator Deflection: 0.25 inches.

END OF SECTION

SECTION 23 0553
IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nameplates.

1.02 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems; 2007.

1.03 SUBMITTALS

A. Refer to Section 23 0510- General HVAC Requirements, for submittal procedures.

B. Product Data: Provide manufacturers catalog literature for each product required.

PART 2 PRODUCTS

2.01 NAMEPLATES

A. Description: Laminated three-layer plastic with engraved black letters on light contrasting background color.

B. Size:1/2 inch high letters unless otherwise noted.

C. Size when located on ceiling grid: 3/8 inch high letters unless otherwise noted.

PART 3 EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.02 INSTALLATION

A. Identify split system heat pump units, interior fan coil units, and fans with plastic nameplates.

END OF SECTION

SECTION 23 0593

TESTING, ADJUSTING AND BALANCING FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Initial testing, adjustment, and balancing of air systems.

B. Winter and Summer Seasonal testing, adjustment, and balancing of air systems.

C. Measurement of final operating condition of HVAC systems.

D. Testing of control sensors, controllers and safeties.

1.02 RELATED REQUIREMENTS

A. Section 01 4000 - Quality Requirements: Employment of testing agency and payment for services.

B. Section 23 3300 - Air Duct Accessories.

1.03 REFERENCE STANDARDS

A. AABC MN-1 - AABC National Standards for Total System Balance; Associated Air Balance Council; 2002.

B. NEBB (TAB) - Procedural Standards for Testing Adjusting Balancing of Environmental Systems; 2005, Seventh Edition.

1.04 SUBMITTALS

A. Refer to Section 23 0510 - General HVAC Requirements for submittal procedures.

B. Submit name of adjusting and balancing agency for approval within 30 days after Notice to Proceed.

C. TAB Plan: Submit a written plan indicating the testing, adjusting, and balancing standard to be followed and the specific approach for each system and component.
   1. Include at least the following in the plan:
      a. List of all air flow measurements to be performed and a description of specific test procedures, parameters, formulas to be used.
      b. Copy of field checkout sheets and logs to be used, listing each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.
      c. Discussion of what notations and markings will be made on the duct and piping drawings during the process.
      d. Final test report forms to be used.
      e. Procedures for formal deficiency reports, including scope, frequency and distribution.

D. Initial Review: Submit results of testing and balancing agency's examination of documents and systems within 30 days after Notice to Proceed.

E. Initial Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
   1. Submit under provisions of Section 01 4000.
   2. Submit prior to Contractor's Request for Material Completion.
   3. Submit copies of report for review prior to final acceptance of Project. Provide final copies for Architect and for inclusion in operating and maintenance manuals.
   4. Include actual instrument list, with manufacturer name, serial number, and date of calibration.
   5. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.
   6. Units of Measure: Report data in both I-P (inch-pound) and SI (metric) units.
   7. Test Reports: Indicate data on AABC MN-1 forms, forms prepared following ASHRAE Std 111, or NEBB forms.
   8. Include the following on the title page of each report:

a. Name of Testing, Adjusting, and Balancing Agency.
b. Address of Testing, Adjusting, and Balancing Agency.
c. Telephone number of Testing, Adjusting, and Balancing Agency.
d. Project name.
e. Project location.
f. Project Architect.
g. Project Engineer.
h. Project Contractor.
i. Report date.

F. Seasonal Reports: Submit seasonal report within 14 days of completion of seasonal adjustments. Include test reports for any equipment that could not be tested at the initial report due to season, temperature or other conditions.
1. List of deficiencies noted, adjustments made and corrective action taken.
2. Temperature of each conditioned space and dry bulb setting of controlling thermostat.
3. Temperature at all sensors in equipment, space duct or pipe and settings of controllers.
4. Date and outdoor DB and WB range during the time of the seasonal test.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

A. Perform total system balance in accordance with one of the following:
1. AABC MN-1, AABC National Standards for Total System Balance.
2. NEBB Procedural Standards for Testing Adjusting Balancing of Environmental Systems.

B. Begin work after completion of systems to be tested, adjusted, or balanced and complete work and submit Report prior to the Final Observation of the project.

C. TAB Agency Qualifications:
1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.
2. Certified by one of the following:
a. AABC, Associated Air Balance Council: www.aabchq.com; upon completion submit AABC National Performance Guaranty.
b. NEBB, National Environmental Balancing Bureau: www.nebb.org/#sle.
3. Company shall an independent firm with no relationship with any Contractor on this Project.

D. TAB Supervisor and Technician Qualifications: Certified by same organization as TAB agency.

E. Pre-Qualified TAB Agencies: Testing and Balancing shall be performed by one of the following firms:
1. Air Analysis of Atlanta.
2. AireBal.
3. Air Data - Macon, Inc.
4. Alpha Air Balance.
5. Georgia Balance.
6. HVAC Testing Services, Inc.
7. TAB Services.
8. Thomas Balancing.

3.02 EXAMINATION

A. Review the contract documents and existing conditions for appurtenances and arrangement for balancing prior to the installation of any equipment or material. the Contractor shall notify Architect of any omissions noted within 30 days of the Contractor's notice to proceed.

B. Verify that systems are complete and operable before commencing work. Ensure the following conditions:

1. Systems are started and operating in a safe and normal condition.
2. Temperature control systems are installed complete and operable.
3. Proper thermal overload protection is in place for electrical equipment.
4. All filters are clean and in place. If required, install temporary media in addition to filters.
5. Duct systems are clean of debris.
6. Fans are rotating correctly.
7. Fire and volume dampers are in place, accessible, operable and open. Report observation on test report.
8. Smoke dampers are in place, damper and operator are accessible, damper is operable, and open. Report observation on test report.
9. All dampers and operators function smoothly from shut-off to full open.
10. Air coil fins are cleaned and combed.
11. Access doors are installed at specified components are accessible, are closed and duct end caps are in place.
12. Air outlets are installed and connected.
13. Duct system leakage is minimized.

3.03 PREPARATION

A. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to Architect to facilitate spot checks during testing.

B. Testing of equipment shall be simultaneous where components of a systems are connected; e.g. DX coil and condensing unit.

3.04 ADJUSTMENT TOLERANCES

A. Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.

B. Air Outlets and Inlets: Adjust total to within plus 5 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.

C. Building Pressure: Ensure that installation tolerances result in each floor of the building being positively pressurized with respect to outside ambient pressure.

3.05 RECORDING AND ADJUSTING

A. Ensure recorded data represents actual measured or observed conditions.

B. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

C. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

D. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

3.06 AIR SYSTEM PROCEDURE

A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities at site altitude.

B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct. Close openings after measurement with permanent manufactured plugs.

C. Measure air quantities at air inlets and outlets.

D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.

E. Use volume control devices to regulate air quantities only to the extent that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.

F. Vary total system air quantities by adjustment of fan speeds by drive sheave adjustment. Provide drive changes required to place belt in mid-position at final RPM. Vary branch air quantities by damper regulation.

G. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.

H. Measure static air pressure conditions on air supply units, including pressure drops at all components including filters and fans, and total pressure across the fan. Make allowances for 50 percent loading of filters.

I. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions. Adjust operators on outside air dampers to ensure tight seal when shut.

J. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.

K. The differential at the time of balance between the outside and return air streams shall be 15 degrees F, minimum, when the outside air quantities are established by temperature differential.

L. Where modulating dampers are provided, take measurements and balance at extreme conditions. Balance variable volume systems at maximum air flow rate, full cooling, and at minimum air flow rate, full heating.

M. Measure building static pressure and adjust supply, return, and exhaust air systems to provide required relationship between each to maintain positive building pressure near the building entries under all operational sequences.

3.07 CONTROL SYSTEM PROCEDURE

A. Fire Thermostats, Smoke Detectors and other Safety devices: Test and verify operation. Record setpoint.

B. Sequence of Operation: Operate systems thru specified Sequence and confirm system function.

C. Thermostats, Input/Output sensors and Controls: Measure temperature or flow at device and record measurement and setting of controller.

3.08 BALANCE UNDER SEASONAL OPERATING CONDITIONS

A. After the initial balance has been completed, reviewed and accepted; the contractor shall balance and adjust the system under seasonal operating conditions by performing operational tests over a minimum period of eight hours under both cooling and heating conditions.

B. These tests shall be performed only after each piece of equipment has been individually tested, and is verified to be in correct operating condition, and shall be made at times when outdoor dry bulb temperatures are above 85 F for cooling, or below 50 F for heating.

C. When test is run during the cooling cycle the building must be occupied, and all lights shall be turned on for a minimum of six (6) hours. Doors to all spaces shall be closed and all space thermostats set at its normal setpoint.

D. Purpose: Prove correctness of installation; prove functioning of capacity and safety controls; prove calibration of operating controls; and prove stability of operation under actual loading conditions.

3.09 SCOPE

A. Test, adjust, and balance the following:
   1. Small Split System Fan Coil Units.
   2. Air Cooled Condensing Units/Heat Pump Units.
   3. Terminal Heat Transfer Units.
   4. Fans, Powered Ventilators and Exhausters
   5. Air Inlets and Outlets.

3.10 MINIMUM DATA TO BE REPORTED

A. Electric Motors:
   1. Manufacturer.
   2. Model/Frame.
   3. HP/BHP.
   4. Phase, voltage, amperage; nameplate, actual, no load.
   5. RPM.
   6. Service factor.
   7. Starter size, rating, heater elements.
   8. Sheave Make/Size/Bore.

B. V-Belt Drives:
   1. Identification/location.
   2. Required driven RPM.
   3. Driven sheave, diameter and RPM.
   4. Belt, size and quantity.
   5. Motor sheave diameter and RPM.
   6. Center to center distance, maximum, minimum, and actual.

C. Cooling coil casings: Test the air handling casing(s) downstream of the cooling coils to determine leakage into this section(s) is less than 3.5% of design maximum system air quantity. This infiltration shall be determined as follows:
   1. Measure cooling coil leaving air temperature.
   2. Measure fan entering air temperature
   3. Measure duct supply air fan motor amperage on all legs.
   4. At time of measurement, the temperature difference between inside and outside of casing shall be at least 20 degrees .
   5. Calculate infiltration percentage and report all values measured for this test

D. Air Cooled Condensing Units/Heat Pump Units:
   1. Identification/number.
   2. Location.
   3. Manufacturer.
   4. Model number.
   5. Serial number.
   6. Entering DB air temperature, design and actual.
   7. Leaving DB air temperature, design and actual.
   8. Number of compressors.

E. Cooling Coils:
   1. Identification/number.
   2. Location.
   3. Service.
   4. Manufacturer.
   5. Air flow, design and actual.
   6. Entering air DB temperature, design and actual.
   7. Entering air WB temperature, design and actual.
   8. Leaving air DB temperature, design and actual.
   9. Leaving air WB temperature, design and actual.
   10. Saturated suction temperature, design and actual.
   11. Air pressure drop, design and actual.

F. Electric Heaters:
   1. Manufacturer.
   2. Identification/number.
   3. Location.
   4. Model number.

5. Design kW.
6. Number of stages.
7. Phase, voltage, amperage.
8. Test voltage (each phase).
9. Test amperage (each phase).
10. Air flow, specified and actual.
11. Temperature rise, specified and actual.

G. Air Moving Equipment:
1. Location.
2. Manufacturer.
3. Model number.
4. Serial number.
5. Arrangement/Class/Discharge.
6. Air flow, specified and actual.
7. Return air flow, specified and actual.
8. Outside air flow, specified and actual.
9. Total static pressure (total external), specified and actual.
10. Inlet pressure.
11. Discharge pressure.
12. Sheave Make/Size/Bore.
13. Number of Belts/Make/Size.
14. Fan RPM.
15. Describe filter condition.
16. Plot actual fan operating point on fan curve chart.

H. Return Air/Outside Air:
1. Identification/location.
2. Design air flow.
3. Actual air flow.
4. Design return air flow.
5. Actual return air flow.
6. Design outside air flow.
7. Actual outside air flow.
8. Return air temperature.
9. Outside air temperature.
10. Required mixed air temperature.
11. Actual mixed air temperature.
12. Design outside/return air ratio.
13. Actual outside/return air ratio.

I. Exhaust Fans:
1. Location.
2. Manufacturer.
3. Model number.
4. Serial number.
5. Air flow, specified and actual.
6. Total static pressure (total external), specified and actual.
7. Inlet pressure.
8. Discharge pressure.
9. Sheave Make/Size/Bore.
10. Number of Belts/Make/Size.
11. Fan RPM.
12. Plot actual operating point on pump curve chart.

J. Duct Traverses:

1. System zone/branch.
2. Duct size.
3. Area.
4. Design velocity.
5. Design air flow.
6. Test velocity.
7. Test air flow.
8. Duct static pressure.
9. Air temperature.
10. Air correction factor.

K. Air Distribution Tests:
1. Air terminal number.
2. Room number/location.
3. Terminal type.
4. Terminal size.
5. Area factor.
6. Design velocity.
7. Design air flow.
8. Test (final) velocity.
9. Test (final) air flow.
10. Percent of design air flow.
11. Relative position of balancing damper

L. Space Temperature and Humidity:
1. Temperature and humidity (whether controlled or not) of each conditioned space
2. Setpoint of each controlling thermostat or humidity sensing device.

END OF SECTION

SECTION 23 0713
DUCT INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Duct insulation

B. Duct Liner

1.02 RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.

1.03 REFERENCE STANDARDS

A. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2010.

B. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2014.

C. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2013.

D. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2014.

E. ASTM C1071 - Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material); 2012.

F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

G. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials; National Fire Protection Association 2007.

H. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005 (Revised 2009).

1.04 SUBMITTALS

A. Refer to Section 23 0510 - General HVAC Requirements, for submittal procedures.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

1.05 QUALITY ASSURANCE

A. Applicator Qualifications: Company specializing in performing the type of work specified in this section, with minimum three years of experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.

B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.07 FIELD CONDITIONS

A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.

B. Maintain temperature during and after installation for minimum period of 24 hours.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E 84, NFPA 255, or UL 723.

2.02 GLASS FIBER, FLEXIBLE

A. Manufacturer:
   1. Knauf Insulation: www.knaufinsulation.com.
   2. Johns Manville: www.jm.com.
   3. Owens Corning Corporation; SOFTR: www.ocbuildingspec.com.
   4. CertainTeed Corporation: www.certainteed.com.

B. Insulation: ASTM C 553; flexible, noncombustible blanket.
   1. 'K' value: 0.36 at 75 degrees F, when tested in accordance with ASTM C 518.
   2. Maximum Service Temperature: 250 degrees F.
   3. Maximum Water Vapor Sorption: 5.0 percent by weight.
   4. Density: 3/4 lb./cu ft.

C. Vapor Barrier Jacket:
   1. Kraft paper with glass fiber yarn and bonded to aluminized film.
   2. Moisture Vapor Permeability: 0.029 ng/Pa s m (0.02 perm inch), when tested in accordance with ASTM E96/E96M.
   3. Secure with pressure sensitive tape.

D. Vapor Barrier Tape:
   1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

E. Tie Wire: Annealed stainless steel, 16 gage.

2.03 GLASS FIBER, RIGID

A. Manufacturer:
   1. Knauf Insulation: www.knaufinsulation.com.
   2. Johns Manville: www.jm.com.
   3. Owens Corning Corporation; 700 Series FIBERGLAS Insulation: www.ocbuildingspec.com/#sle.
   4. CertainTeed Corporation: www.certainteed.com.

B. Insulation: ASTM C 612; rigid, noncombustible board.
   1. 'K' Value: 0.24 at 75 degrees F, when tested in accordance with ASTM C518.
   2. Maximum Service Temperature: 450 degrees F.
   3. Maximum Water Vapor Absorption: 5.0 percent.
   4. Density: 6 lb./cu ft.

C. Vapor Barrier Jacket:
   1. Kraft paper with glass fiber yarn and bonded to aluminized film.
   2. Moisture Vapor Permeability: 0.029 ng/Pa s m (0.02 perm inch), when tested in accordance with ASTM E96/E96M.
   3. Secure with pressure sensitive tape.

D. Vapor Barrier Tape:
   1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

2.04 JACKETS

A. Interior Glass Fabric Vapor Barrier Finish:
   1. Cloth: Untreated 9 oz./sq. yd. weight plain mesh glass cloth.
   2. Blanket: 1.0 lb./cu ft. density.
   3. Weave: 5x5.
   4. Lagging Adhesive: Fire resistant compatible with insulation.
   5. Finish: Vinyl emulsion type acrylic, compatible with insulation, white color.

2.05 DUCT LINER - GLASS FIBER

A. Manufacturers: Certainteed ToughGard-R, Owens-Corning QuietR, JohnsManville Permacote Linacoustic RC-HP, Knauf Atmosphere Liner.

B. Insulation: Incombustible glass fiber complying with ASTM C 1071; flexible blanket; impregnated surface and edges coated with acrylic polymer shown to be fungus and bacteria resistant by testing to ASTM G 21.
   1. Apparent Thermal Conductivity: Maximum of 0.31 at 75 degrees F.
   2. Service Temperature: Up to 250 degrees F.
   3. Rated Velocity on Coated Air Side for Air Erosion: 5,000 fpm, minimum.
   4. Density: 1.5 pcf.
   5. Minimum Noise Reduction Coefficients:
      a. 1 inch Thickness: 0.70
      b. 2 inch Thickness: 0.95

C. Adhesive: Waterproof, fire-retardant type, ASTM C916.

D. Liner Fasteners: Galvanized steel, welded with press-on head.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that ducts have been tested before applying insulation materials.

B. Verify that surfaces are clean, foreign material removed, and dry.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

C. Provide insulation with vapor barrier jackets.

D. Seal all joints, mechanical fastener penetrations, and vapor barrier penetrations with Vapor Barrier Tape

E. Continue insulation through walls, sleeves, hangers, and other duct penetrations.

F. Insulate entire system including fittings, joints, flanges, fire dampers, flexible connections, duct lined with duct liner, heating coil return bends at terminal units, and expansion joints.

G. Fiber Glass, Flexible:
   1. Do not pull insulation tight around ducts.
   2. Lap transverse joints 2 inch, minimum and secure with staples 18 inches on center.
   3. Wrap insulation with Tie Wire 18 inches on center, maximum.
   4. Install mechanical fasteners not more than 18 inches on center on ducts over 24 inches wide.
   5. Provide 24 inch length, minimum, of rigid glass fiber insulation on bottom of ducts supported from trapeze hangers.

H. Glass Fiber, Rigid:
   1. Cut to fit between standing seams and stiffeners to provide 1/2 inch, minimum cover.
   2. Secure insulation to ducts with duct insulation adhesive applied to duct to provide 100% coverage and with mechanical fasteners 12 inch on centers, maximum.
   3. Butt transverse joints.
   4. Secure metal corner beads to all exterior edges.
   5. Tape all joints and fastener penetrations with 4 inch wide, minimum, foil scrim kraft tape after pointing clip penetrations with insulating cement.

I. Weld mechanical fasteners to duct. No glue or stick on allowed.

J. Rigid duct insulation exposed in the mechanical equipment rooms or Finished Spaces : Finish with glass cloth adhered with fire resistant adhesive and finished with a white coating.

K. Duct Accessories, Duct Mounted Meters and Gages Instruments and Duct Mounted Instrumentation and Other Control Devices:
   1. In conditioned spaces devices shall be left exposed and/or accessible above the insulation vapor barrier jacket for access. Seal to vapor barrier jacket.

2. In non-conditioned spaces devices shall be insulated within the insulation vapor barrier jacket with the insulation and jacket arranged to provide access.
3. Accessible devices to include:
   a. Duct mounted Instrumentation,
   b. Airflow Measuring Station pressure ports,
   c. Input/Output Sensors,
   d. Duct access door handles,
   e. Volume Control damper handles(MVD),
4. Damper operators shall be left exposed and/or accessible above the insulation vapor barrier jacket for access. Seal to vapor barrier jacket.

L. Duct Liner Locations:
1. Line supply, return, and mixed air ducts where noted on drawings with 1 inch liner.
2. Provide 2 inch liner at field fabricated mixing plenums.
3. Do not install liner in duct within six feet downstream of a cooling coil or outside air intake.

M. Duct and Plenum Liner Application: (Glass Fiber Liner)
1. Install liner in accordance with manufacturer's Published Installation Instructions and SMACNA Installation Standards including Figure No. 7-11 and 7-12.
2. Adhere insulation with adhesive for 90 percent coverage.
3. Secure insulation with mechanical liner fasteners, type 3 or 4 located in accordance with SMACNA Figure 7-11. Refer to SMACNA (DCS) Standards for spacing.
4. Install with longitudinal and transverse joints under compression.
5. Seal and smooth all longitudinal and transverse joints, field cuts exposed edges and any minor surface damage with edge coat.
6. Seal liner surface penetrations with edge coat.
7. Provide 26 gauge metal nosing on leading edge at fan discharges and at any interval of lined duct proceeded by unlined duct.
8. Terminate liner at duct mounted accessories such as turning vanes and dampers. Provide sheet metal "hat" section build out in accordance with SMACNA Figure 7-13.
9. Duct dimensions indicated are net metal inside dimensions required for air flow. Do not Increase duct size to allow for insulation thickness.
10. Provide protection for surfaces that may be subject to damage by tradesmen installing electrical, controls or other work.

3.03 CLEANING

A. Clean adjacent surfaces, valves, valve handles, etc. of jacketing materials.

3.04 SCHEDULES

A. Exhaust Ducts Within 10 ft. of Exterior Openings/Termination:
1. Concealed - Glass Fiber, Flexible;2 inch thick.
2. Exposed - Glass Fiber, Rigid. 2 inch thick with glass fabric vapor barrier jacket.

B. Outside Air Intake Ducts:
1. Concealed: Glass Fiber, Flexible; 2 inch thick.
2. Exposed: Glass Fiber, Rigid; 2 inch thick with glass fabric vapor barrier jacket.

C. Plenums:
1. Concealed: Glass Fiber, Flexible; 2 inch thick.
2. Exposed: Glass Fiber, Rigid; 2 inch thick with glass fabric vapor barrier jacket.

D. Supply Ducts:
1. Concealed: Glass Fiber, Flexible; 2 inch thick.
2. Exposed Supply Ducts in Mechanical Rooms and Non-Conditioned Interior Spaces: Glass Fiber, Rigid; 2 inch thick with glass fabric jacket.
3. Exposed Supply Ducts in Conditioned Spaces: Do Not Insulate.
4. Tops of Ceiling diffusers: Glass Fiber, Flexible; 2 inch thick.

E. Return Ducts:

1. Concealed Return ducts in Non-Conditioned Space: Glass Fiber, Flexible; 2 inch thick.
2. Exposed Return Ducts in Non-Conditioned Space: Glass fiber, Rigid;2 inch thick with glass fabric vapor barrier jacket.
3. Return Ducts in Conditioned Space or Return Air Plenum: Do Not Insulate.

END OF SECTION

SECTION 23 0719
HVAC PIPING INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Piping insulation.

1.02 REFERENCE STANDARDS

A. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2014.

B. ASTM C585 - Standard Practice for Inner and Outer Diameters of Thermal Insulation for Nominal Sizes of Pipe and Tubing; 2010.

C. ASTM C591 - Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation; 2015.

D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

E. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials; National Fire Protection Association 2007.

F. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.03 SUBMITTALS

A. See Section 23 0510 - General HVAC Requirements for submittal procedures.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

1.04 QUALITY ASSURANCE

A. All insulation, mastics, coatings, sealants, and adhesives shall be certified by the manufacturer to be Asbestos-free.

B. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum Three years of experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E 84, NFPA 255, or UL 723.

2.02 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Manufacturer:
   1. Aeroflex USA, Inc.; Aerocel: www.aeroflexusa.com/#sle.
   2. Armacell LLC: www.armacell.us/#sle.
   3. K-Flex USA LLC; Insul-Tube: www.kflexusa.com/#sle.

B. Insulation: Preformed flexible closed-cell elastomeric rubber insulation complying with ASTM C 534 Grade 1; use molded tubular material. Split tube installation is prohibited.
   1. 'K' ('Ksi') value: 0.25 at 75 degrees F (0.04 at 24 degrees C).
   2. Maximum Moisture Absorption: < 1.0 percent (pipe) by volume, when tested in accordance with ASTM C 209.
   3. Water Vapor Permeability: 0.05 perm-inches, when tested in accordance with ASTM E 96.
   4. Minimum Service Temperature: Minus 40 degrees F.

5. Maximum Service Temperature: 220 degrees F.
6. Connection: Waterproof vapor barrier adhesive.

C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

2.03 STAPLES, BANDS, AND WIRES

A. Staples shall be outward clinching type of type 304 or 316 stainless steel, or monel.

B. Bands shall be galvanized steel, aluminum, brass, or nickel copper alloy, of 3/4 inch nominal width. The band thickness exclusive of coating shall be not less than 30 gauge for steel and nickel copper alloy.

C. Wire shall be 18-gauge stainless steel.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that piping has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

C. Exposed Piping: Locate insulation and cover seams in least visible locations. Exterior of insulation shall be uniform in appearance.

D. Insulation jacket shall fit snug to insulation.

E. Valves and fittings:
1. Insulate pipe and all valves and fittings including valve bonnets on A.C. condensate drain and refrigerant suction piping. Leave only valve stems, open ends of wells and gauge cocks exposed.

F. Insulation at Hangers: Hangers for horizontal, A.C. condensate drain, refrigerant suction, and trapeze supports shall be outside of insulation with saddles as specified herein.

G. Saddles:
1. Provide galvanized steel saddles at each point where pipe insulation passes through a hanger or rests on a support.
2. Saddles shall be 180 arc for horizontal piping, 360 arch for vertical piping.
3. Center saddle on pipe hanger.
4. Length and gauge of saddle shall be as follows:
   a. 2 inch pipe size and smaller: 18 Gauge saddle, 8 inch long, minimum.
   b. 2-1/2 & 3 inch pipe size: 18 Gauge saddle, 12 inch long, minimum.
   c. 4 inch pipe size: 16 Gauge saddle, 16 inch long, minimum.
   d. 6 inch pipe size and larger: 16 Gauge saddle, 24 inch long, minimum.

H. Flexible elastomeric cellular rubber insulation: Install without splitting and under compression during pipe fabrication. Seal Joints with adhesive. Paint exposed insulation with two coats of vinyl insulation paint after adhesive has dried for twelve hours, minimum. Allow two hours, minimum, between coats.

3.03 CLEANING

A. Clean adjacent surfaces, valves, valve handles, etc. of jacketing materials.

3.04 SCHEDULES

A. DX Cooling Systems:
1. Refrigerant Suction: 3/4 inch thick preformed flexible elastomeric cellular rubber insulation.

B. Condensate Drains from Cooling Coils: 3/4 inch thick preformed flexible elastomeric cellular rubber insulation.

END OF SECTION

SECTION 23 0913

INSTRUMENTATION AND CONTROL DEVICES FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Thermostats.

B. Automatic dampers.

C. Damper operators.

1.02 RELATED REQUIREMENTS

A. Section 23 3300 - AIR DUCT ACCESSORIES: Installation of automatic dampers.

B. Section 26 0519 - Low-Voltage Electrical Power and Conductors & Cables.

1.03 REFERENCE STANDARDS

A. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2015.

1.04 SUBMITTALS

A. Refer to Section 23 0510- General HVAC Requirements for submittal procedures.

B. Product Data: Provide description and engineering data for each control system component. Include sizing as requested. Provide data for each system component and software module.

C. Shop Drawings: Indicate complete operating data, system drawings, wiring diagrams, and written detailed operational description of sequences. Submit schedule of valves indicating size, flow, and pressure drop for each valve. For automatic dampers indicate arrangement, velocities, and static pressure drops for each system.

D. Operation and Maintenance Data: Include inspection period, cleaning methods, recommended cleaning materials, and calibration tolerances.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this section with minimum 5 years' experience employed directly by the digital equipment manufacturer.

B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 EQUIPMENT - GENERAL

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

2.02 CONTROL DAMPERS

A. Manufacturers: Arrow 395, Johnson VD-1300, Ruskin CD-60, National Controlled Air SCD-LL-HD-57, TAMCO-1000 Greenheck VCD-33.

B. Frames: Galvanized steel, welded or riveted with corner reinforcement, minimum 16 gage.

C. Blades: Galvanized steel, double thickness airfoil, maximum blade size 8 inches wide, 48 inches long, minimum 16 gage, attached to minimum 1/2 inch shafts with set screws.

D. Blade Seals: Synthetic elastomeric mechanically attached, field replaceable.

E. Jamb Seals: Spring stainless steel.

F. Shaft Bearings: Oil impregnated sintered bronze.

G. Linkage and linkage Bearings: Blade linkage outside of airstream with Oil impregnated sintered bronze bearings.

H. Leakage: Class 1; 8.0 CFM/Sq.FT.inch maximum at 4-inch W.G. pressure difference.

I. Pressure Drop: Less than 0.10 inches W.G. based on fully open 48" x 48" damper and an approach velocity of 2000 FPM.

J. Maximum Pressure Differential: 6 inches wg.

K. Temperature Limits: -40 to 200 degrees F.

2.03 DAMPER OPERATORS

A. General: Provide smooth proportional control with sufficient power for air velocities 20 percent greater than maximum design velocity and to provide tight seal against maximum system pressures. Provide spring return for two position control and for fail safe operation.
   1. Provide sufficient number of operators to achieve unrestricted movement throughout damper range.
   2. Provide one operator for maximum 36 sq. ft. damper section.

B. Electric Operators:
   1. Manufacturers: Belimo AF24, TFB24, or NF24, Neptune, Siemens, Johnson Controls.
   2. Spring return, adjustable stroke motor having oil immersed gear train, with auxiliary end switch.
   3. 24 VAC reversible motor with Class F insulation or better with drive mechanism in enclosure, 10VA maximum..
   4. Feedback Signal: Independent of input signal providing feedback of true position indication.
   5. Enclosure: Aluminum cover and base, NEMA-2, IP 54, coupling direct to damper.
   6. Provide all corrosion resistant (non-ferrous) components, fasteners and mounting devices and connections.
   7. Unit shall be prewired. Provide a conduit fitting and a three foot long appliance cord.
   8. Status display: Visual indicator to display damper position through full range of travel.
   9. External built-in travel limit switch to reverse direction.
   10. Manual override with hex operator.

2.04 SWITCHING DEVICES

A. Electric Relays:
   1. Heavy duty, isolated, cabinet mounted, blade plug-in type with base.
   2. Rating: 10 amps, minimum at 125 VAC:

2.05 THERMOSTATS

A. Fire Thermostats(Firestats):
   1. UL labeled, factory set in accordance with NFPA 90A.
   2. Normally closed contacts, adjustable setpoint, manual reset, dust cover and adjustable duct mounting flange with extension for mounting on insulated duct.
   3. Set point range: 100-250 Degree F.
   4. Initial Setpoint: 195 Degree F

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that systems are ready to receive work.

C. Beginning of installation means installer accepts existing conditions.

D. Sequence work to ensure installation of components is complementary to installation of similar components in other systems.

E. Coordinate installation of system components with installation of mechanical systems equipment such as air handling units and air terminal units.

F. Ensure installation of components is complementary to installation of similar components.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Locate all control devices except for sensors and devices integral to equipment within control panels, unless otherwise noted.

C. Install control devices in a readily accessible location. Refer to definitions in Section 23 0510.

D. Coordinate with Contractor and monitor the work so that other trades do not obstruct control devices or other items requiring access for service.

E. Device mounting:
   1. All devices shall be permanently mounted and secured in place.
   2. Gypsum Board and Plaster walls: Moly-bolt type anchor. No adhesive or plastic insert anchors.
   3. Concrete Walls: Non-ferrous screws and expansion shields.
   4. Concrete masonry units: Mount to recessed box or secure with moly-bolt type anchor.
   5. Provide accessory wall adapter plates where required to cover block or wall opening edges.
   6. Mount dampers with blades horizontal.

F. Identification:
   1. Nameplates: Identify all sensors mounted in mechanical rooms using device ID and number from control drawings with permanent label mounted adjacent to device. Nameplates shall be engraved plastic laminate with uppercase black letters on a white field, 1/4 inch minimum height.
      a. Include sensor type, normal setpoints information on nameplate.
      b. Mounting: Attach nameplates with epoxy cement or non-ferrous screws after final painting.
   2. Color code conductors with both ends identified with manufactured alpha-numeric self-adhesive vinyl tags, 3 mils thick, minimum, keyed to termination points.

G. Electrical wiring:
   1. All control and interlock wiring shall be provided under this section.
   2. No splices between field devices and control panels are permitted.
   3. All Wiring materials and methods shall comply with Division 26 except:
      a. Minimum wire size shall be 14 AWG(copper) for line voltages.
      b. Minimum wire size shall be 18 AWG(copper) for signal.
   4. Fire Alarm System Interface: Signal for fan shutdown shall be obtained from fire alarm output relay located in mechanical room adjacent to the starter/motor control center, unless otherwise noted.
   5. Electric Operators:
      a. Power wiring for controls provided under Division 26 is shown on the Electrical Drawings. Provide conduit, conductors, power supplies and transformers as required for power to operate electric operators.
      b. The feedback signal for each separately controlled damper operator shall be wired back to a terminal strip in the control panel for trouble-shooting purposes.

H. Provide isolation (two position) dampers of parallel blade construction.

I. Install damper operators in accessible locations.

J. Install damper operators on outside of duct in warm areas. Do not install operators in locations at outdoor temperatures.

3.03 SCHEDULES

A. Refer to Sequence of Operation for damper normal positions.

END OF SECTION

SECTION 23 0994
HVAC SEQUENCE OF OPERATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Sequence of operation for:
   1. Small Split System Heat Pump Units.
   2. Fan Interlocks.

1.02 RELATED SECTIONS

1.03 SYSTEM DESCRIPTION

A. This Section defines the manner and method by which controls function. Requirements for each type of control system operation are specified. Equipment, devices, and system components required for control systems are specified in other Sections.

1.04 SUBMITTALS

A. Refer to Section 23 0510 - General HVAC Requirements for submittal procedures.

B. Shop Drawings: Indicate mechanical system controlled and control system components.
   1. Label with settings, adjustable range of control and limits.
   2. Include written description of control sequence.
   3. Include flow diagrams for each control system, graphically depicting control logic.

C. Project Record Documents: Record actual locations of components and setpoints of controls, including changes to sequences made after submission of shop drawings.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL

A. All operators shall be in NORMAL position when each system is OFF.

B. Provide smoke detector in supply air stream on all air systems over 2000 CFM. Refer to NFPA 90A , 2002 .

C. All temperatures are Fahrenheit.

3.02 SPLIT SYSTEM HEAT PUMPS: FCU-1 THRU FCU-3, FCU-5 THRU FCU-10

A. Fan Start-Stop:
   1. A programmable heat-pump thermostat with seven day time clock feature and over-ride timer control the system.
   2. The thermostat provides cooling and heating setpoints for Occupied and Un-occupied schedules.
   3. Program the thermostat to the occupied and un-occupied, cooling and heating setpoints in coordination with the User.
   4. Program the thermostat fan operation to ON for the occupied times and to the AUTO mode for the un-occupied times.

B. Safety Controls to Stop Fan:
   1. Smoke Detector in S.A. duct.
   2. Firestat in R.A. duct.
   3. N.C. fire alarm relay.
   4. Float switch in Auxiliary Drain Pan (FCU-5 and FCU-6)

C. Single stage cooling and single stage heating thermostat cycles heat pump, reversing valve, and auxiliary electric heat to maintain thermostat setpoint.

3.03 SPLIT SYSTEM HEAT PUMPS: FCU-4A AND FCU-4B

A. Fan Start-Stop:

1. A programmable heat-pump thermostat with seven day time clock feature and over-ride timer controls the system.
2. The thermostat provides cooling and heating setpoints for Occupied and Un-occupied schedules.
3. Program the thermostat to the occupied and un-occupied, cooling and heating setpoints in coordination with the User.
4. Program the thermostat fan operation to ON for the occupied times and to the AUTO mode for the un-occupied times.

B. Safety Controls to Stop Fan:
1. Firestat in R.A. duct.
2. Smoke Detector in supply air duct.
3. N.C. fire alarm relay.
4. Float switch in Auxiliary Drain Pan.

C. Two-stage cooling and two-stage heating thermostat cycles condensing units, reversing valves, and auxiliary electric heaters in sequence to maintain thermostat setpoint. Provide twinning kit. (Jackson Systems TK-400)

3.04 DUCTLESS SPLIT SYSTEM AIR CONDITIONING UNITS

A. Temperature Controls: Provided with unit. Refer to Section 23 8130.

3.05 MISCELLANEOUS FAN SEQUENCES

A. EF-1: Interlock to operate when FCU-6 thermostat indicates building is occupied.

B. EF-2: Interlock with toilet room lights.

C. SF-1: Interlock to operate when FCU-1 thermostat indicates building is occupied. Open associated OA AVD when fan is ON.

D. SF-2: Interlock to operate when FCU-4A/B thermostat indicates building is occupied. Open associated OA AVD when fan is ON.

E. SF-3: Interlock to operate when FCU-7 thermostat indicates building is occupied. Open associated OA AVD when fan is ON,

END OF SECTION

SECTION 23 3100
HVAC DUCTS AND CASINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal ductwork.

B. Flexible Ducts.

C. Ductwork Fabrication.

1.02 RELATED REQUIREMENTS

A. Section 23 0713 - DUCT INSULATION: External insulation and duct liner.

B. Section 23 3300 - AIR DUCT ACCESSORIES.

1.03 REFERENCE STANDARDS

A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2017.

B. ASTM C443M - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets (Metric); 2011.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

D. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005 (Revised 2009).

E. SMACNA - Duct Cleanliness for New Construction Guidelines., 2000.

F. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; current edition, including all revisions.

1.04 DEFINITIONS

A. Low Pressure Duct: Duct having Pressure Class of 2-inches or less.

B. Medium or High pressure Duct: Duct having Pressure Class over 2-inches.

1.05 SUBMITTALS

A. Refer to Section 23 0510 - General HVAC Requirements for submittal procedures.

B. Product Data: Provide data for :
   1. Duct take-off fittings.
   2. Manufactured metal ductwork and fittings.
   3. Flexible ducts.
   4. Transverse Duct Connection System.

C. Project Record Documents: Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience, and approved by manufacturer.

B. Installer Qualifications: Company specializing in performing the type of work specified in this section, with minimum five years of documented experience.

1.07 FIELD CONDITIONS

A. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.

B. Maintain temperatures within acceptable range during and after installation of duct sealants.

1.08 DELIVERY, STORAGE, AND PROTECTION(REFER TO DUCT CLEANLINESS LEVEL SPECIFIED IN INSTALLATION)

A. Store in clean dry place and protect from weather and construction traffic.

B. Exercise care during construction to prevent the accumulation of dust, dirt, and refuse in the supply and return ductwork.

C. All openings shall be tightly closed with 8-mil polyethylene when work creating dust and debris is in progress.

PART 2 PRODUCTS

2.01 MATERIALS

A. Galvanized Steel for Ducts: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G90/Z275 coating.

B. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.
   1. Type: Heavy mastic or liquid used alone or with tape, suitable for joint configuration and compatible with substrates, and recommended by manufacturer for pressure class of ducts.
   2. VOC Content: Not more than 250 g/L, excluding water.
   3. Surface Burning Characteristics: Flame spread index of zero and smoke developed index of zero, when tested in accordance with ASTM E84.
   4. Manufacturers:
      a. Manufacturers (water based): Ductmate Proseal, Hardcast IronGrip 601, Marathon 460, Foster 32-19; Childers CP-146, DuroDyne SAS.

2.02 DUCTWORK FABRICATION

A. General:
   1. Fabricate and support in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

B. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

C. Provide turning vanes of perforated metal with glass fiber insulation when acoustical lining is indicated.

D. All dimensions are net inside metal measurements in inches unless otherwise shown.

E. Duct sizes shown include allowance for liner thickness unless otherwise noted, except sizes shown for lined round spiral and flat oval duct are sizes of perforated inner liner

F. Transverse Duct Connection System: SMACNA "E" rated rigidly class connection, interlocking angle and duct edge connection system with sealant, gasket, cleats, and corner clips.

G. Low Pressure Duct- Supply, Return, and Exhaust (2" Class or less):
   1. Longitudinal Seams:
      a. Corner Seams: Fig. 2-2, Type L1 (Pittsburgh Lock).
         1) Corner seams for ducts less than 18 inch, L-2 (Button Punch Snap Lock) is acceptable.
      b. Fig. 2-2, Type L-3 for seams other than corner.
   2. Transitions:
      a. Changes in duct sizes shall be made by transitions.
      b. Refer to Fig. 4-7, CONCENTRIC TRANSITION, unless otherwise noted.
      c. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.
      d. Transitions shall be provided between equipment and duct where sizes are not the same.
   3. Rectangular Duct:
      a. Elbows:

1) Mitered with turning vanes. Type RE 2, Figure 4-2, unless otherwise noted.

b. Turning Vanes:
1) Turning vanes shall be in accordance with Figs 4-3 and 4-4, unless otherwise noted.
2) Provide single wall vanes for ducts 18" width or less.
3) Provide double wall vanes for ducts over 18" width.

c. Splits and Tees:
1) Fig. 4-5, Type 1, Type 2 (with stationary splitter), 4A, or 4B only.
2) Use of Square Throat Elbow with Turning Vanes is acceptable, unless otherwise noted.
(a) Provide volume control damper in each branch.
3) Omit volume control damper in Return and Exhaust duct unless otherwise noted.

d. Where acoustical lining is indicated, provide acoustical turning vanes of perforated metal with glass fiber insulation.

4. Round Duct - Manufactured Spiral Duct:
a. Elbows: Radius elbow with radius not less than 1-1/2 times width of duct on centerline.

5. Branch and Runout Connections:
a. Entry fittings for Return and Exhaust: Construct for a 45 degree entry angle to ease the turbulence created by converging airstreams. Increase the minimum length shown in Fig. 4-6, 45 DEGREE ENTRY, from 4 inch to 6 inch.
b. Rectangular Branch or Runout from Rectangular Duct:
1) Fig. 4-6, 45 DEGREE ENTRY, with flange and gasket for connection to trunk with a minimum of six screws.
c. Round Branch or Runout from Rectangular Duct:
1) Fig. 4-6, 45 DEGREE LEAD IN, with flange and gasket for connection to trunk with a minimum of six screws.
2) Provide volume control damper with locking quadrant at branch or runout connection.
d. Round Branch or Runout from Round Duct:
1) Fig. 3-5, 90 DEGREE tee fitting with 45 DEGREE oval to round tap, unless otherwise noted.
2) Fig. 3-6, CONICAL TEE fitting.
e. Rectangular Runout to Sidewall Grille/Register:
1) Fig. 4-6, 45 DEGREE ENTRY, with flange and gasket for connection to trunk with a minimum of six screws.

6. Offsets: Fig. 4-7, Type 1 and Type 3 only, unless otherwise indicated.
7. Dampers: Fig. 7-4, SINGLE BLADE TYPE, or 7-5, MULTIBLADE TYPE.
8. Reinforcement:
a. Fabricate ducts in clearance critical areas such as chases and above ceilings to unreinforced standards, Fig. 2-8.
1) Tie Rod Reinforcement is acceptable in Supply, Return, and Exhaust duct only.
2) No screw or rivets are allowed to penetrate ducts.

H. Fabricate continuously welded round and oval duct fittings in accordance with SMACNA (DCS).

I. Field Fabricated Mixing Plenums:
1. Outer wall to provide pressure class rating scheduled.
2. Provide 2 inch acoustical lining.
3. Inner wall to be 20 gauge perforated sheet metal.
4. For air handling unit mixed air plenums, provide LOCK Type 2, Fig. 7-2M.

J. Ducts Connecting to Wall Louvers:
1. Provide sheet metal plenum sealing louver area and connecting duct.
2. Fabricate in accordance with Fig. 6-1.

3. Fabricate plenum using same material and pressure class as connecting duct.
4. Paint exterior side of plenum flat black.

2.03 MANUFACTURED DUCTWORK AND FITTINGS

A. Manufacture in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

B. Flexible Ducts: UL 181, Class 1, aluminum laminate and polyester film with latex adhesive supported by helically wound spring steel wire.
1. Insulation: Fiberglass insulation with polyethylene vapor barrier film.
2. Insulation thickness shall be 1 inch thick, minimum; 3/4 lbs./cu ft., minimum.
3. Pressure Rating: 10 inches WG positive and 1.0 inches WG negative.
4. Maximum Velocity: 4000 fpm.
5. Temperature Range: Minus 20 degrees F to 210 degrees F.
6. Manufacturers:
   a. Atco Rubber Products, Inc.; Model UPC-037: www.atcoflex.com.
   b. Flexible Technologies Group-Thermaflex, Inc.; Model M-KE: www.thermaflex.net
   c. Flexmaster USA; Model Type 3M: www.flexmasterusa.com.
   d. Wiremold, Inc.; Model WK: www.wiremold.com.

C. Transverse Duct Connection System: SMACNA "E" rated rigidly class connection, interlocking angle and duct edge connection system with sealant, gasket, cleats, and corner clips in accordance with SMACNA (DCS).

PART 3 EXECUTION

3.01 INSTALLATION

A. Install, support, and seal ducts in accordance with SMACNA (DCS).

B. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

C. Duct sizes for lined duct are net metal and include allowance for liner. For unlined duct, sizes are inside clear dimensions.

D. Duct sizes for runouts to grilles, registers and diffusers shall match the size of the device unless otherwise noted.

E. Duct Cleanliness level: Advanced Level in accordance with SMACNA Duct Cleanliness for New Construction Guidelines.

F. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

G. Provide minimum 24 inch wide by 48 inch high access door in field fabricated mixing plenums of same construction as the mixing plenums.

H. Use double nuts and lock washers on threaded rod supports.

I. Seal all transverse and longitudinal joints in all metal supply, exhaust and return ducts.

3.02 SCHEDULES

A. Ductwork Material:
1. Low Pressure Supply: Galvanized Steel.
2. Return and Relief: Galvanized Steel.
3. General Exhaust: Galvanized Steel.
4. Outside Air Intake: Galvanized Steel.

B. Ductwork Pressure Class:
1. Supply System: 2 inch.
2. Return and Relief: 2 inch.
3. General Exhaust: 2 inch negative.
4. Outside Air Intake: 2 inch negative.

5. Mixing Plenums: 2 inch.

END OF SECTION

SECTION 23 3300
AIR DUCT ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Duct access doors.

B. Fire dampers.

C. Flexible duct connections.

D. Volume control dampers.

1.02 RELATED REQUIREMENTS

A. Section 23 3100 - HVAC DUCTS AND CASINGS.

1.03 REFERENCE STANDARDS

A. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2015.

B. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005 (Revised 2009).

C. UL 33 - Safety Heat Responsive Links for Fire-Protection Service; Current Edition, Including All Revisions.

D. UL 555 - Standard for Fire Dampers; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. Refer to Section 23 0510 - General HVAC Requirements for submittal procedures.

B. Product Data: Provide for shop fabricated assemblies including volume control dampers. Include electrical characteristics and connection requirements.

C. Manufacturer's Installation Instructions: Provide instructions for fire dampers.

D. 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 Fusible Links: One of each type and size.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

PART 2 PRODUCTS

2.01 DUCT ACCESS DOORS(AP)

A. Manufacturer: Cesco Model *AD.

B. Other acceptable manufacturers offering equivalent products: Airstream, Flexmaster Inspector Series, Nailor Industries Model 0800, National Controlled Air ADR, Prefco, Ruskin, Ventlok, Pottorff.

C. Fabrication:
   1. Factory fabricated in accordance with SMACNA (DCS) - HVAC Duct Construction Standards - Metal and Flexible, Figures 7-2, 7-3 and as indicated.
   2. Rigid and close-fitting of galvanized steel with sealing gaskets and quick fastening locking devices.
   3. Install minimum 1 inch thick insulation with sheet metal cover for insulated ducts.
   4. Access doors up to 2 inch pressure class:
      a. Less Than 12 inches Square: Secure with sash locks.
      b. Up to 18 inches Square: Provide two hinges and two sash locks.
      c. Up to 24 x 48 inches: Three hinges and two compression latches with outside and inside handles.
      d. Larger Sizes: Provide an additional hinge.

5. Fabricate access doors over 2 inch pressure class in accordance with Figure 7-2.

D. Access doors with sheet metal screw fasteners are not acceptable.

2.02 FIRE DAMPERS(FD)

A. Manufacturer: Ruskin.

B. Other acceptable manufacturers offering equivalent products: Advanced Air, Inc., Air Balance, Air Control Products, Airstream, American Warming and Ventilating, Cesco, Greenheck, Louvers and Dampers, Nailor Industries, National Controlled Air, Pacific Air Products, Phillips, Safe-Aire, Shipman, United, Ventco, Pottorff.

C. Fabricate in accordance with NFPA 90A and UL 555 for dynamic systems, and as indicated.

D. Curtain Type Dampers: Galvanized steel with interlocking blades. Provide stainless steel closure springs and latches for horizontal installations.

E. Fusible Links: UL 33, separate at 165 degrees F with adjustable link straps for combination fire/balancing dampers.

F. Dampers shall be Type 'A' with breakaway connections, same size as duct unless otherwise noted. Net damper opening of low resistance type 'B' dampers in retracted position shall not be less than 90% of cross sectional area of attached duct.

G. Multiple Fire Damper Assemblies (Vertical Installations; Allowed Only for Sizes Exceeding 48 inches in Length or Width): Fire dampers assembled together to form protection for a single opening shall be provided with steel mullion(s) meeting the requirements of UL 555 Standard for Safety Fire Dampers and Ceiling Dampers.

2.03 FLEXIBLE DUCT CONNECTIONS

A. Fabricate in accordance with SMACNA (DCS) - HVAC Duct Construction Standards - Metal and Flexible, Figures 7-8 and 7-9, and as indicated.

B. Flexible Duct Connections: Fabric crimped into metal edging strip.

C. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A, minimum density 30 oz. per sq. yd.
   1. Net Fabric Width: Approximately 2 inches wide.
   2. Metal: 3 inches wide, 24 gage, 0.0239 inch thick galvanized steel.

2.04 VOLUME CONTROL DAMPERS (MVD).

A. Manufacturer: Ruskin MD35.

B. Other acceptable manufacturers offering equivalent products: Airstream, Arrow, Greenheck, Nailor Industries, National Controlled Air, Prefco, Pottorff.

C. Single Blade Dampers: Figure 7-4. Fabricate for duct sizes up to 6 x 30 inch.

D. Multi-Blade Damper: Figure 7-5. Fabricate of opposed blade pattern with maximum blade sizes 8 x 48 inch long. Assemble center and edge crimped blades in galvanized channel frame with suitable hardware; 16 gauge, minimum, steel channel frame with blade stops top and bottom; 16 gauge steel blades with formed edge groove to have 3/8 inch interlock between adjacent blades, with 1/2 inch diameter cadmium plated shaft extended 6 inches beyond frame and blade linkage.

E. End Bearings: Except in round ducts 12 inches and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon or sintered bronze bearings.

F. Quadrants:
   1. Provide locking, indicating quadrant regulators on single and multi-blade dampers.
   2. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA (DCS). Refer to Section 23 3100 for duct construction and pressure class.

B. Duct Access Doors:
   1. Provide duct access doors for inspection and cleaning before automatic dampers and fire dampers and elsewhere as indicated for service access or cleaning access.
   2. Provide minimum 8 x 8 inch size for hand access, 18 x 18 inch size for shoulder access, and as indicated. Provide 4 x 4 inch for balancing dampers only. Review locations prior to fabrication.

C. Label access doors as required by NFPA 90A.

D. Provide fire dampers at locations indicated, where ducts and outlets pass through fire rated components. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.

E. Demonstrate re-setting of fire dampers to Owner's representative.

F. Provide flexible connections immediately adjacent to equipment in ducts associated with fans and motorized equipment, and supported by vibration isolators. Refer to Section 23 0548.

G. Volume Control Dampers:
   1. Install where shown on drawings or required by details.
   2. Lock all volume control dampers in the full open position for adjustment by the TAB agency.

END OF SECTION

SECTION 23 3423
HVAC POWER VENTILATORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Inline centrifugal fans.

B. Ceiling exhaust fans.

1.02 RELATED REQUIREMENTS

A. Section 23 0513 - MOTORS FOR HVAC EQUIPMENT.

B. Section 26 2717 - Equipment Wiring: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

A. AMCA (DIR) - [Directory of] Products Licensed Under AMCA International Certified Ratings Program; http://www.amca.org/certified/search/company.aspx.

B. AMCA 99 - Standards Handbook; 2010.

C. AMCA 204 - Balance Quality and Vibration Levels for Fans; 2005.

D. AMCA 210 - Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating; 2007.

E. AMCA (DIR) - [Directory of] Products Licensed Under AMCA International Certified Ratings Program; Air Movement and Control Association International, Inc.; http://www.amca.org/certified/search/company.aspx.

F. AMCA 300 - Reverberant Room Method for Sound Testing of Fans; 2014.

G. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data; 2014.

H. NEMA MG 1 - Motors and Generators; 2014.

I. UL 705 - Power Ventilators; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. Refer to Section 23 0510 - General HVAC Requirements for submittal procedures.

B. Product Data: Provide data on fans and accessories including fan curves with specified operating point clearly plotted, power, RPM, sound power levels at rated capacity, and electrical characteristics and connection requirements.

C. Manufacturer's Instructions: Indicate installation instructions.

D. Maintenance Data: Include instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

E. 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 Fan Belts: One set for each individual fan.

1.05 QUALITY ASSURANCE

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.06 DELIVERY, STORAGE, AND PROTECTION

A. Refer to Section 23 0510 - General HVAC Requirements for delivery, storage and protection requirements.

B. Do not operate units until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

1.07 FIELD CONDITIONS

A. Permanent ventilators may be used for ventilation during construction only after ductwork is clean, filters are in place, bearings have been lubricated, and fan has been test run under observation.

1.08 EXTRA MATERIALS

A. See Section 01 6000 - Product Requirements, for additional provisions.

B. Provide a second adjustable sheave for each belt driven fan to place belt at mid-position of sheave at RPM required for final air balance.

PART 2 PRODUCTS

2.01 POWER VENTILATORS - GENERAL

A. Static and Dynamically Balanced: AMCA 204 - Balance Quality and Vibration Levels for Fans.

B. Performance Ratings: Determined in accordance with AMCA 210 and bearing the AMCA Certified Rating Seal.

C. Sound Ratings: AMCA 301, tested to AMCA 300 and bearing AMCA Certified Sound Rating Seal.

D. Fabrication: Conform to AMCA 99.

E. UL Compliance: UL listed and labeled, designed, manufactured, and tested in accordance with UL 705.

F. Electrical Components: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

2.02 INLINE CENTRIFUGAL FANS(ILC)

A. Manufacturers: Acme XB, Breidert BIC, Cook SQI, Greenheck BSQ, Peerless Centrifan, PennBarry SX, Rupp RA, Twin City ILB.

B. Motor: Refer to Section 23 0513.

C. Fan Unit: Air foil centrifugal fan with V-belt as indicated, aluminum wheel, belt guard, companion flanges, inlet cone, flow vanes, grease lubricated with external fittings, and access door.

D. Disconnect Switch: Factory wired, non-fusible, in housing for thermal overload protected motor . Provide NEMA 1 housing for interior locations and NEMA 3R for exterior locations.

E. Backdraft Damper: Gravity actuated, aluminum multiple blade construction, felt edged with offset hinge pin, nylon bearings, blades linked.

F. Drive and Sheaves: Drives rated at 1.5 time motor HP, minimum. Cast iron or steel sheaves, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheave selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.

2.03 CABINET(CAB) AND CEILING(CLG) EXHAUST FANS

A. Manufacturers: Acme V, Carnes VCDB, Cook Gemini, Greenheck SP, Jenn J, PennBarry Z, Powerline CF, Rupp CF, Twin City TCTB.

B. Motor: Refer to Section 23 0513.

C. Centrifugal Fan Unit: Direct driven unless noted otherwise with galvanized steel housing lined with acoustic insulation, resilient mounted motor, gravity backdraft damper in discharge.

D. Disconnect Switch: Cord and plug in housing for thermal overload protected motor and wall mounted switch.

E. Capacity Control: Solid State speed controller mounted on/in fan housing.

F. Grille for ceiling mounted fan(s): Molded white plastic.

G. Service Access: Removable grille for ceiling mounted fan(s) or access panel for inline cabinet fan(s).

H. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheaves selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.

PART 3 EXECUTION

3.01 PREPARATION

A. Seal all duct roof penetrations at roof structure air-tight.

B. Ensure exhaust duct is clean and free of debris.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide backdraft dampers on outlet from cabinet and ceiling exhauster fans and as indicated.

3.03 STARTING EQUIPMENT

A. Adjust for proper operation within manufacturer's published tolerances.

B. Demonstrate proper operation of equipment to Owner 's designated representative.

3.04 SCHEDULES

A. Refer to Schedule on Drawings.

END OF SECTION

SECTION 23 3700
AIR OUTLETS AND INLETS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Diffusers

B. Registers/grilles

C. Louvers

1.02 SUBMITTALS

A. Refer to Section 23 0510 - General HVAC Requirements for submittal procedures.

B. Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.

PART 2 PRODUCTS

2.01 RECTANGULAR LOUVERED FACE (RLF2) CEILING DIFFUSERS

A. Manufacturer: Titus Model TDC.

B. Other acceptable manufacturers offering equivalent products:
   1. Nailor Model 6500.
   2. Carnes Model SKBA.
   3. Price Model SMD.
   4. Krueger Model SH.
   5. Tuttle & Bailey 'MSR'.

C. Type: Square and rectangular, multi-louvered diffuser with flush face, round neck duct connection and rod mounted air pattern deflectors as required by pattern indicated on floor plans.

D. Frame: Surface Mount, Snap-In, Inverted T-Bar(Lay-in), or Spline type to match ceiling. Refer to schedule on Drawings. A rapid mount plaster sub-frame may be substituted to convert a Lay-in frame for use in a sheetrock or plaster ceiling provided that the diffuser & frame match the face size specified.

E. Fabrication: Diffusers shall be constructed of 24 gauge steel or 0.04 aluminum and shall have a finish as scheduled.

F. Dimensions:
   1. The diffuser neck shall have a minimum 1 1/8-inch depth for duct connection.

G. Accessories:
   1. Radial opposed blade damper adjustable from diffuser face as scheduled on drawings.
   2. Provide 24" x 24" module for ceiling diffusers in a lay-in ceiling.

2.02 CEILING GRID CORE EXHAUST AND RETURN REGISTERS/GRILLES (CGC)

A. Manufacturer: Titus Model 50F

B. Other acceptable manufacturers offering equivalent products:
   1. Anemostat GC5
   2. Carnes RAPAF
   3. Price 80
   4. Krueger RA
   5. Nailor 51EC.
   6. MetalAire CC5
   7. Tuttle & Bailey CRE500

C. Type: Fixed grilles of 1/2 x 1/2 x 1/2 inch eggcrate grid core.

D. Fabrication: Aluminum with factory off-white enamel finish.

E. Frame: 1-1/4 inch margin with countersunk screw mounting.

F. Damper: Integral, gang-operated, opposed blade type with removable key operator, operable from face.

2.03 WALL EXHAUST AND RETURN REGISTERS/GRILLES (WRAG)

A. Manufacturer: Titus Model 350RL.

B. Other acceptable manufacturers offering equivalent products:
1. Krueger.
2. MetalAire -SRH .
3. Tuttle & Bailey T70D.

C. Type: Streamlined blades, 3/4 inch minimum depth, 3/4 inch maximum spacing, with 35 degree, minimum fixed blade deflection, horizontal face.

D. Frame: 1-1/4 inch margin with countersunk screw mounting.

E. Fabrication: Steel frames and blades, with factory finish .

F. Damper: Integral, gang-operated, opposed blade type with removable key operator, operable from face.

2.04 NARROW BLADE WALL EXHAUST AND RETURN REGISTERS/GRILLES(NBW)

A. Manufacturer: Titus Model 1700L.

B. Other acceptable manufacturers offering equivalent products:
1. Anemostat 2250.
2. Carnes 6700.
3. Price 42CD.
4. Krueger AL5815-FR820.
5. MetalAire 42CD.
6. Tuttle & Bailey GHA.

C. Type: Streamlined narrow blade core with fixed blades in removable core, 3/4 inch minimum depth, 5/16 inch maximum blade spacing, with device to set cores in one of four air pattern deflections, horizontal face. Model Numbers listed are for supply registers. Return grilles/registers shall have matching core without indents.

D. Frame: 1 inch ,minimum, margin with countersunk screw mounting.

E. Fabrication: Steel frames and blades, with factory finish as scheduled on Drawings.

F. Damper: Integral, gang-operated, opposed blade type with removable key operator, operable from face where scheduled.

2.05 LOUVERS-ALUMINUM-DRAINABLE BLADE STYLE

A. Manufacturer: Ruskin Model ELF-6375DX.

B. Other acceptable manufacturers offering equivalent products:
1. American Warming & Ventilating LE-33.
2. Air Balance .
3. Arrow EA-615-D.
4. Dowco DW-6.
5. Greenheck ESD-603.
6. Industrial Louvers 653.
7. Louvers & Dampers IEL-6.
8. Shipman LE-33.
9. Tuttle & Bailey DB-645.

C. Type: 6 inch deep with blades on 45 degree slope, drainable blade with gutter, heavy channel frame, 19 gauge birdscreen with 1/2 inch square mesh for exhaust and 3/4 inch for intake.

D. Fabrication: 12 gage thick extruded aluminum, welded assembly, with factory baked enamel finish color to be selected.

E. Mullions: Provide hidden or exposed mullions to support blades as shown on architectural elevations.

F. Mounting: Furnish with masonry strap anchors for installation.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Check location of outlets and inlets and make necessary adjustments in position to conform with architectural features, symmetry, and lighting arrangement.

C. Install diffusers to ductwork with air tight connection.

3.02 AIR OUTLET AND INLET SCHEDULE

A. Refer to Schedule on Drawings.

END OF SECTION

SECTION 23 4000
HVAC AIR CLEANING DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Disposable panel filters.

B. Extended surface non-supported media Outside Air filters.

C. Filter frames and housings.

1.02 RELATED SECTIONS

A. Section 23 0510 - General HVAC Requirements - Space Conditioning during construction and building flushout.

B. Section 23 0519 - Gages and Meters - Filter Gages.

1.03 REFERENCE STANDARDS

A. UL 900 - Standard for Air Filter Units; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. Refer to Section 23 0510 - General Mechanical Requirements for submittal procedures.

B. Product Data: Provide data on filter media, filter performance data, filter assembly and filter frames, dimensions, motor locations and electrical characteristics and connection requirements.

C. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Provide filters whenever any system is operated during construction. Refer to Section 23 0510.
   3. For every system requiring fitters;
      a. Provide and install one set of new disposable panel filters at Material Completion.
      b. Provide one set of spare disposable panel filters at Material Completion.

PART 2 PRODUCTS

2.01 EXTENDED SURFACE NON-SUPPORTED MEDIA OUTSIDE AIR FILTERS

A. Manufacturers: Fiber Bond , Model Dustlok DL-440, Air Guard or American Air Filter.

B. Media: UL 900 Class 2 polyester fiber preformed into two tapered pockets treated with an anti-microbial biocide.

C. Biocide:
   1. The antimicrobial shall effectively control the growth of mold, algae, mildew, and fungi on the filter. The filter shall not support the growth of microbes.
   2. Regulations:
      a. The antimicrobial must be registered by the E.P.A. for the use in filters.
      b. Clearance for use under regulations of U.S.D.A. and F.D.A.
      c. All testing on the antimicrobial must be in compliance with the American Society of Test Methods (ASTM).

D. Frame: Galvanized steel.

E. Nominal size: 20x24.

F. Nominal thickness: 15 inch.

G. Minimum Efficiency Reporting Value (MERV): 8, when tested in accordance with ASHRAE 52.2.

H. Recommended final resistance: 1.0 inch WG.

2.02 DISPOSABLE PANEL FILTERS

A. Media: UL 900 Class 2, fiber blanket, factory sprayed with flameproof, non-drip, non-volatile adhesive.

1. Thickness: 1 inch.

B. Performance Rating:
   1. Face Velocity: 500 FPM.
   2. Initial Resistance: 0.15 inch WG.
   3. Recommended Final Resistance: 0.50 inches WG.

C. Casing: Cardboard frame.

2.03 FILTER FRAMES AND HOUSINGS

A. Manufacturers: Provide housing of same manufacturer as filter media supplied

PART 3 EXECUTION

3.01 INSTALLATION

A. Install air cleaning devices in accordance with manufacturer's instructions.

B. Prevent passage of unfiltered air around filters with felt, rubber, or neoprene gaskets.

C. Do not operate fan system until filters (temporary or permanent) are in place. Replace temporary filters used during construction and testing, with clean set.

END OF SECTION

SECTION 23 8101

TERMINAL HEAT TRANSFER UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electric heaters.

1.02 RELATED REQUIREMENTS

A. Section 23 0510 - General HVAC Requirements - Submittals

B. Section 26 2717 - Equipment Wiring: Electrical characteristics and wiring connections. Installation of room thermostats. Electrical supply to units.

1.03 SUBMITTALS

A. Refer to Section 23 0510 - General HVAC Requirements for submittal procedures.

B. Product Data: Provide typical catalog of information including arrangements.

C. Refer to Submittals in Section 23 0510 for requirements regarding Tabulation of Power Wiring Requirements.

D. Manufacturer's Instructions: Indicate installation instructions and recommendations.

E. Operation and Maintenance Data: Include manufacturers descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listings.

1.04 QUALITY ASSURANCE

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.05 DELIVERY, STORAGE, AND PROTECTION

A. Refer to Section 23 0510 - General HVAC Requirements for general delivery, storage and protection requirements.

B. Do not operate duct mounted equipment until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

PART 2 PRODUCTS

2.01 ELECTRIC WALL HEATERS(EWH)

A. Manufacturer: Qmark Model AWH-4000.

B. Other acceptable manufacturers offering equivalent products: Berko FRC, Electromode RFAC, Erincraft AWH, Markel 3400, Raywall AFA, Singer Series 5900.

C. Assembly: UL listed and labelled with terminal box and cover, and built-in controls.

D. Heating Elements: Enclosed copper tube, aluminum finned element of coiled nickel-chrome resistance wire centered in tubes and embedded in refractory material.

E. Enclosure: Minimum 0.030 inch steel box for recessed mounting with removable 16 gauge steel bar grille with satin finished aluminum frame.

F. Fan: Direct drive propeller type, statically and dynamically balanced.

G. Motor: Permanently lubricated, sleeve bearings.

H. Built-in Controls:
   1. Power disconnect switch.
   2. Automatic reset thermal overload protector.
   3. Tamper-proof bi-metal thermostat with 40-90 Degree F range adjustable through grille face.

2.02 ELECTRIC UNIT HEATERS(EUH)

A. Manufacturers:
   1. Berko; Model HUH.

2. Electromode; Model EUH.
3. INDEECO (Industrial Engineering and Equipment Company): www.indeeco.com/#sle.
4. Markel; Model 5100.
5. QMARK; Model MUH.
6. Raywall; Model UH.

B. Assembly: UL listed and labelled assembly with terminal box and cover, and built-in controls.

C. Heating Elements: Enclosed copper tube, aluminum finned element of coiled nickel-chrome resistance wire centered in tubes and embedded in refractory material.

D. Cabinet: 0.0478 inch steel with easily removed front panel with integral air outlet and inlet grilles.

E. Element Hangers: Quiet operating, ball bearing cradle type providing unrestricted longitudinal movement, on enclosure brackets.

F. Fan: Direct drive propeller type, statically and dynamically balanced, with fan guard.

G. Motor: Permanently lubricated, sleeve bearings for horizontal models, ball bearings for vertical models.

H. Control: Separate fan speed switch and thermostat heat selector switch, factory wired, with switches built-in behind cover. Provide thermal overload.

I. Electrical Characteristics:
1. Refer to the power requirements indicated on the electrical drawings.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install terminal units in a readily accessible location.

C. Install equipment exposed to finished areas after walls and ceiling are finished and painted. Do not damage equipment or finishes.

D. Protection: Provide finished cabinet units with protective covers during balance of construction.

E. Install electric heating equipment including devices furnished by manufacturer but not factory-mounted. Furnish copy of manufacturer's wiring diagram submittal.

3.02 CLEANING

A. After construction is completed, including painting, clean exposed surfaces of units. Vacuum clean coils and inside of cabinets.

3.03 SCHEDULES

A. Refer to Schedules on the Drawings.

END OF SECTION

SECTION 23 8128
SPLIT SYSTEM AIR CONDITIONERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Interior Unit.

B. Exterior Unit.

C. Controls.

1.02 RELATED SECTIONS

A. Section 23 0510 - General HVAC Requirements - Warranty.

B. Section 23 0513 - Motors for HVAC Equipment: Evaporator and condenser fan motors.

C. Section 23 2300 - Refrigerant Piping and Specialties.

1.03 REFERENCES

A. ARI 210/240 - Unitary Air-Conditioning and Air-Source Heat Pump Equipment; Air-Conditioning and Refrigeration Institute; 1994.

B. ARI 270 - Sound Rating of Outdoor Unitary Equipment; Air-Conditioning and Refrigeration Institute; 1995.

C. NEMA MG 1 - Motors and Generators; National Electrical Manufacturers Association; 1993 (and Revision 1,2,3,4).

D. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; National Fire Protection Association; 2012.

1.04 PERFORMANCE REQUIREMENTS

1.05 SUBMITTALS

A. See Section 23 0510 - General HVAC Requirements, for submittal procedures.

B. Product Data: Provide data for manufactured products and assemblies. Indicate water, drain, thermostatic valves, and electrical rough-in connections with electrical characteristics and connection requirements.

C. Manufacturer's Instructions: Indicate assembly, support details, connection requirements, and include start-up instructions.

D. Maintenance Data: Include instructions for lubrication, filter replacement, motor and drive replacement, spare parts lists, and wiring diagrams.

E. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.07 WARRANTY

A. See Section 23 0510 - General HVAC Requirements, for additional warranty requirements.

B. Provide a five year warranty to include coverage for compressor including materials only.

1.08 EXTRA MATERIALS

A. See Section 01 6000- Product Requirements, for additional provisions.

B. Provide one set of disposable panel filters for each unit at Final Inspection.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. The Carrier Corporation.

B. The Trane Company.

C. York International, Inc..

2.02 AIR CONDITIONING UNITS

A. Description: Packaged, split system, factory fabricated units, consisting of interior and exterior units, controls .

B. Assembly: Up flow air delivery, in draw-through configuration as indicated.

2.03 INTERIOR UNIT

A. Cabinet
   1. Frame and Panels: Galvanized steel with baked enamel finish, easily removed access doors or panels with quick fasteners.
   2. Insulation: Minimum 1/2 inch thick acoustic duct liner for lining cabinet interior.
   3. Drain Pan: Galvanized steel with corrosion-resistant coating.

B. Evaporator fan
   1. Fan: Direct drive, double width, double inlet, forward curved centrifugal fan, statically and dynamically balanced, resiliently mounted.
   2. Motors: single phase, 60 Hz; multi-speed PSC type; Refer to electrical Drawings for voltage.

C. Evaporator coil
   1. Direct expansion coiling coil of seamless copper tubes expanded into aluminum fins.
   2. Refrigeration circuit with fixed metering device (capillary tube) unless noted otherwise.

D. Auxiliary electric heat
   1. Assembly: UL listed and labelled assembly with steel frame and side mounted control cabinet and cover, and built-in controls.
   2. Heating Elements: Exposed helical coil of nickel-chrome resistance wire with refractory ceramic support bushings.
   3. Control Cabinet: 0.0478 inch steel with hinged front panel with latching disconnect switch.
   4. Built-in Controls: Disconnect in control panel face, mercury controlling contactors, manually resettable thermal cut-outs, 24 Volt control transformer, circuit fuses for heaters over 48 Amps, factory wired differential air-flow switch and terminal blocks.

E. Disconnect Switch: Factory mounted disconnect switch or circuit breaker for single point power connection with fan motor power plug.

F. Air filters
   1. Easily removed one inch thick disposable panel filters.

2.04 EXTERIOR UNIT

A. Casing
   1. House components in welded steel frame with galvanized steel panels with weather resistant, baked enamel finish.
   2. Mount starters, disconnects, and controls in weatherproof panel provided with full opening access doors. Provide mechanical interlock to disconnect power when door is opened.
   3. Provide removable access doors or panels with quick fasteners and piano hinges.

B. Compressor
   1. Hermetically sealed, 3600 rpm maximum, resiliently mounted with positive lubrication and internal motor protection.
   2. Compressor: Hermetic reciprocating type or Hermetic scroll type.
   3. Sump Oil Heater: Evaporates refrigerant returning to sump during shut down. Energize heater thermostatically when compressor is not operating.

C. Condenser coils
   1. Coils: Aluminum fins mechanically bonded to seamless copper tubing or all aluminum fins and tube. Air test under water to 425 psig, and vacuum dehydrate. Seal with holding charge of refrigerant.

2. Coil Guard: Louvered or PVC coat steel wire .

D. Fans and motors
1. Vertical discharge direct driven propeller type condenser fans with fan guard on discharge.
2. Fan Guard: Louvered or PVC coated steel wire.

E. Refrigerant circuit
1. Refrigerant: Precharge unit with R-410a
2. For each refrigerant circuit, provide:
a. Filter dryer liquid line.
b. Liquid line sight glass and moisture indicator.
c. Thermal expansion valve for maximum operating pressure.
d. Suction accumulator.
e. Suction and liquid line service valves .
f. Charging valve.
g. Condenser pressure relief mechanism.

F. Controls
1. Factory wired with single point power connection.
2. Factory wired controls shall include contactor, high and low pressure cutouts, internal winding thermostat for compressor, control circuit transformer, non-cycling reset relay.
3. Provide a surge capacitor and lightning arrestor in unit cabinet for protection from power surges due to lightning and switching transients.
4. Five minute stop to restart timer prevents compressor from short cycling.

2.05 CONTROLS

A. Provide electric solid state microcomputer based room thermostat, located as indicated.
1. Incorporate:
a. Automatic switching from heating to cooling.
b. Preferential rate control to minimize overshoot and deviation from set point.
c. Instant override of setpoint for continuous or timed period from one hour to 31 days.
d. Short cycle protection.
e. Programming based on weekdays, Saturday and Sunday.
2. Display shall include:
a. Time of Day.
b. Actual room temperature.
c. Programmed temperature.
d. Day of week.
e. System mode indication: Heating, cooling, auto, off, fan auto, fan on.
f. Stage (heating or cooling) operation.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide level housekeeping pad or base as indicated.

C. Pipe refrigerant piping from interior unit to exterior unit; refer to section 23 2300.

D. Drain Pan: Route discharge from cooling coil drain pan to floor drain with drawn copper tube, full size of connection. Provide air seal trap (Refer to detail on drawings).

E. Auxiliary Drain Pan: Provide 22 gauge, G90 galvanized steel, auxiliary drain pan, 2 inches deep and extending beyond unit 3 inches on all sides, on units in locations other than in mechanical equipment rooms located on grade with floor drains. Mount factory condensate overflow switch in auxiliary drain pan and wire to unit.

F. Install flexible connections specified in Section 23 3300 between fan inlet and discharge ductwork. Ensure metal bands of connectors are parallel with minimum one inch flex between ductwork and unit while running.

G. Electric Duct Coils: Wire in accordance with NFPA 70. Refer to Section 26 2717.

H. Check and verify location of thermostats with plans and room details before construction of wall assemblies. Locate between 42 to 48 inches above finished floor. Mount at common elevation within same space. Align with lighting switches .

I. Mount in center of 8x8 inch block face with recessed mounting box and accessory wall adapter plate covering block opening where mounted in concrete masonry units.

J. Interlock safety devices required by Section 23 0913 for safety shutdown.

3.02 SCHEDULES

A. Capacities shall not be less than scheduled when matched together; 45 F minimum SST, 95 F ODT.

B. Refer to schedule on Drawings.

END OF SECTION

SECTION 23 8130

DUCTLESS SPLIT SYSTEM AIR CONDITIONERS(DAC-* & DCU-*)

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Interior Unit.

B. Exterior Unit.

C. Controls.

1.02 RELATED SECTIONS

A. Section 23 0510 - General HVAC Requirements - Warranty.

B. Section 23 0513 - Motors for HVAC Equipment: Evaporator and condenser fan motors.

C. Section 23 2300 - Refrigerant Piping and Specialties.

1.03 REFERENCES

A. ARI 210/240 - Unitary Air-Conditioning and Air-Source Heat Pump Equipment; Air-Conditioning and Refrigeration Institute; 1994.

B. ARI 270 - Sound Rating of Outdoor Unitary Equipment; Air-Conditioning and Refrigeration Institute; 1995.

C. NEMA MG 1 - Motors and Generators; National Electrical Manufacturers Association; 1993 (and Revision 1,2,3,4).

D. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilation Systems; National Fire Protection Association; 1996.

1.04 PERFORMANCE REQUIREMENTS

A. Air entering exterior coil-summer: 95 degrees F.

B. Coordinate refrigerant pipe routing with Contractor and provide equipment whose scheduled length limitation exceeds the refrigerant piping length requirements.

1.05 SUBMITTALS

A. Refer to Section 23 0510 - General HVAC Requirements for submittal procedures.

B. Product Data: Provide data for manufactured products and assemblies. Indicate water, drain, thermostatic valves, and electrical rough-in connections with electrical characteristics and connection requirements.

C. Refrigerant Piping: Obtain manufacturer's recommendations for piping and piping appurtenances for the equipment supplied and incorporated into the refrigerant piping specified in Section 23 2300.

D. Manufacturer's Instructions: Indicate assembly, support details, connection requirements, and include start-up instructions.

E. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

1.06 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. See Section 23 0510 - General HVAC Requirements, for additional Warranty requirements.

C. Provide a five year warranty to include coverage for compressor including materials only.

1.07 EXTRA MATERIALS

A. See Section 01 6000 - Product Requirements, for additional provisions.

B. Provide one set of filters for each unit at the Final Observation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. The Carrier Corporation.

B. Johnson Controls.

C. Daikin.

D. Liebert.

E. Mitsubishi .

2.02 AIR CONDITIONING UNITS

A. Description: Packaged, ductless split air conditioning system consisting of interior and exterior units and controls .

2.03 INTERIOR UNIT

A. Cabinet
   1. Decorative cabinet with exposed corners and edges rounded, easily removed panels, glass fiber insulation and integral air outlet and inlet grilles.
   2. Finish: Factory apply baked enamel of color as selected on visible surfaces of enclosure or cabinet.
   3. Insulation: Minimum 1/2 inch thick acoustic duct liner for lining cabinet interior.
   4. Drain Pan: Galvanized steel with corrosion-resistant coating.

B. Evaporator fan
   1. Fan: Direct drive, double width, double inlet, forward curved centrifugal fan, statically and dynamically balanced, resiliently mounted.

C. Evaporator coil
   1. Direct expansion coiling coil of seamless copper tubes expanded into aluminum fins.
   2. Refrigeration circuit with fixed metering device(capillary tube) unless noted otherwise.

D. Air filters
   1. Filter: Easily removed 1 inch thick permanent washable type, located to filter air before coil.

2.04 EXTERIOR UNIT

A. Casing
   1. House components in welded steel frame with galvanized steel panels with weather resistant, baked enamel finish.
   2. Mount contactors and controls in weatherproof panel provided with full opening access doors.
   3. Provide removable access doors or panels with quick fasteners .

B. Compressor
   1. Hermetically sealed, 3600 rpm maximum, resiliently mounted with positive lubrication and internal motor protection.
   2. Compressor: Hermetic reciprocating type or Hermetic scroll type.

C. Condenser coils
   1. Coils: Aluminum fins mechanically bonded to seamless copper tubing or all aluminum fins and tube. Air test under water to 600 psig, and vacuum dehydrate. Seal with holding charge of refrigerant.
   2. Coil Guard: Louvered or PVC coat steel wire .

D. Fans and motors
   1. Direct driven propeller type condenser fans with fan guard on discharge.
   2. Weatherproof motors suitable for outdoor use, single phase permanent split capacitor with permanent lubricated ball bearings and built in thermal overload protection.
   3. Fan Guard: PVC coat steel wire .

E. Refrigerant: Charge with R-410A.

F. Refrigerant circuit
   1. For each refrigerant circuit, provide:
      a. Suction and liquid line service valves and gage ports.
      b. Charging valve.
      c. Condenser pressure relief mechanism.

G. Controls
   1. Factory wired with single point power connection.
   2. Factory wired controls shall include contactor, high and low pressure cutouts, internal winding thermostat for compressor, control circuit transformer, non-cycling reset relay.
   3. Provide a surge capacitor and lightning arrestor in unit cabinet for protection from power surges due to lightning and switching transients.
   4. Provide controls to permit operation down to 0 degrees F ambient temperature where scheduled to include:
      a. Crankcase heater with thermostat.
      b. Head pressure switch to cycle fan motors in response to refrigerant condensing pressure.
      c. Solid state control to vary speed of one condenser fan motor in response to refrigerant condensing pressure.

2.05 CONTROLS

A. Provide wall mounted room thermostat to control cooling with 'cool-off' selector switch and 'auto-on' fan control switch.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide level housekeeping pad or base as indicated.

C. Pipe refrigerant piping from interior unit to exterior unit; refer to section 23 2300.

D. Drain Pan: Route discharge from cooling coil drain pan to floor drain with drawn copper tube, full size of connection. Provide air seal trap(Refer to detail on drawings).

3.02 SCHEDULES

A. Capacities shall not be less than scheduled when matched together; 45 F minimum SST, 95 F ODT.

B. Refer to schedule on Drawings.

END OF SECTION

SECTION 26 0510
GENERAL ELECTRICAL REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Definitions

B. Quality Assurance Requirements and Installer Qualifications.

C. Submittal Procedures

D. Execution Requirements common to Division 26 systems

E. Equipment bases and housekeeping pads

1.02 DEFINITIONS

A. Manufacturer's Representatives: Wherever MANUFACTURER'S REPRESENTATIVE is referred to in this division, said representative shall be regularly employed by the manufacturer to perform similar activities to those called for herein, which indicates his competence in that field of work.

B. Concealed: Where the word concealed is used in this Division, it shall mean items above ceilings, in attics, in crawl spaces, in chases, in tunnels, in cabinet work, and under counters or equipment so as to be not visible from an elevation of 5 feet at a horizontal distance of 10 feet.

C. Finished Spaces or Areas: Where finished spaces or areas are referred to in this Division, it shall mean all spaces except concealed spaces, mechanical rooms, or boiler rooms unless otherwise noted.

D. Provide: Where the word provide is used, it shall mean to furnish and install the item(s) in accordance with plans, specifications or manufacturer's instructions.

E. Control and Interlock Wiring: All wiring, both line voltage and low voltage, other than power wiring from an electrical distribution panel, through the primary control device, to the equipment.

F. Primary Control Device: That ONE device for any item of equipment which interrupts power flow during normal operation. Where magnetic starters are provided, they are the primary control. For items not switched by starters, the primary control device will be the ONE thermostat, manual switch, aquastat, P.E. switch, or relay performing the primary switching.

G. Diagrammatic: A drawing that shows arrangement and relations (as of parts).i.e.: A diagrammatic drawing uses symbols rather than pictorial representation of pipes, ducts, conduit and other items shown and is not necessarily to scale. Arrangement, location, and sizes shown are firm.

H. Readily Accessible: Equipment, valves and other items requiring service shall be installed to be readily accessible. These items shall be available for maintenance or use in a space, through an access door from floor elevation, or above a lay-in ceiling by maintenance staff standing on a ladder no taller than the ceiling.

I. Noted, Indicated or Shown: Where the terms "Noted", "Indicated" or "Shown" are used in these specifications, the words "in the specifications or on the plans" shall be inferred.

J. Detail: Details referenced shall pertain to plans unless otherwise noted.

K. Specifications: Where reference is made to these specifications, it shall be inferred in this Division of specifications.

L. Notification by Contractor, and Instructions to Contractor: Where reference is made in these specifications to notification by or instructions given to Contractor, it shall be inferred that Architect shall be the notifier or the instructor as the case exists.

M. Submittal Data, Equipment Cuts, Shop Drawings: Wherever these terms are used in the plans or specifications, the information is to be submitted for review as part of the packaged submittal specified under "SUBMITTALS".

N. Conduit of Duct Bank: Two or more, 2-inch or larger conduits with a common point of origin and a common point of termination routed parallel, and as specifically designated on plans.

O. See Article 100 of the 2017 National Electrical Code with all Georgia State Amendments.

P. Division or Section Reference: Where reference is made to another Division or Section within this Division, refer to specifications table of contents for Division, Section, or Page Number.

Q. Diagrammatic: A drawing that shows arrangement and relations (as of parts). A diagrammatic drawing uses symbols rather than pictorial representation of pipes, ducts, conduit and other items shown and are not necessarily to scale. Arrangement, location and sizes shown are firm.

R. Horizontal Cabling: A data cabling term indicating the cable from the work area back to the patch panel. Commonly used in the description "conduit for horizontal cabling shall be 1" minimum in size".

1.03 REGULATORY REQUIREMENTS

A. General: Where requirements of these specifications exceed specified codes and ordinances, conform to these specifications.

B. Materials and equipment included in Underwriters Label Service shall bear that label. Electrical equipment shall be U.L. approved as installed.

C. Jurisdiction: Where codes or guides refer jurisdiction to local governing code officials, such official in this procedure shall be the City Building Official.

D. Permits: Coordinate with General Contractor and General Conditions.

E. Energy: Conform to the International Energy Conservation Code, 2009 Edition, with all Georgia State Amendments.

F. Fire Prevention: Conform to Georgia State Minimum Standard Fire Prevention Code (International Fire Code), 2012 Edition, with all Georgia State Amendments.

G. Building Code: Conform to the Georgia State Minimum Standard Building Code (International Building Code), 2012 Edition with all Amendments.

H. Electrical: Conform to the 2017 National Electrical Code (NEC), NFPA, and the National Electrical Safety Code.

I. Life Safety: Conform to the 2012 Edition of NFPA 101 - Life Safety Code, with Georgia State Amendments.

J. Fire Alarm: Conform to the 2013 Edition of NFPA 72 - National Fire Alarm Code, with Georgia State Amendments.

1.04 PERFORMANCE REQUIREMENTS

A. Requirements specified herein are minimum. All equipment, when installed, shall perform equal to or exceed specified requirements.

1.05 SUBMITTALS

A. Supplementing Division 1 requirements; Contractor shall:
   1. Review the submittal data and check to ensure compliance with specifications prior to submitting.
      a. The Contractor agrees that submittals of equipment and material and shop drawings of equipment and material layouts required under provisions of these specifications and processed by the Architect are not Change Orders.
      b. The purpose of submittals is to demonstrate that Contractor understands the design concept of the project by indicating the equipment and materials he intends to furnish and install, and by detailing the installation he intends to achieve. The review by Architect shall NOT be construed to be for the purpose of "approving" equipment or drawings. The plans and specifications alone are the contract document. The contractor has agreed to follow the contract document, regardless of the results of the submittal submission.

c. The Contractor shall conform to the requirements of the Contract Documents unless a change order or a specific letter of clarification is issued. The Contractor shall identify on each submittal and in letter form to Architect any and all deviations from the Contract Documents.
d. Any submittal or shop drawing not conforming to the Contract Documents without this identification and notification shall be assumed to be marked "Revise and Resubmit" (Contractor acknowledges this by the submission), and Contractor shall promptly resubmit said submittal so as to be in full compliance with the Contract Documents.
e. Failure of Contractor to provide this information during the shop drawing phase shall make Contractor responsible for all changes to achieve compliance with the Contract Documents without additional compensation.

2. Assemble the submittal data in compete sets in hard back three-ring binders, separated by trade, (Electrical), and bound with numbered index sheets and tabs. Submittal data shall be submitted at one time unless unavailable data such as control submittal would delay project progress. Submittal data for Fire Alarm System shall include the following:
   a. Devices and panels data sheets.
   b. Typical devices wiring diagrams.
   c. Plans showing devices, zone of each device, & interconnecting conductor/conduit.
   d. System operation description.
3. Identify all submittals by a cover sheet showing project name, specification sections, drawing or detail number, room number, date, revision date, Contractor and subcontractor's organization and project manager with phone number, the model, style and size of item being submitted with manufacturers' representative, salesman (or a preparer who can answer questions), and preparer's phone number.
4. Manufacturers' standard drawings shall be modified by deletions or additions to show only items applicable to this project.
5. Prepare a master list of submittals proposed to be submitted on the project. This list shall be updated for each submission and shall be the first sheet(s) of the submission in the quantity that is submitted for review. The information and general format shall contain an Tab number, Item Description, Item Status and any comment. Items that require quicker submittal review because of material lead times should be indicated in this list.
6. Provide a Letter stating that all submittals have been checked for compliance with specifications.
7. Deliver submittals to the Architect at the business address.
8. Paperless Delivery of Submittal:
   a. Submittal data may be posted to NBP's FTP site when agreed upon by the Design Professional and the Owner during preconstruction. The Contractor will be provided with a project folder and password.
   b. Prepare the submittals as described above. Take steps to reduce submittal file size.
   c. Do not scan in color or high resolution unless needed for clarity.
   d. Ensure any reproduction are legible.
   e. Send an email to submittal@nbpengineers.com with a copy to the Electrical Design Professional and the Architectural Design Professional identified during the preconstruction phase.
   f. Identify the submittal in the email subject line using the official project title, specification section and submitted item. I.E. Project No. G-xxx, Addition to Administration Building Section 26 0534- Conduit.
   g. Ensure the submittal posted to the FTP site has the same identification.
   h. NBP Design Professionals will not process or react to submittals not properly sent or identified.

B. Power Wiring Requirements: The Contractor shall submit a letter acknowledging receipt and review of the Tabulated List of Power Wiring Requirements of all Mechanical Equipment specified in Division 23 of the Specifications. Failure to submit this letter will require Contractor to assume responsibility for any required changes to the electrical design attributed to mechanical equipment. Include a copy of the Tabulated List of Power Wiring Requirements with

the letter. The electrical requirements for the mechanical equipment is based on the best information available at the time of design. The Contractor is responsible for coordinating with the purchased equipment. Power Wiring letters are required for the following equipment:
1. Mechanical

C. Service Voltage Verification: The Contractor shall provide a letter verifying the availability of indicated service voltage from the serving utility company. The letter shall be included in the submittal data. No electrical equipment shall be released for fabrication until such verification has been made.

D. Certificates:
1. For Fire Alarm System: Start-up, testing and placing into operation shall be performed by the field representatives of the manufacturers.
2. Certificates of the manufacturers shall be provided on the letter heads of the manufacturers in which the manufacturer certifies that the equipment has been installed in strict compliance with the manufacturers recommendations and is operating properly.
3. The manufacturers shall list in the certificate the item or items furnished to the job.
4. The Contractor shall coordinate performance of the aforesaid services and shall, in all cases where the equipment of two or more manufacturers tie in and function together, require the field representatives to perform simultaneously the initial start-up, the testing, and the placing of their equipment into operation. Start-up is defined as putting the equipment into action. Testing is defined as performing such testing as is stipulated in the contract documents to be performed. Placing into operation is defined as operating the equipment for a sufficient period of time for the determination to be made that it is performing properly.
5. Notification shall be given at least 48 hours in advance of start-up. The Contractor shall give each system supplier the advance notice time he requests for his work on his system.

1.06 OPERATING AND MAINTENANCE MANUALS

A. Each Manual shall be compiled as follows:
1. Data shall be bound in smooth surface hard back commercial quality three-ring notebooks with project identification shown on the front cover and binding back. Identification labels shall be typed and adhered with waterproof glue.
2. Notebooks shall have 9-1/2-inch by 11-1/2-inch covers with back width to permit the covers to lie parallel or to converge, and have not less than 1-1/2-inch back width.
3. Index divider sheets of heavy Manila paper shall be inserted between each section of the Manual with a 2-inch x 1/3-inch ready-cut shield tab attached to each sheet for identification of sections.
4. Data sheets and diagrams shall be 8-1/2-inch x 11-inch or be mounted on 8-1/2-inch x 11-inch sheets of 16-pound paper if smaller, with reinforced 11-inch mechanically perforated edges. Drawings and diagrams larger than 8-1/2-inch by 11-inch shall be folded up from the bottom to form a height of 11-inches and folded to the left to form a width of 8-1/2-inches.
5. Table of Contents(Index) sheets shall be provided in the order listed with identifications typed in capital letters.

B. Digital delivery of Operating and Maintenance Manuals:
1. Operating and Maintenance Manuals may be delivered digitally and posted to the NBP Engineers FTP site when agreed upon by the Design Professional and the Owner during the preconstruction phase. The Contractor will be provided with a project folder and password.
2. Prepare the Operating and Maintenance Manuals as described above. Take steps to reduce submittal file size.
3. Do not scan in color or high resolution unless required for clarity.
4. Ensure any reproductions are legible.

5. Send an email to submittal@nbpengineers.com with a copy to the Electrical Design Professional and the Architectural Design Professional identified during the preconstruction phase.
6. Identify the manuals in the email subject line using the official project title, specification section and submitted item. I.E. Project No. G-xxx, Addition to Administrative Building.
7. Table of Contents(Index) sheets shall be included in the order listed with identifications typed in capital letters.
8. Ensure the manuals posted to the FTP site has the same identification.
9. NBP Design Professionals will not process or react to manuals which are not properly transmitted, indexed, and identified.

C. Each Manual shall contain the following information, data and drawings:
1. Copies of approved submittals (with Design Professional's review comments and stamp), equipment and materials.
2. Manufacturer's installation, operating and maintenance instructions for each item of equipment.
3. Manufacturer's list of renewal parts for each item of equipment with recommended stock items and quantities indicated.
4. Control diagrams.
5. Wiring diagrams and color codes for fire alarm system. Refer to fire alarm specifications.
6. Copies of shop drawings showing layouts and construction details. Shop drawings are required for the following systems:
   a. Lighting control (occupancy sensor and relay panels)
   b. Fire Alarm system
7. Warranty Information.
8. Sign in sheets for all owner training sessions.

1.07 QUALITY ASSURANCE

A. Electrical Installer's Qualifications:
1. General: Wherever the word "Sub-Contractor" or "Firm" is used in these subparagraphs, it shall mean Contractor/sub-contractor of record for the installations used for proficiency qualification.
2. Warranty of Contractor: The Contractor shall warrant that the Firm(s) selected by him are reputable, skilled, reliable, competent, qualified in the trade or field in which they are to perform on the project, and thoroughly familiar with applicable codes and standards.
3. Location: The firm which performs the installation of the work under this section shall be one who maintains an established, experienced organization with a permanent, manned office. See General Conditions.
4. Experience: The firm's proficiency in the installation and adjustment of Electrical systems shall have been demonstrated by the successful performance of work as specified herein on at least three commercial, hospital or institutional buildings with a minimum floor area of 10000 square feet, 208 volt, 800 amps, 3 phase service entrance.
5. The firm shall have been in business performing services as specified herein for at least 3 years.

B. Substitutions:
1. All costs incurred by acceptance of substitutions shall be borne by Contractor. Should any proposed substitute equipment require services in addition to or in excess of services provided in the Contract Documents, these services shall be provided at no extra cost to Owner.
2. Request for approval of a proposed product (substitution) shall be accompanied by the schedule setting forth in which respects the materials or equipment submitted for consideration differ from the materials or equipment designated in the Contract Documents and from the design intent. If there are no deviations or changes required to the design, the submittal shall be accompanied by the following statement: "The proposed material or equipment submitted for approval requires no changes to the Contract

Documents to achieve the design intent." Lack of the schedule or statement will result in automatic disapproval of the request.

3. Facsimile (Fax) Requests for prior approval will not be considered due to the inability of the sender being able to assure that information sent was information received and possible poor clarity of the fax, and the short time period for review and response.

C. Architectural And/Or Structural Requirements:
   1. Refer to the specifications and Architectural and Structural drawings for additional requirements pertaining to work under this discipline. Notify Architect if conflict for clarification.

1.08 WARRANTY

A. Refer to Section 01 7000 - Project Closeout, for additional warranty requirements.

B. See General Conditions.

C. Where extended warranties beyond Contractor's one (1) year warranty are specified, the additional warranty time shall start at the end of Contractor's warranty.

D. Correct defective Work within a one year period after Date of Material Completion.

1.09 ABBREVIATIONS - ELECTRICAL

AIC	AVAILABLE INTERRUPTING CAPACITY
AFF	ABOVE FINISHED FLOOR
AL	ALUMINUM
ANT	ANTENNA
AWG	AMERICAN WIRE GAUGE
BE	BOTTOM ELEVATION
BG	BELOW FINISHED GRADE
BRKR	BREAKER
C	CONDUIT
CAT	CATALOG
CH	CEILING HEIGHT
CLG	CEILING
CO	CONVENIENCE OUTLET
COND	CONDUCTOR(S)
CR	CONTROL RELAY
CU	COPPER
D	DIAMETER
EMER	EMERGENCY
EMT	ELECTRICAL METALLIC TUBING
FO	FIBER OPTIC
FAP	FIRE ALARM PANEL
FUT	FUTURE
GND	GROUND
HOA	HAND-OFF-AUTO
HPS	HIGH PRESSURE SODIUM
HTR	HEATER
IAW	IN ACCORDANCE WITH
IC	INTERCOM MASTER STATION

IMC	INTERMEDIATE METALLIC CONDUIT
MB	MAIN BREAKER
MC	MASTER CLOCK
MFGR	MANUFACTURER
MLO	MAIN LUGS ONLY
MTD	MOUNTED
MTG	MOUNTING
MV	MERCURY VAPOR
NEC	NATIONAL ELECTRICAL CODE (2017)
NFDS	NON FUSED DISCONNECT SWITCH
NIC	NOT IN CONTRACT
NMC	NON METALLIC CONDUIT
NO.	NUMBER
PB	PUSHBUTTON
PLCS	PLACES
PVC	POLYVINYL CHLORIDE
R	RADIUS
RGS	RIGID STEEL CONDUIT
SCHED	SCHEDULE
SEC	SECTION
SMR	SURFACE METAL RACEWAY
SURF	SURFACE
SYM	SYMMETRICAL
TEL	TELEPHONE
TR	TIME RELAY
TYP	TYPICAL
W/	WITH
WP	WEATHERPROOF
XFMR	TRANSFORMER
20A/3P	20 AMP / 3 POLE TYPICAL

PART 2 PRODUCTS-NOT USED

PART 3 EXECUTION

3.01 EXAMINATION

A. Hazardous Materials:

1. A/E's Responsibility: Plans and specifications have been prepared by the A/E for Owner without the A/E having conducted investigation as to the presence of asbestos or hazardous waste on the project. Not being a part of this contract, the A/E has not charged any fees and has not and will not advise Owner with regard to the detection and/or removal of asbestos or hazardous waste. The Owner is aware that asbestos or hazardous waste could be present and will make all decisions with regard to its removal. The removal of all hazardous materials and encapsulation of remaining surfaces is the sole responsibility of Owner.
2. If Contractor observes the existence of a friable material which must be disturbed during the course of his work, Contractor shall promptly notify Owner and Architect. The Owner

shall make all arrangements regarding testing and removal or encapsulation of asbestos material if present. The Contractor shall not perform any work pertinent to the friable material prior to receipt of special instructions from Owner through Architect.

3. "Friable Material" is any material which can be crumbled, pulverized or reduced to a powder by hand pressure when dry.

B. Asbestos (ACBM)

1. Specifications written for equipment and materials in this division of the specifications are intended to eliminate any asbestos containing substance. The Contractor and his suppliers are hereby notified that NO ASBESTOS CONTAINING PRODUCT IS PERMITTED. If a product is listed in these specifications which contains asbestos, Contractor and his supplier shall so inform Architect immediately and shall not deliver such product to the project site until additional written instructions are received.
2. Upon completion of construction, and prior to final inspection, Contractor for work performed under this division of the specifications shall be required to provide a certificate to Architect in the following form:

CERTIFICATION FOR ASBESTOS CONTAINMENT

I/we _____(Sub-Contractor), certify that there is no asbestos contained in materials provided and/or installed by us in_____
_____(Project/Building).

WITNESS _____(Notary Public)
DATE:_____
CONTRACTOR:_____
_____
BY: _____
TITLE: _____

3.02 PREPARATION

A. Drawings are diagrammatic and show the general location of the equipment, raceway, and equipment, but are not to be scaled. All dimensions shall be verified at the building site. Prefabrication and/or installation of work from drawings shall be at Contractor's risk. Refer to Architectural plans for exact building dimensions and details.

B. Space Conditions:

1. All apparatus shall fit into the available spaces in the building and must be introduced into the building so as not to cause damage to the structure. Equipment larger than access to equipment spaces shall be disassembled into sub-assemblies for installation.
2. Where deviations from the plans are required in order to conform to the space limitations, such changes shall be made at no additional cost to Owner and shall be subject to approval.
3. All equipment requiring service shall be made accessible.

3.03 INSTALLATION

A. All equipment shall be installed in accordance with manufacturer's published installation instructions shipped with the equipment. In the event there is a discrepancy between these specifications or Drawings and the manufacturer's instructions, no work shall be performed until additional instructions are received.

B. Route conduits and cable trays to avoid skylights, translucent, and transparent ceilings.

C. Cutting and patching in connection with the installation shall be done by the trade whose work is to be cut. The Contractor shall lay out and install his work ahead of the work of other trades wherever possible.

D. Where penetrations are made in fire rated partitions, walls, floors or ceilings during the course of electrical installation, these penetrations shall be restored to their intended fire ratings by the use of fittings or materials as approved by Underwriter's Laboratories for this purpose.

E. See General Conditions.

F. Fire Prevention Precautions in Cutting and Welding Areas: Conform to Article 2904 Fire Prevention Precautions, Georgia State Minimum Standard Fire Prevention Code (International Fire Code), 2012 Edition, with all Georgia State Amendments for all work involving cutting and welding.

G. Seal sleeves and openings in exterior walls and mechanical room walls vaportight, watertight, or for smoke/fire protection as applicable. Refer to Section 07 8400 - Firestopping.

H. Refer to Section 07 9000.

I. Record Drawings:
   1. After completion, any changes in the location of conduits, the connections of circuits, or any other changes from the contract documents shall be noted on a clean set of blue line white prints and delivered to Architect before final acceptance of work.

J. Condition of Work Upon Project Completion:
   1. The condition of equipment and work upon project completion shall be NEW and UNDAMAGED. For example, broken fixture lenses and dented or scratched housings shall be replaced. Painted-over wiring devices shall be cleaned or replaced. Do not use tape or other adhesive for temporary labels, as they leave residue. All circuit breaker factory-printed data/information shall be legible and undamaged. Panelboards and transformers shall be free of scratches, dents, and rust. Any equipment or work deemed by the design professional as not meeting the requirement of NEW and UNDAMAGED shall be replaced by the Contractor at no cost to the Owner.

3.04 INTERFACE WITH OTHER WORK

A. General: No roughing shall be done until roughing drawings and exact electrical demand of equipment is obtained. Notify Architect of any discrepancies.

B. Mechanical:
   1. Review Tabulated List of Power Wiring Requirements of all Mechanical Equipment specified in Division 23 of the specifications. Conduit, conductor and breaker sizes shown for mechanical equipment are based upon the best available information on the equipment specified. The Contractor shall be allowed to provide electrical circuits compatible with the proposed mechanical equipment where the mechanical equipment conforms to Division 23 of the specifications, but does not conform to the electrical criteria of these contract documents . The Contractor shall submit the proposed electrical modifications to Architect for review prior to roughing. No additional costs to the contract will be allowed for these modifications.
   2. Provide control, program and interlock wiring as shown on Mechanical and/or Electrical drawings.
   3. Provide conduit, wiring, boxes, adaptors for equipment terminations and disconnect switches. Provide power wiring through primary control device.
   4. Starters, push-button stations, contactors, relays, limit and safety devices, and control items are specified in Division 26 of the specifications (except as shown in Motor Control Center). Unless otherwise noted, all starters shall be mounted between 24" and 80" above finished floor. Push-button stations shall be mounted at switch height except as noted.

C. Site Utilities: The information shown on the plans is based upon the best information available. Before performing any work on the site, Contractor shall contact the utility company(s) serving the facility and stake out all underground services. Notify Architect of any discrepancies.

3.05 EQUIPMENT BASES AND HOUSEKEEPING PADS

A. Provide housekeeping and equipment pads where penetrations occur through any slab in the electrical and data rooms. Conduit that penetrates the slab and is exposed in the space shall be wrapped in a housekeeping pad. These include under electrical panels and conduit sleeves through data room slabs. All electrical items that sit on the slab shall have housekeeping pads below. Rough up slab under bases before pouring concrete.

B. Materials: Refer to Section 03 3000 - Cast-in-Place Concrete. Omit test cylinders for concrete poured under this section.

C. Bases/Pads shall be rectangular with vertical sides 4 inches from centerline of anchor bolts or 2 inches from edges of equipment supports, whichever provides the larger dimension, side of equipment or base edge, unless otherwise noted. Housekeeping pads shall be minimum 4 inches thick.

D. Chamfer: 3/4 inch on edges and corners.

E. Reinforcing: 6"x 6" 10/10 WWF at mid-depth of slab. (4 inch thick pads.)

3.06 STARTING EQUIPMENT AND SYSTEMS

A. Adjust equipment for proper operation within manufacturers' published tolerances.

B. Demonstrate proper operation of systems and equipment to Owner 's designated representative.

3.07 DEMONSTRATION, TRAINING AND INSTRUCTIONS

A. Instructions:
   1. Instruct operating personnel designated by Owner in operation and maintenance of systems prior to request for final inspection. Provide signed statement certifying instructions have been received.
      a. Generator and transfer switch
      b. Lighting Sensors/controls
      c. Walk through description of panel locations and location in riser
      d. Fire Alarm System

3.08 CLEANING and PROTECTION

A. All materials, equipment and electrical/telecommunications rooms shall be cleaned prior to Final Observation.

B. Remove any stored materials. Vacuum interiors of all panelboards, switchboards, switchgear, transformers and any other electrical equipment.

C. Paint equipment where finish has been damaged requiring retouching of finish to match factory finish. Equipment which has been damaged beyond the point of retouching or has been retouched not to match shall be repainted to match factory finish.

D. Chipped or scraped paint shall be retouched to match original finish.

E. All equipment shall be free of dust, rust and stains prior to material completion.

F. During Construction: Conduit openings shall be closed with caps or plugs. All equipment shall be covered and protected against water, dirt and chemical or mechanical injury. All equipment and material shall be stored in accordance with manufacturer's recommendations.

3.09 FINISHING ELECTRICAL EQUIPMENT AND MATERIAL

A. Use paint systems specified in Division 9 for the substrates to be finished.

B. Paint conduit and electrical equipment in exposed, public areas per Architect's instructions.

C. All ferrous fasteners and hanger supports not having a corrosion resistant plated finish shall be painted to prevent rust.

D. Paint all equipment, including that which is factory-finished, exposed to weather or to view on the roof and outdoors.

END OF SECTION

SECTION 26 0519

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Single conductor building wire.

B. Metal-clad cable.

C. Wire and cable for 600 volts and less.

D. Wiring connectors.

E. Electrical tape.

F. Heat shrink tubing.

G. Wire pulling lubricant.

H. Cable ties.

1.02 RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.

B. Section 26 0526 - Grounding and Bonding for Electrical Systems: Additional requirements for grounding conductors and grounding connectors.

C. Section 26 0574 - Electrical Testing.

D. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

1.03 REFERENCE STANDARDS

A. NECA 120 - Standard for Installing Armored Cable (AC) and Metal-Clad Cable (MC); 2012.

B. NFPA 70 - National Electrical Code, 2017 Edition; National Fire Protection Association.

C. UL 44 - Thermoset-Insulated Wires and Cables; Current Edition, Including All Revisions.

D. UL 83 - Thermoplastic-Insulated Wires and Cables; Current Edition, Including All Revisions.

E. UL 486A-486B - Wire Connectors; Current Edition, Including All Revisions.

F. UL 486C - Splicing Wire Connectors; Current Edition, Including All Revisions.

G. UL 486D - Sealed Wire Connector Systems; Current Edition, Including All Revisions.

H. UL 510 - Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape; Current Edition, Including All Revisions.

I. UL 1569 - Metal-Clad Cables; Current Edition, Including All Revisions.

1.04 SUBMITTALS - NOT REQUIRED

A. See Section 26 0510 - General Electrical Requirements for submittal procedures.

1.05 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

PART 2 PRODUCTS

2.01 CONDUCTOR AND CABLE APPLICATIONS

A. Do not use conductors and cables for applications other than as permitted by NFPA 70 and product listing.

B. Provide single conductor building wire installed in suitable raceway unless otherwise indicated, permitted, or required.

C. Nonmetallic-sheathed cable is not permitted.

D. Underground feeder and branch-circuit cable is not permitted.

E. Service entrance cable is not permitted.

F. Armored cable is not permitted.

G. Metal-clad cable is permitted only as follows:
   1. Where not otherwise restricted, may be used:
      a. Where concealed above accessible ceilings for final connections from junction boxes to luminaires.
         1) Maximum Length: 6 feet.
      b. Where concealed in hollow stud walls, above accessible ceilings, and under raised floors for branch circuits up to 20 A.
         1) Exception: Provide single conductor building wire in raceway for circuit homerun from first outlet to panelboard. If the outlet or junction box is the only thing shown on the homerun (i.e. only one circuit in the homerun), then provide a dedicated conduit for that homerun.

2.02 CONDUCTOR AND CABLE MANUFACTURERS - MANUFACTURED IN USA

2.03 CONDUCTOR AND CABLE GENERAL REQUIREMENTS

A. Provide products that comply with requirements of NFPA 70.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.

D. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.

E. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.

F. Conductors for Grounding and Bonding: Also comply with Section 26 0526.

G. Conductor Material:
   1. Provide copper conductors only. Aluminum conductors are not acceptable for this project. Conductor sizes indicated are based on copper.
   2. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B787M unless otherwise indicated.

H. Minimum Conductor Size:
   1. Branch Circuits: 12 AWG.
      a. Exceptions:
         1) 20 A, 120 V circuits longer than 75 feet: 10 AWG, for voltage drop.
         2) 20 A, 120 V circuits longer than 150 feet: 8 AWG, for voltage drop.
         3) 20 A, 277 V circuits longer than 150 feet: 10 AWG, for voltage drop.

I. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

J. Conductor Color Coding:
   1. Color code conductors as indicated. Maintain consistent color coding throughout project.
   2. Color Coding Method: Integrally colored insulation.
   3. Color Code:
      a. 208Y/120 V, 3 Phase, 4 Wire System:
         1) Phase A: Black.
         2) Phase B: Red.
         3) Phase C: Blue.
         4) Neutral/Grounded: White.
      b. Equipment Ground, All Systems: Green.

2.04 SINGLE CONDUCTOR BUILDING WIRE

A. Conductor Stranding:
   1. Feeders and Branch Circuits:
      a. Size 10 AWG and Smaller: Solid.
      b. Size 8 AWG and Larger: Stranded.

B. Insulation Voltage Rating: 600 V.

C. Insulation:
   1. Copper Building Wire: Type THHN/THWN or THHN/THWN-2, except as indicated below.
      a. Installed Underground: Type XHHW-2.

2.05 METAL-CLAD CABLE

A. Description: NFPA 70, Type MC cable listed and labeled as complying with UL 1569, and listed for use in classified firestop systems to be used.

B. Conductor Stranding:
   1. Size 10 AWG and Smaller: Solid.
   2. Size 8 AWG and Larger: Stranded.

C. Insulation Voltage Rating: 600 V.

D. Insulation: Type THHN, THHN/THWN, or THHN/THWN-2.

E. Grounding: Full-size integral equipment grounding conductor.

F. Armor: Steel, interlocked tape.

G. Manufacturers:
   1. Manufactured in USA.

H. MC Cable Description:
   1. MC cable shall be rated for the application.
   2. MC cable shall have a steel armor which shall be spiral wrapped.
   3. MC Cable shall have copper conductors with THHN or XHHW insulation.
   4. MC cable shall be used for sizes #12 AWG or #10AWG only.
   5. MC cable shall contain a green equipment grounding conductor.
   6. Color code the conductors as specified for the application voltage. Black insulation with color code tape shall not be acceptable.
   7. Provide conductors quantity as required by the application.

I. Application Location for MC Cable in addition to paragraph 2.01 above:
   1. MC cable shall be allowed inside casework as an alternative to conductor in conduit. Provide MC cable from casework outlets, concealed through casework, to a homerun box located in the casework. MC cable shall not be exposed.
   2. Conduit, not MC cable, shall be provided through fire rated surfaces.

2.06 WIRING CONNECTORS

A. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as applicable.

B. Connectors for Grounding and Bonding: Comply with Section 26 0526.

C. Wiring Connectors for Splices and Taps:
   1. Copper Conductors Size 8 AWG and Smaller: Use twist-on insulated spring connectors.
   2. Copper Conductors Size 6 AWG and Larger: Use mechanical connectors or compression connectors.

D. Wiring Connectors for Terminations:
   1. Provide terminal lugs for connecting conductors to equipment furnished with terminations designed for terminal lugs.
   2. Provide compression adapters for connecting conductors to equipment furnished with mechanical lugs when only compression connectors are specified.
   3. Where over-sized conductors are larger than the equipment terminations can accommodate, provide connectors suitable for reducing to appropriate size, but not less than required for the rating of the overcurrent protective device.
   4. Provide motor pigtail connectors for connecting motor leads in order to facilitate disconnection.

5. Copper Conductors Size 8 AWG and Larger: Use mechanical connectors or compression connectors where connectors are required.

E. Do not use insulation-piercing or insulation-displacement connectors designed for use with conductors without stripping insulation.

F. Do not use push-in wire connectors as a substitute for twist-on insulated spring connectors.

G. Twist-on Insulated Spring Connectors: Rated 600 V, 221 degrees F for standard applications and 302 degrees F for high temperature applications; pre-filled with sealant and listed as complying with UL 486D for damp and wet locations.
   1. Manufacturers:
      a. 3M: www.3m.com/#sle.
      b. Ideal Industries, Inc.: www.idealindustries.com/#sle.
      c. NSI Industries LLC: www.nsiindustries.com/#sle.

H. Mechanical Connectors: Provide bolted type or set-screw type.

I. Compression Connectors: Provide circumferential type or hex type crimp configuration.

2.07 WIRING ACCESSORIES

A. Electrical Tape:
   1. Vinyl Insulating Electrical Tape: Complying with ASTM D3005 and listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; conformable for application down to 0 degrees F and suitable for continuous temperature environment up to 221 degrees F.
   2. Rubber Splicing Electrical Tape: Ethylene Propylene Rubber (EPR) tape, complying with ASTM D4388; minimum thickness of 30 mil; suitable for continuous temperature environment up to 194 degrees F and short-term 266 degrees F overload service.
   3. Electrical Filler Tape: Rubber-based insulating moldable putty, minimum thickness of 125 mil; suitable for continuous temperature environment up to 176 degrees F.
   4. Varnished Cambric Electrical Tape: Cotton cambric fabric tape, with or without adhesive, oil-primed and coated with high-grade insulating varnish; minimum thickness of 7 mil; suitable for continuous temperature environment up to 221 degrees F.
   5. Moisture Sealing Electrical Tape: Insulating mastic compound laminated to flexible, all-weather vinyl backing; minimum thickness of 90 mil.

B. Heat Shrink Tubing: Heavy-wall, split-resistant, with factory-applied adhesive; rated 600 V; suitable for direct burial applications; listed as complying with UL 486D.

C. Wire Pulling Lubricant: Listed; suitable for use with the conductors or cables to be installed and suitable for use at the installation temperature.

D. Cable Ties: Material and tensile strength rating suitable for application.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that interior of building has been protected from weather.

B. Verify that work likely to damage wire and cable has been completed.

C. Verify that raceways, boxes, and equipment enclosures are installed and are properly sized to accommodate conductors and cables in accordance with NFPA 70.

D. Verify that raceway installation is complete and supported.

E. Verify that field measurements are as shown on the drawings.

F. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Clean raceways thoroughly to remove foreign materials before installing conductors and cables.

B. Verify that interior of building has been protected from weather.

3.03 INSTALLATION

A. Circuiting Requirements:
   1. Unless dimensioned, circuit routing indicated is diagrammatic.
   2. When circuit destination is indicated without specific routing, determine exact routing required.
   3. Arrange circuiting to minimize splices.
   4. Include circuit lengths required to install connected devices within 10 ft. of location indicated.
   5. Maintain separation of Class 1, Class 2, and Class 3 remote-control, signaling, and power-limited circuits in accordance with NFPA 70.
   6. Maintain separation of wiring for emergency systems in accordance with NFPA 70.
   7. Circuiting Adjustments: Unless otherwise indicated, when branch circuits are indicated as separate, combining them together in a single raceway is permitted, under the following conditions:
      a. Provide no more than six current-carrying conductors in a single raceway. Dedicated neutral conductors are considered current-carrying conductors.
      b. Increase size of conductors as required to account for ampacity derating.
      c. Size raceways, boxes, etc. to accommodate conductors.
   8. Common Neutrals: Unless otherwise indicated, sharing of neutral/grounded conductors among single phase branch circuits of different phases installed in the same raceway is not permitted. Provide dedicated neutral/grounded conductor for each individual branch circuit. lighting and power.

B. Install products in accordance with manufacturer's instructions.

C. Install conductors and cable in a neat and workmanlike manner in accordance with NECA 1.

D. Install metal-clad cable (Type MC) in accordance with NECA 120.

E. Installation in Raceway:
   1. Tape ends of conductors and cables to prevent infiltration of moisture and other contaminants.
   2. Pull all conductors and cables together into raceway at same time.
   3. Do not damage conductors and cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.
   4. Use suitable wire pulling lubricant where necessary, except when lubricant is not recommended by the manufacturer.

F. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.

G. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods. Provide independent support from building structure. Do not provide support from raceways, piping, ductwork, or other systems.

H. Terminate cables using suitable fittings.
   1. Metal-Clad Cable (Type MC):
      a. Use listed fittings.
      b. Cut cable armor only using specialized tools to prevent damaging conductors or insulation. Do not use hacksaw or wire cutters to cut armor.

I. Install conductors with a minimum of 12 inches of slack at each outlet.

J. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.

K. Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 70.

L. Make wiring connections using specified wiring connectors.
   1. Make splices and taps only in accessible boxes. Do not pull splices into raceways or make splices in conduit bodies or wiring gutters.

2. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors.
3. Do not remove conductor strands to facilitate insertion into connector.
4. Clean contact surfaces on conductors and connectors to suitable remove corrosion, oxides, and other contaminates. Do not use wire brush on plated connector surfaces.
5. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
6. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

M. Insulate splices and taps that are made with uninsulated connectors using methods suitable for the application, with insulation and mechanical strength at least equivalent to unspliced conductors.
1. Dry Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.
   a. For taped connections, first apply adequate amount of rubber splicing electrical tape or electrical filler tape, followed by outer covering of vinyl insulating electrical tape.
   b. For taped connections likely to require re-entering, including motor leads, first apply varnished cambric electrical tape, followed by adequate amount of rubber splicing electrical tape, followed by outer covering of vinyl insulating electrical tape.
2. Damp Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.
   a. For connections with insulating covers, apply outer covering of moisture sealing electrical tape.
   b. For taped connections, follow same procedure as for dry locations but apply outer covering of moisture sealing electrical tape.
3. Wet Locations: Use heat shrink tubing.

N. Insulate ends of spare conductors using vinyl insulating electrical tape.

O. Color Code Legend: Provide identification label identifying color code for ungrounded conductors at each piece of feeder or branch-circuit distribution equipment when premises has feeders or branch circuits served by more than one nominal voltage system.

P. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.

Q. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.

R. Install wire and cable securely, in a neat and workmanlike manner, as specified in NECA-1.

S. Route wire and cable as required to meet project conditions.
1. Wire and cable routing indicated is approximate unless dimensioned.
2. Include circuit of lengths required to install connected devices within 10 ft. of location shown.

T. Use wiring methods indicated.

3.04 MC Cable Installation:

A. Install MC cable with minimum 12 inches of slack cable per run at each end of each cable, accessible for future use at the boxes.

B. MC cable two feet or shorter may be supported at boxes only. Support MC cable longer than two feet within 12 inches of each end of cable, and at maximum 5 foot intervals along the cable.

C. Route MC cable parallel with building walls and structure, and neatly support MC cable from them. Utilize conduit clamps or unistrut support to hold one, two or three MC cables. Utilize unistrut support to hold more than three MC cables.

D. Conform to the requirements of conduit routing and clearances from other utilities. Support MC cable according to N.E.C.

E. Provide manufacturer's compatible fittings meeting U.L. at boxes.

F. Provide metal clips or clamps within two feet of cable ends and maximum six feet intervals.

G. Conform to NEC bend radius.

H. Route MC cable parallel with building walls and structure, and neatly support MC cable from them. Do not "Beeline".

I. At turns in the MC cable, conform to NEC bend radius and provide slack. Do not pull MC cable tight around corners or other utilities.

END OF SECTION

SECTION 26 0526
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Grounding and bonding requirements.

B. Conductors for grounding and bonding.

C. Connectors for grounding and bonding.

D. Ground rod electrodes.

E. Grounding and bonding components.

F. Building Grounding System consisting of Riser conductors and Grounding Plates located in Electrical rooms and Data closets.

G. Provide all components necessary to complete the grounding system(s) consisting of:
   1. Metal underground water pipe.
   2. Metal frame of the building.

1.02 RELATED REQUIREMENTS

A. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables: Additional requirements for conductors for grounding and bonding, including conductor color coding.

1.03 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code, 2017; National Fire Protection Association.

B. UL 467 - Grounding and Bonding Equipment; Current Edition, Including All Revisions.

1.04 SUBMITTALS - NOT REQUIRED

1.05 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

PART 2 PRODUCTS

2.01 GROUNDING AND BONDING REQUIREMENTS

A. Do not use products for applications other than as permitted by NFPA 70 and product listing.

B. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.

C. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.02 GROUNDING AND BONDING COMPONENTS

A. General Requirements:
   1. Provide products listed, classified, and labeled by Underwriter's Laboratories, Inc. (UL) as suitable for the purpose intended.
   2. Provide products listed and labeled as complying with UL 467 where applicable.

B. Conductors for Grounding and Bonding, in Addition to Requirements of Section 26 0526:
   1. Use insulated copper conductors unless otherwise indicated.
      a. Exceptions:
         1) Use bare copper conductors where installed underground in direct contact with earth.
         2) Use bare copper conductors where directly encased in concrete (not in raceway).

C. Connectors for Grounding and Bonding:
   1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.

2. Unless otherwise indicated, use exothermic welded connections for underground, concealed and other inaccessible connections.
3. Unless otherwise indicated, use mechanical connectors, compression connectors, or exothermic welded connections for accessible connections.

D. Ground Rod Electrodes:
1. Comply with NEMA GR 1.
2. Material: Copper-bonded (copper-clad) steel.
3. Size: 3/4 inch diameter by 10 feet length, unless otherwise indicated.

2.03 CONNECTORS AND ACCESSORIES

A. Exothermic Connections: Shall be used for all connections to rods. A compression connection may be used so long as it is an IEEE 837-2002 approved connection method.

B. Wire: Stranded copper.

C. Grounding Electrode Conductor: Size to meet NFPA 70 requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that work likely to damage grounding and bonding system components has been completed.

B. Verify that field measurements are as shown on the drawings.

C. Verify that conditions are satisfactory for installation prior to starting work.

D. Verify existing conditions prior to beginning work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install grounding and bonding system components in a neat and workmanlike manner in accordance with NECA 1.

C. Ground Rod Electrodes: Unless otherwise indicated, install ground rod electrodes vertically. Where encountered rock prohibits vertical installation, install at 45 degree angle or bury horizontally in trench at least 30 inches (750 mm) deep in accordance with NFPA 70 or provide ground plates.

D. Make grounding and bonding connections using specified connectors.
1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.
2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.
3. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.
4. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
5. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

E. Identify grounding and bonding system components in accordance with Section 26 0553.

F. Bond all conduits and/or other conductor enclosures.

G. Bond all panelboards, safety switches and non-current carrying, metal enclosures of fixed equipment.

H. Provide bonding connection (minimum 2 AWG copper, or as shown on the riser diagram, whichever is larger) from grounding electrode to the Telecommunications Main Grounding Busbar (TMGB) as required.

I. Provide a minimum 2 AWG copper wire bond across the water meter, to be attached to ground clamps on water line on each side of the meter.

J. Provide a code size copper wire grounding electrode conductor in Schedule 40 PVC conduit from the ground bus in the main building service disconnecting means (such as Main Switchboard) to the line side of the main inside water valve and union, and to structural steel, ground rods, and other metallic piping systems as per NEC.

K. No PVC conduit containing copper grounding/bonding conductors shall be allowed in plenums.

L. Provide bonding strap from neutral to ground inside the main service entrance equipment as per the NEC and the Georgia State Electrical Code.

M. Install additional rod electrodes as required to achieve specified resistance to ground.

N. In earth outdoors, install solid ground rods with the top at 12" below grade.

O. Provide grounding triad configuration outside nearest the Main Electrical Room. Provide three 10 foot ground rods spaced a minimum of 20 feet apart to form the triad.

P. Provide grounding electrode conductor and connect to reinforcing steel in foundation footing . Bond steel together.

Q. Provide a separate grounding conductor in all flexible conduit.

R. Provide 12 AWG copper wire in all surface metal raceway and in all multi-outlet assemblies. Attach to ground terminals of each wiring device and bond to the conduit grounding system.

S. Equipment Grounding Conductor: Provide separate, insulated conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.

1. Bond to all metal boxes that the conductors pass through, including, but not limited to, pull boxes, junction boxes, and outlet boxes. The means of connection shall be through a grounding screw or other listed grounding device that is used for no other purpose.

3.03 FIELD QUALITY CONTROL

A. Perform ground electrode resistance tests under normally dry conditions. Precipitation within the previous 48 hours does not constitute normally dry conditions.

B. Investigate and correct deficiencies where measured ground resistances do not comply with specified requirements.

END OF SECTION

SECTION 26 0529

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Support and attachment components for equipment, conduit, cable, boxes, and other electrical work.

1.02 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code, 2017 Edition; National Fire Protection Association

1.03 SUBMITTALS - NOT REQUIRED

1.04 QUALITY ASSURANCE

A. Comply with NFPA 70.

B. Comply with applicable building code.

PART 2 PRODUCTS

2.01 SUPPORT AND ATTACHMENT COMPONENTS

A. General Requirements:
   1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of electrical work.
   2. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.
   3. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported. Include consideration for vibration, equipment operation, and shock loads where applicable.
   4. Do not use products for applications other than as permitted by NFPA 70 and product listing.
   5. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
      a. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
      b. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.

B. Conduit and Cable Supports: Straps, clamps, etc. suitable for the conduit or cable to be supported.
   1. Conduit Straps: One-hole or two-hole type; steel or malleable iron.
   2. Conduit Clamps: Bolted type unless otherwise indicated.

C. Outlet Box Supports: Hangers, brackets, etc. suitable for the boxes to be supported.

D. Metal Channel (Strut) Framing Systems: Factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.
   1. Comply with MFMA-4.

E. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.

F. Anchors and Fasteners:
   1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.

2.02 MATERIALS

A. Hangers, Supports, Anchors, and Fasteners - General: Corrosion-resistant materials of size and type adequate to carry the loads of equipment and conduit, including weight of wire in conduit.

B. Supports: Fabricated of structural steel or formed steel members; galvanized or painted. All ferrous fasteners exposed to outside conditions and refrigerated spaces shall be coated with corrosion resistant, plated finish to prevent rust.

C. Anchors and Fasteners:
   1. Concrete Structural Elements: Use precast inserts, expansion anchors, or preset inserts.
   2. Steel Structural Elements: Use beam clamps, steel spring clips, or welded fasteners.
   3. Concrete Surfaces: Use expansion anchors.
   4. Hollow Masonry, Plaster, and Gypsum Board Partitions: Use toggle bolts.
   5. Solid Masonry Walls: Use expansion anchors or preset inserts.
   6. Sheet Metal: Use sheet metal screws.
   7. Wood Elements: Use wood screws.

D. All ferrous fasteners exposed to outside conditions and refrigerated spaces shall be coated with corrosion resistant, plated finish to prevent rust.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install support and attachment components in a neat and workmanlike manner in accordance with NECA 1.

C. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

D. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.

E. Unless specifically indicated or approved by Architect, do not provide support from roof deck.

F. Do not penetrate or otherwise notch or cut structural members without approval of Structural Design Professional.

G. Equipment Support and Attachment:
   1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
   2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
   3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
   4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

H. Secure fasteners according to manufacturer's recommended torque settings.

I. Remove temporary supports.

3.02 FIELD QUALITY CONTROL

A. Inspect support and attachment components for damage and defects.

B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

C. Correct deficiencies and replace damaged or defective support and attachment components.

D. Install hangers and supports as required to adequately and securely support electrical system components, in a neat and workmanlike manner, as specified in NECA 1.
   1. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.
   2. Do not drill or cut structural members.
   3. Hanger rods shall not extend more than 1" below the equipment or mounting bracket. Trim any excess length.

E. Rigidly weld support members or use hexagon-head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.

F. Install surface-mounted cabinets and panelboards with minimum of four anchors. Provide a 3/4 inch fire resistant plywood backboard behind all surface-mounted cabinets, panelboards, telecommunications equipment, starters, relays, disconnect switches, and as shown.
   1. All backboards shall be coated with two (2) coats of fire resistant light gray enamel paint. Paint and finish shall be applied prior to installation.
   2. Anchor backboard to wall with 1/4-inch toggle bolts.

G. In wet and damp locations use steel channel supports to stand cabinets and panelboards 1 inch off wall. Do not install plywood backboards in wet locations.

H. Use sheet metal channel to bridge studs above and below cabinets and panelboards recessed in hollow partitions.

END OF SECTION

SECTION 26 0534
CONDUIT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Flexible metal conduit (FMC).

B. Liquidtight flexible metal conduit (LFMC).

C. Electrical metallic tubing (EMT).

D. Rigid polyvinyl chloride (PVC) conduit.

E. Liquidtight flexible nonmetallic conduit (LFNC).

F. Conduit fittings.

G. Conduit, fittings and conduit bodies.

1.02 RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.

1.03 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code, 2017 Edition; National Fire Protection Association.

B. UL 360 - Liquid-Tight Flexible Steel Conduit; Current Edition, Including All Revisions.

C. UL 797 - Electrical Metallic Tubing-Steel; Current Edition, Including All Revisions.

D. UL 1660 - Liquid-Tight Flexible Nonmetallic Conduit; Current Edition, Including All Revisions.

1.04 SUBMITTALS - NOT REQUIRED

1.05 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for purpose specified and shown.

1.06 ABBREVIATIONS

A. GRS indicates galvanized rigid steel conduit also termed rigid steel conduit .

B. RGS indicates galvanized rigid steel conduit also termed rigid steel conduit .

C. GRC indicates galvanized rigid steel conduit also termed rigid steel conduit .

D. IMC indicates intermediate metal conduit whether made of galvanized steel or aluminum. See Part 2 for specification.

E. EMT indicates Electrical Metallic Tubing whether made of galvanized steel or aluminum. See Part 2 for specification.

F. PVC40 indicates PVC electrical conduit, schedule 40.

G. PVC80 indicates PVC electrical conduit, schedule 80.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conduit and fittings in accordance with manufacturer's instructions.

B. Accept conduit on site. Inspect for damage.

C. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

D. Protect PVC conduit from sunlight.

PART 2 PRODUCTS

2.01 CONDUIT REQUIREMENTS

A. Provide all conduit, fittings, supports, and accessories required for a complete raceway system.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.02 METAL CONDUIT

A. Rigid Metal Conduit.

B. Fittings and Conduit Bodies: Material to match conduit. Fittings shall be malleable iron threaded.

C. Intermediate Metal Conduit (IMC) may be substituted for Rigid Steel conduit as allowed by the National Electrical Code (NEC). All fittings shall be the same as for Rigid Steel conduit.

2.03 FLEXIBLE METAL CONDUIT (FMC)

A. Description: NFPA 70, Type FMC standard wall steel flexible metal conduit listed and labeled as complying with UL 1, and listed for use in classified firestop systems to be used.

B. Fittings:
   1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   2. Material: Use steel or malleable iron.

C. Description: Interlocked steel construction.

D. Connectors: Provide Zinc or cadmium plated steel. Fittings anchoring conduit by means of set screws are prohibited.

E. B-X cable is prohibited.

F. Provide separate grounding conductor inside flexible conduit.

G. Flexible conduit shall be liquid-tight neoprene coated in damp & wet locations and for all motor connections.

H. Flexible conduit shall be minimum 1/2-inch nominal.

2.04 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

A. Description: NFPA 70, Type LFMC polyvinyl chloride (PVC) jacketed steel flexible metal conduit listed and labeled as complying with UL 360.

B. Fittings:
   1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   2. Material: Use steel or malleable iron.

C. Description: Interlocked steel construction with PVC jacket.

D. Fittings: NEMA FB 1.

E. Use LFMC for the final connection to all HVAC equipment (indoors and outdoors), all vibrating equipment, and all outdoor equipment. Maximum length 4 feet.

2.05 ELECTRICAL METALLIC TUBING (EMT)

A. Description: NFPA 70, Type EMT steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.

B. Fittings:
   1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   2. Material: Use steel or malleable iron.
   3. Connectors and Couplings: Use compression (gland) or set-screw type.
      a. Do not use indenter type connectors and couplings.

C. Fittings and Conduit Bodies: Steel or malleable iron compression type.

2.06 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT

A. Description: NFPA 70, Type PVC rigid polyvinyl chloride conduit complying with NEMA TC 2 and listed and labeled as complying with UL 651; Schedule 40 unless otherwise indicated, Schedule 80 where subject to physical damage; rated for use with conductors rated 90 degrees C.

B. Fittings:
   1. Manufacturer: Same as manufacturer of conduit to be connected.
   2. Description: Fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; material to match conduit.

C. Description: Schedule 40 PVC.

D. Fittings and Conduit Bodies: Material to match conduit.
   1. The conduit, fittings, elbows and cement shall be produced by the same manufacturer.

2.07 LIQUIDTIGHT FLEXIBLE NONMETALLIC CONDUIT (LFNC)

A. Description: NFPA 70, Type LFNC liquidtight flexible nonmetallic conduit listed and labeled as complying with UL 1660.

B. Fittings:
   1. Manufacturer: Same as manufacturer of conduit to be connected.
   2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B; suitable for the type of conduit to be connected.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as shown on drawings.

B. Verify that mounting surfaces are ready to receive conduits.

C. Verify that conditions are satisfactory for installation prior to starting work.

D. Verify routing and termination locations of conduit prior to rough-in.

E. Conduit routing is shown on drawings in approximate locations unless dimensioned. Route as required to complete wiring system.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install conduit in a neat and workmanlike manner in accordance with NECA 1.

C. Install liquidtight flexible nonmetallic conduit (LFNC) in accordance with NECA 111.

D. Conduit Support:
   1. Secure and support conduits in accordance with NFPA 70 and Section 26 0529 using suitable supports and methods.
   2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

E. Connections and Terminations:
   1. Use suitable adapters where required to transition from one type of conduit to another.
   2. Provide drip loops for liquidtight flexible conduit connections to prevent drainage of liquid into connectors.
   3. Provide insulating bushings or insulated throats at all conduit terminations to protect conductors.
   4. Secure joints and connections to provide maximum mechanical strength and electrical continuity.

F. Penetrations:
   1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Design Professional.
   2. Make penetrations perpendicular to surfaces unless otherwise indicated.

3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.
4. Conceal bends for conduit risers emerging above ground.
5. Seal interior of conduits entering the building from underground at first accessible point to prevent entry of moisture and gases.
6. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
7. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty. Include proposed locations of penetrations and methods for sealing with submittals.
8. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.

G. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:
1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
2. Where conduits are subject to earth movement by settlement or frost.

H. Condensation Prevention: Where conduits cross barriers between areas of potential substantial temperature differential, provide sealing fitting or approved sealing compound at an accessible point near the penetration to prevent condensation. This includes, but is not limited to:
1. Where conduits pass from outdoors into conditioned interior spaces.
2. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.

I. Provide grounding and bonding in accordance with Section 26 0526.

3.03 INTERFACE WITH OTHER PRODUCTS

A. Penetration of fire rated walls, partitions, floors and ceilings: The contractor shall seal around all raceway penetrating fire rated walls, partitions, floors, and ceilings. Contractor shall utilize UL Listed material and shall install per UL Testing.

B. Install conduit to preserve fire resistance rating of partitions and other elements.

C. Route conduit through roof openings for piping and ductwork whenever possible. Where separate roofing penetration is required, coordinate location and installation method with roofing installation specified herein.

END OF SECTION

SECTION 26 0537
BOXES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Outlet and device boxes up to 100 cubic inches, including those used as junction and pull boxes.

B. Cabinets and enclosures, including junction and pull boxes larger than 100 cubic inches.

C. Wall and ceiling outlet boxes.

D. Pull and junction boxes.

1.02 RELATED REQUIREMENTS

A. Section 26 0529 - Hangers and Supports for Electrical Systems.

B. Section 26 2726 - Wiring Devices:
   1. Wall plates.

1.03 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code, 2017 Edition; National Fire Protection Association.

1.04 SUBMITTALS - NOT REQUIRED

1.05 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

PART 2 PRODUCTS

2.01 BOXES

A. General Requirements:
   1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.
   2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.
   3. Provide products listed, classified, and labeled as suitable for the purpose intended.
   4. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
   5. Provide grounding terminals within boxes where equipment grounding conductors terminate.

B. Outlet and Device Boxes Up to 100 cubic inches, Including Those Used as Junction and Pull Boxes:
   1. Use sheet-steel boxes for dry locations unless otherwise indicated or required.
   2. Use cast iron boxes or cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.
   3. Use suitable concrete type boxes where flush-mounted in concrete.
   4. Use suitable masonry type boxes where flush-mounted in masonry walls.
   5. Use raised covers suitable for the type of wall construction and device configuration where required.
   6. Use shallow boxes where required by the type of wall construction.
   7. Do not use "through-wall" boxes designed for access from both sides of wall.
   8. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.
   9. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.
   10. Boxes for Supporting Luminaires and Ceiling Fans: Listed as suitable for the type and weight of load to be supported; furnished with fixture stud to accommodate mounting of luminaire where required.

11. Boxes for Ganged Devices: Use multigang boxes of single-piece construction. Do not use field-connected gangable boxes.
12. Wall Plates: Comply with Section 26 2726.

C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches:
1. Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E, or UL 508A.
2. NEMA 250 Environment Type, Unless Otherwise Indicated:
3. Junction and Pull Boxes Larger Than 100 cubic inches:
a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.

2.02 MANUFACTURERS

A. Appleton Electric: www.appletonelec.com.

B. Arc-Co./Division of Arcade Technology: www.arc-co.com.

C. Unity Manufacturing: www.unitymfg.com.

D. Steel City: www.steelcity.com

E. or equal.

2.03 OUTLET BOXES

A. Sheet Metal Outlet Boxes: NEMA OS 1, galvanized steel.
1. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; include 3/8 inch male fixture studs where required.
a. Boxes and covers shall not be less than 1/16 inch thick.
b. Box shall be anchored in place.
c. Unless otherwise specified, ceiling outlet boxes need not be provided with plaster rings and shall be minimum two inches (2") deep. Boxes shall be provided with blank covers.
2. Concrete Ceiling Boxes: Concrete type.
3. Switch and wall receptacles outlet boxes in plaster walls shall be four inches (4") square.
4. In exposed masonry or tile walls, four inch (4") square boxes with deep plaster covers shall be used.

B. Cast Boxes: NEMA FB 1, Type FD, cast feralloy. Provide gasketed cover by box manufacturer. Provide threaded hubs.

C. Wall Plates for Finished Areas: As specified in Section 26 2726.

2.04 PULL AND JUNCTION BOXES

A. All pullboxes and junction boxes shall be sized in accordance with the National Electrical Code.

B. Sheet Metal Boxes: NEMA OS 1, galvanized steel.

C. Hinged Enclosures: As specified in Section 26 2716.

D. Surface Mounted Exposed Boxes: Boxes shall be corrosion resistant cast iron in wet locations. Use solid steel boxes with no knockouts in dry locations. Holes for raceways shall be drilled on the job.

E. Surface Mounted Cast Metal Box: NEMA 250, Type 4; flat-flanged, surface mounted junction box:
1. Material: Galvanized cast iron.
2. Cover: Furnish with ground flange, neoprene gasket, and galvanized steel cover/screws.

F. In-Ground Cast Metal Box: NEMA 250, Type 6, outside flanged, recessed cover box for flush mounting:
1. Material: Galvanized cast iron.
2. Cover: Nonskid cover with neoprene gasket and stainless steel cover screws.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as shown on drawings.

B. Verify that mounting surfaces are ready to receive boxes.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

C. Box Supports:
   1. Secure and support boxes in accordance with NFPA 70 and Section 26 0529 using suitable supports and methods.
   2. Provide independent support from building structure except for cast metal boxes (other than boxes used for fixture support) supported by threaded conduit connections in accordance with NFPA 70. Do not provide support from piping, ductwork, or other systems.

D. Install boxes plumb and level.

E. Flush-Mounted Boxes:
   1. Install boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that front edge of box or associated raised cover is not set back from finished surface more than 1/4 inch or does not project beyond finished surface.
   2. Install boxes in combustible materials such as wood so that front edge of box or associated raised cover is flush with finished surface.
   3. Repair rough openings around boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that there are no gaps or open spaces greater than 1/8 inch at the edge of the box.

F. Install boxes as required to preserve insulation integrity.

G. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

H. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.

I. Close unused box openings.

J. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.

K. Provide grounding and bonding in accordance with Section 26 0526.

L. Install boxes securely, in a neat and workmanlike manner, as specified in NECA 1.

M. Install in locations as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections, and as required by NFPA 70.

N. No more than one box extension shall be installed on any outlet or pull box. Larger boxes shall be installed as required per NEC.

O. Provide outlet boxes for lighting fixtures, wall switches, wall receptacles, telecommunications equipment, protection equipment, antenna, and all equipment.

P. Coordinate installation of outlet boxes for equipment connected under Section 26 2717.

Q. Unless otherwise indicated wall outlet boxes shall be placed with center lines at distances above the finished floor (except at casework) as follows:
   1. Convenience Outlets: 18"
   2. Switches: 42"
   3. Clocks: 8'-2" or 12" below ceiling. Conform to lowest mounting.

4. Fire Alarm Pull Stations: 48" to the operable handle.
5. Fire Alarm Visual or Horn/Visual: 80" or 6" below ceiling - conform to lowest mounting. Note that this measurement is to the BOTTOM of the lens on the device.
6. Television Outlets: 18 inches
7. Telecommunications Outlets: 18 inches
8. Wall Phone Outlets: Per ADA requirements.
9. Drinking Fountain Outlets: As recommended by manufacturer.

R. The approximate locations of outlets are shown on the plans. The exact locations shall be determined at the building. The right is reserved to change the exact location of any outlet a maximum of 10 feet before it is permanently installed without additional cost.

S. Orient boxes to accommodate wiring devices oriented as specified in Section 26 2726.

T. Maintain headroom and present neat mechanical appearance.

U. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.

V. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 6 inches from ceiling access panel or from removable recessed luminaire.

W. Install boxes to preserve fire resistance rating of partitions and other elements, using materials and methods specified.

X. Coordinate mounting heights and locations of outlets mounted above counters, benches, and backsplashes.

Y. Locate outlet boxes to allow luminaires positioned as shown on reflected ceiling plan.

Z. Where outlets are shown above cabinets and casework, the outlets shall be mounted so the bottom of the device plates will be 1 to 3 inches above the backsplash.
1. Where outlets of different levels are shown adjacent, they shall be installed in one vertical line. Outlets shown back to back on a common wall shall be offset a minimum of 10 inches to dampen sound transmission through the wall. On all walls with 1 hour or greater fire rating, "back to back" outlets shall be minimum 24 inches apart with a stud between outlets for gypboard constructed partition.
2. Where the mounting height of an outlet is not shown on the plans or specifications, the contractor shall contact the architect for exact mounting height requirements.
3. At locations where two or more devices are shown adjacent and at the same mounting height, they shall be installed in one outlet box and covered with one face plate.

AA. Where outlets are installed in unfinished block or tile partitions, they shall be installed at the points in the tile to permit the face plate to cover the rough opening. The horizontal and vertical locations indicated may be altered to permit doing this. However, contractor shall check the Architectural drawings to prevent conflicts when shifting location. Where outlets are shown back to back on a common wall, they shall be offset 10" to avoid sound transmission.

AB. Outlets in Poured-in-Place Concrete: A six by six by three inch (6"X6"X3") deep wood box shall be placed in the form before the concrete is poured. This box shall be removed before waterproofing is applied. Install outlet and grout around the box. Boxes shall be set so that cover plates are flush.

AC. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.

AD. Use flush mounting outlet box in finished areas.

AE. Do not install flush mounting box back-to-back in walls; provide minimum 6 inches separation. Provide minimum 24 inches separation in acoustic rated walls.

AF. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.

AG. Use stamped steel bridges to fasten flush mounting outlet box between studs.

AH. Install flush mounting box without damaging wall insulation or reducing its effectiveness.

AI. Use adjustable steel channel fasteners for hung ceiling outlet box.

AJ. Do not fasten boxes to ceiling support wires.

AK. Support boxes independently of conduit. Provide threaded rods, screws, bolts, toggle bolts, etc. for support. Do not use clips or other hardware to attach boxes to ceiling grids.

AL. Use gang box where more than one device is mounted together. Do not use sectional box.

AM. Use two gang box with plaster ring for single device outlets.

AN. Use cast outlet boxes in exterior locations exposed to the weather and wet locations.

AO. Use cast outlet boxes for all surface mount box installations in Mechanical Rooms.

AP. Boxes for any specialty devices such as speakers, fire alarm horns and stations, and program signals shall be obtained from the equipment manufacturer.

3.03 ADJUSTING

A. Install knockout closures in unused box openings.

3.04 CLEANING

A. Clean interior of boxes to remove dirt, debris, plaster and other foreign material.

END OF SECTION

SECTION 26 0538
NON-CONTINUOUS CABLE SUPPORT SYSTEM (J-HOOKS)

PART 1 GENERAL

1.01 SECTION INCLUDES

A. J-hooks and accessories.

1.02 RELATED REQUIREMENTS

A. Section 26 0529 - Hangers and Supports for Electrical Systems.

1.03 REFERENCES

A. NFPA 70 - National Electrical Code, 2017 Edition; National Fire Protection Association.

1.04 SUBMITTALS

A. See Section 26 0510 - General Electrical Requirements, for submittal procedures.

B. Product Data: Provide data for j-hooks, attachment means, and accessories.

C. Indicate tray type, dimensions, support points, and finishes.

D. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Quality Assurance. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.05 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Products: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Erico Caddy Cat HP Series.

B. B-Line

C. Garvin JHK Series

2.02 NON-CONTINUOUS CABLE SUPPORT SYSTEM (J-HOOKS)

A. J-Shaped cable support.

B. Material: Pre-galvanized steel with rounded edges.

C. Meets TIA 568-C and TIA 569-C.

D. No rings or fabric loops allowed.

E. Shall be a "j-hook" intended and listed for cable support, not a "pipe-hanger"

F. Size: Contractor shall provide j-hooks sized for the wirefill installed in this project plus 20% spare space in each hook. The Contractor may use stacked j-hooks.

G. Provide manufacturer's standard clamps, hangers, and brackets intended and listed for the application.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install j-hooks in accordance with manufacturer's instructions and all applicable sections of the NEC.

B. Support j-hooks in accordance with Section 26 0529. J-hooks shall not be attached to piping, duct, ceiling grids or their support wires, conduit, or anything other than structure or structural walls.

C. Connections to supports shall be made with fittings and hardware specifically designed for the purpose.

D. Provide a j-hook support within two feet of any telecomm conduit opening and at 4-foot intervals along the pathway.

E. Penetration of Fire/Smoke Rated Partitions: Provide a 4" rigid conduit through the wall stubbed out 6-inches on each side, with a bushing on each opening. Fill the conduit with Dow Corning RTV foam or 3M Barrier compounds (leaving no voids around the cables) to maintain the integrity of the partition fire or smoke rating.

F. The Contractor shall coordinate the path and placement of all j-hooks with all trades above the ceiling. Modify the path from what is shown on the drawings as required for field coordination. Access to the cable pathway shall be maintained at all times.

G. **T**he j-hooks shall remain free of paint, fire proofing spray, and construction debris.

END OF SECTION

SECTION 26 0553
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electrical identification requirements.

B. Identification nameplates and labels.

C. Warning signs and labels.

1.02 RELATED REQUIREMENTS

A. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables: Color coding for power conductors and cables 600 V and less; vinyl color coding electrical tape.

1.03 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code, 2017 Edition.

B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. NFPA 70E - Standard for Electrical Safety in the Workplace; 2015.

1.04 SUBMITTALS

A. See Section 25 0510 for general submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.

C. Shop Drawings: Provide schedule of items to be identified indicating proposed designations, materials, legends, and formats.

1.05 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

PART 2 PRODUCTS

2.01 IDENTIFICATION REQUIREMENTS

A. Identification for Equipment:
   1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.
      a. Panelboards:
         1) Identify power source and circuit number. Include location when not within sight of equipment.
         2) Identify main overcurrent protective device. Use identification label for panelboards with a door. For power distribution panelboards without a door, use identification nameplate.
         3) Use typewritten circuit directory to identify load(s) served for panelboards with a door. Identify spares and spaces.
         4) For power panelboards without a door, use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.
      b. Enclosed switches, circuit breakers, and motor controllers:
         1) Identify voltage and phase.
         2) Identify power source and circuit number. Include location when not within sight of equipment.
         3) Identify load(s) served. Include location when not within sight of equipment.
   2. Available Fault Current Documentation: Use identification label to identify the available fault current and date calculations were performed at locations requiring documentation by NFPA 70, including but not limited to the following.
      a. Service equipment.
      b. Elevator control panels.

3. Arc Flash Hazard Warning Labels: Use warning labels to identify arc flash hazards for electrical equipment, such as switchboards, panelboards, industrial control panels, meter socket enclosures, and motor control centers that are likely to require examination, adjustment, servicing, or maintenance while energized.
   a. Minimum Size: 3.5 by 5 inches.
   b. Legend: Include orange header that reads "WARNING", followed by the word message "Arc Flash and Shock Hazard; Appropriate PPE Required; Do not operate controls or open covers without appropriate personal protection equipment; Failure to comply may result in injury or death; Refer to NFPA 70E for minimum PPE requirements" or approved equivalent.

B. Identification for Conductors and Cables:
   1. Color Coding for Power Conductors 600 V and Less: Comply with Section 26 0519.

2.02 IDENTIFICATION NAMEPLATES AND LABELS

A. Identification Nameplates:
   1. Materials:
      a. Indoor Clean, Dry Locations: Use plastic nameplates.
      b. Outdoor Locations: Use plastic, stainless steel, or aluminum nameplates suitable for exterior use.
   2. Plastic Nameplates: Two-layer or three-layer laminated acrylic or electrically non-conductive phenolic with beveled edges; minimum thickness of 1/16 inch; engraved text.
   3. Stainless Steel Nameplates: Minimum thickness of 1/32 inch; engraved or laser-etched text.
   4. Aluminum Nameplates: Anodized; minimum thickness of 1/32 inch; engraved or laser-etched text.
   5. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch high; Four, located at corners for larger sizes.

B. Identification Labels:
   1. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.
   2. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.

2.03 WARNING SIGNS AND LABELS

A. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.

B. Warning Signs:
   1. Materials:
   2. Minimum Size: 7 by 10 inches unless otherwise indicated.

C. Warning Labels:
   1. Materials: Use factory pre-printed or machine-printed self-adhesive polyester or self-adhesive vinyl labels; UV, chemical, water, heat, and abrasion resistant; produced using materials recognized to UL 969.
   2. Machine-Printed Labels: Use thermal transfer process printing machines and accessories recommended by label manufacturer.
   3. Minimum Size: 2 by 4 inches unless otherwise indicated.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Unless otherwise indicated, locate products as follows:
   1. Surface-Mounted Equipment: Enclosure front.
   2. Flush-Mounted Equipment: Inside of equipment door.

3. Free-Standing Equipment: Enclosure front; also enclosure rear for equipment with rear access.
4. Elevated Equipment: Legible from the floor or working platform.
5. Branch Devices: Adjacent to device.
6. Interior Components: Legible from the point of access.
7. Conductors and Cables: Legible from the point of access.

C. Install identification products centered, level, and parallel with lines of item being identified.

D. Secure nameplates to exterior surfaces of enclosures using stainless steel screws and to interior surfaces using self-adhesive backing or epoxy cement.

E. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.

F. Mark all handwritten text, where permitted, to be neat and legible.

3.02 FIELD QUALITY CONTROL

A. Replace self-adhesive labels and markers that exhibit bubbles, wrinkles, curling or other signs of improper adhesion.

END OF SECTION

SECTION 26 2416
PANELBOARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Power distribution panelboards.

B. Lighting and appliance panelboards.

C. Overcurrent protective devices for panelboards.

1.02 RELATED REQUIREMENTS

A. Section 26 0529 - Hangers and Supports for Electrical Systems.

B. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

1.03 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code, 2017 Edition; National Fire Protection Association.

1.04 SUBMITTALS

A. See Section 26 0510 - General Electrical Requirements, for submittal procedures.

B. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, circuit breaker arrangement and sizes.

C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

D. Project Record Documents: Record actual installed locations of panelboards and actual installed circuiting arrangements.

E. Maintenance Data: Include spare parts listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

1.05 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.06 MAINTENANCE MATERIALS

A. Furnish two of each panelboard key.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Eaton Electrical/Cutler-Hammer: www.eatonelectrical.com.

B. GE Industrial: www.geindustrial.com.

C. Square D: www.squared.com.

D. Siemens Industry, Inc.: www.usa.siemens.com.

2.02 PANELBOARDS - GENERAL REQUIREMENTS

A. Provide products listed, classified, and labeled as suitable for the purpose intended.

B. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
   1. Altitude: Less than 6,600 feet.
   2. Ambient Temperature:
      a. Panelboards Containing Circuit Breakers: Between 23 degrees F and 104 degrees F.

C. Short Circuit Current Rating:
   1. Provide panelboards with listed short circuit current rating as indicated on the drawings.

D. Mains: Configure for top or bottom incoming feed as indicated or as required for the installation.

E. Branch Overcurrent Protective Devices: Replaceable without disturbing adjacent devices.

F. Bussing: Sized in accordance with UL 67 temperature rise requirements.
   1. Provide solidly bonded equipment ground bus in each panelboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.

G. Conductor Terminations: Suitable for use with the conductors to be installed.

H. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
   1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
   2. Boxes: Galvanized steel unless otherwise indicated.
      a. Provide wiring gutters sized to accommodate the conductors to be installed.
   3. Fronts:
      a. Fronts for Surface-Mounted Enclosures: Same dimensions as boxes.
      b. Fronts for Flush-Mounted Enclosures: Overlap boxes on all sides to conceal rough opening.
   4. Lockable Doors: All locks keyed alike unless otherwise indicated.

I. Future Provisions: Prepare all unused spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.

2.03 POWER DISTRIBUTION PANELBOARDS

A. Description: Panelboards complying with NEMA PB 1, power and feeder distribution type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.

B. Conductor Terminations:
   1. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
   2. Main and Neutral Lug Type: Mechanical.

C. Bussing:
   1. Phase and Neutral Bus Material: Aluminum.
   2. Ground Bus Material: Aluminum.

D. Circuit Breakers:
   1. Provide bolt-on type or plug-in type secured with locking mechanical restraints.

E. Enclosures:
   1. Provide surface-mounted enclosures unless otherwise indicated.

F. Description: NEMA PB 1, circuit breaker type, factory assembled.

G. Bus Assembly Arrangement: Distribution phase sequence type vertically numbered so that odd numbered single poles and spaces are located on the left. No two single poles or spaces, vertically, shall be connected to the same phase. All current carrying parts shall be plated. See schedules for special arrangements. Provide black vinyl pole identifiers with white text; no paper stickers. Numbers shall start with 1 at the top of the panel.

H. Minimum integrated short circuit rating: As indicated.
   1. Series rating is permitted. Manufacturer shall certify in writing that all series rated elements have been tested and approved for the application by U.L. This certification shall be included with the submittals.

I. Molded Case Circuit Breakers: With integral thermal and instantaneous magnetic trip in each pole; UL listed. For air conditioning equipment branch circuits provide circuit breakers UL listed as Type HACR. All load side connections of the same breaker shall be in the same gutter for multi-pole breakers.

J. Circuit Breaker Accessories: Trip units and auxiliary switches as indicated.

K. Enclosures shall be NEMA 1 unless otherwise noted. Dimensions of enclosure shall not exceed what is shown on the plans.
   1. Provide with code size side and end gutters, 4 inch minimum.
   2. Enclosure shall be constructed of galvanized code gauge steel.
   3. Boxes shall NOT be furnished with concentric knockouts pre-punched by the manufacturer.

L. Cabinet Front: Surface type, fastened with adjustable, concealed trim clamps, hinged door with flush lock, metal directory frame, finished in rust inhibiting prime coat and manufacturer's standard gray enamel. Directory cover shall be glass or clear plastic. Front shall be constructed of code gauge steel.

2.04 LIGHTING AND APPLIANCE PANELBOARDS

A. Description: Panelboards complying with NEMA PB 1, lighting and appliance branch circuit type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.

B. Conductor Terminations:
   1. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
   2. Main and Neutral Lug Type: Mechanical.

C. Bussing:
   1. Phase Bus Connections: Arranged for sequential phasing of overcurrent protective devices.
   2. Phase and Neutral Bus Material: Aluminum.
   3. Ground Bus Material: Aluminum.

D. Circuit Breakers: Thermal magnetic bolt-on type unless otherwise indicated.

E. Enclosures:
   1. Provide surface-mounted or flush-mounted enclosures as indicated.
   2. Provide clear plastic circuit directory holder mounted on inside of door.

F. Description: NEMA PB1, circuit breaker type, factory assembled lighting and appliance branch circuit panelboard.

G. Bus Assembly Arrangement: Distribution phase sequence type vertically numbered so that odd numbered single poles and spaces are located on the left. No two single poles or spaces, vertically, shall be connected to the same phase. All current carrying parts shall be plated. See schedules for special arrangements. Provide black vinyl pole identifiers with white text; no paper stickers. Numbers shall start with 1 at the top of the panel.

H. Minimum Integrated Short Circuit Rating: As indicated.
   1. Series rating is permitted. Manufacturer shall certify in writing that all series elements have been tested and approved for the application by U.L. This certification shall be included with the submittals.

I. Molded Case Circuit Breakers: Thermal magnetic trip circuit breakers, bolt-on type, quick-make, quick-break, ambient compensated with common trip handle for all poles; UL listed.
   1. Type SWD for lighting circuits.
   2. Type HACR for air conditioning equipment circuits.
   3. Class A ground fault interrupter circuit breakers where scheduled.
   4. Do not use tandem circuit breakers.
   5. All load side connections of the same breaker shall be in the same gutter for multi-pole breakers.

2.05 OVERCURRENT PROTECTIVE DEVICES

A. Molded Case Circuit Breakers:

1. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
2. Interrupting Capacity:
   a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated.
   b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
3. Conductor Terminations:
   a. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
4. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
5. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install panelboards securely, in a neat and workmanlike manner in accordance with NECA 1 (general workmanship), NECA 407 (panelboards), and NEMA PB 1.1.

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide required supports in accordance with Section 26 0529.

E. Install panelboards plumb.

F. Install flush-mounted panelboards so that trims fit completely flush to wall with no gaps and rough opening completely covered.

G. Mount panelboards such that the highest position of any operating handle for circuit breakers or switches does not exceed 79 inches above the floor or working platform.

H. Provide minimum of six spare 1 inch trade size conduits out of each flush-mounted panelboard stubbed into accessible space above ceiling.

I. Provide grounding and bonding in accordance with Section 26 0526.

J. Install all field-installed branch devices, components, and accessories.

K. Install panelboards in accordance with NEMA PB 1.1 and the NECA Standard of Installation.

L. Install panelboards plumb. Install recessed panelboards flush with wall finishes.

M. Height: 6 feet to top of panelboard; install panelboards taller than 6 feet with bottom no more than 4 inches above floor.

N. Provide 4 inch high, 6 inch deep concrete housekeeping pad beneath each surface mounted panelboard. The concrete pad shall enclose all conduits feeding into the panelboard from the floor.

O. Provide filler plates to cover unused spaces in panelboards.

P. Provide computer-generated circuit directory for each lighting and appliance panelboard and each power distribution panelboard provided with a door, clearly and specifically indicating the loads served. Identify spares and spaces.

Q. Provide typed circuit directory for each branch circuit panelboard. Revise directory to reflect circuiting changes required to balance phase loads. Directory shall contain complete equipment identification and space numbers of all spaces controlled by branch circuits.

R. Provide identification nameplate for each panelboard in accordance with Section 26 0553.

S. Provide arc flash warning labels in accordance with NFPA 70.

T. Provide spare conduits out of each recessed panelboard to an accessible location above ceiling. Identify each as SPARE.
   1. Minimum spare conduits: 3 empty 3/4 inch.

U. Shunt Trip Circuit Breakers: Provide conduit and conductors to interlock control of shunt trip breakers.

V. Ground and bond panelboard enclosure according to Section 26 0526.

3.02 FIELD QUALITY CONTROL

A. Correct deficiencies and replace damaged or defective panelboards or associated components.

3.03 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

B. Adjust alignment of panelboard fronts.

3.04 CLEANING

A. Clean dirt and debris from panelboard enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

SECTION 26 2417
SURGE PROTECTIVE DEVICES (SPDS)

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Low Voltage AC Surge Protection for Electrical Distribution Systems

1.02 RELATED SECTIONS

A. Section 26 2416 - Panelboards

1.03 REFERENCES

A. NFPA 70 - National Electrical Code; National Fire Protection Association; 2017.

B. ANSI/UL 1449 - Fourth Edition

1.04 DEFINITIONS

A. Where items are shown as "lightning arrestor", "lightning suppressor", "surge arrestor", "arrestor", "suppressor", "transient voltage surge suppressor" (TVSS), or "surge suppressor", provide Surge Protective Device (SPD).

1.05 SUBMITTALS

A. See Section 26 0510- General Electrical Requirements, for submittal procedures.

B. Provide verification that the SPD complies with the required ANSI/UL 1449 4th Edition listing by Underwriters Laboratories (UL). Compliance may be in the form of a file number that can be verified on UL's website, as long as the website contains the following information at a minimum: model number, SPD Type, system voltage, phases, modes of protection, Voltage Protection Rating (VPR), and Nominal Discharge Current (In).

C. For sidemount mounting applications (SPD mounted external to electrical assembly), electrical/mechanical drawings showing unit dimensions, weights, installation instruction details, and wiring configuration.

D. Product Data: Provide data sheets for each different component to be used.
   1. Provide a list of device locations with the corresponding device type proposed.
   2. Show that Surge Protective Devices (SPDs) and associated components are manufactured in the United States of America.

E. Submit a copy of the written guarantee.

F. Provide a letter stating that the manufacturer shall provide unit replacement within 48 hours of notification by Owner with or without prior receipt of damaged parts.

G. Operating & Maintenance Data:
   1. Submit the service organization name and phone number.
   2. Operation and maintenance manuals shall be provided with each SPD shipped.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years of documented experience.

B. SPD units and all components shall be designed, manufactured, and tested in accordance with the latest applicable UL standard (ANSI/UL 1449 4th Edition).

1.07 DELIVERY, STORAGE, AND PROTECTION

A. Equipment shall be handled and stored in accordance with manufacturer's instructions. One (1) copy of manufacturer's instructions shall be included with the equipment at time of shipment.

1.08 WARRANTY

A. The manufacturer shall provide a full five (5) year warranty from the date of shipment against any SPD part failure when installed in compliance with manufacturer's written instructions and any applicable national or local code.

B. Warranty shall begin upon the date of final building acceptance by the Owner.

C. During the warranty period, the manufacturer shall provide new SPDs to arrive at Owner's premises within 48 hours of Owner's request.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. APT

B. Liebert

C. Square D

D. General Electric

E. Eaton

F. Siemens

G. Surge Suppression, Inc.

2.02 VOLTAGE SURGE SUPPRESSION - GENERAL

A. Electrical Requirements:
   1. Unit Operating Voltage - Refer to drawings for operating voltage and unit configuration.
   2. Maximum Continuous Operating Voltage (MCOV) - The MCOV shall not be less than 125% of the nominal system operating voltage.
   3. The suppression system shall incorporate thermally protected metal-oxide varistors (MOVs) as the core surge suppression component for the service entrance and all other distribution levels. The system shall not utilize silicon avalanche diodes, selenium cells, air gaps, or other components that may crowbar the system voltage leading to system upset or create any environmental hazards.
   4. Protection Modes - The SPD must protect all modes of the electrical system being utilized. The required protection modes are:
      a. Line-to-Neutral
      b. Line-to-Ground
      c. Line-to-Line
      d. Neutral-to-Ground
   5. Nominal Discharge Current (In) - All SPDs applied to the distribution system shall have a 20kA In rating regardless of their SPD Type (includes Types 1 and 2) or operating voltage. SPDs having an In less than 20kA shall be rejected.
   6. ANSI/UL 1449 4th Edition Voltage Protection Rating (VPR) - The maximum ANSI/UL 1449 4th Edition VPR for the device shall not exceed the following:
      a. 480Y/277 Volts:
         1) L-N, L-G, N-G = 1200
         2) L-L = 2000
      b. 208Y/120 Volts:
         1) L-N, L-G, N-G = 800
         2) L-L = 1200

B. SPD Design:
   1. Maintenance Free Design - The SPD shall be maintenance free and shall not require any user intervention throughout its life. SPDs containing items such as replaceable modules, replaceable fuses, or replaceable batteries shall not be accepted. SPDs requiring any maintenance of any sort such as periodic tightening of connections shall not be accepted. SPDs requiring user intervention to test the unit via a diagnostic test kit or similar device shall not be accepted.
   2. Balanced Suppression Platform - The surge current shall be equally distributed to all MOV components to ensure equal stressing and maximum performance. The surge suppression platform must provide equal impedance paths to each matched MOV. Designs incorporating replaceable SPD modules shall not be accepted.

3. Electrical Noise Filter - Each unit shall include a high-performance EMI/RFI noise rejection filter. Noise attenuation for electric line noise shall be up to 30 dB from 10 kHz to 100 MHz using the MIL-STD-220A insertion loss test method. Products unable able to meet this specification shall not be accepted.
4. Internal Connections - No plug-in component modules or printed circuit boards shall be used as surge current conductors. All internal components shall be soldered, hardwired with connections utilizing low impedance conductors.
5. Monitoring Diagnostics - Each SPD shall provide the following integral monitoring options:
    a. Protection Status Indicators - Each unit shall have a green / red solid-state indicator light that reports the status of the protection on each phase.
        1) For wye configured units, the indicator lights must report the status of all protection elements and circuitry in the L-N and L-G modes. Wye configured units shall also contain an additional green / red solid-state indicator light that reports the status of the protection elements and circuitry in the N-G mode. SPDs that indicate only the status of the L-N and L-G modes shall not be accepted.
        2) For delta configured units, the indicator lights must report the status of all protection elements and circuitry in the L-G and L-L modes.
        3) The absence of a green light and the presence of a red light shall indicate that damage has occurred on the respective phase or mode. All protection status indicators must indicate the actual status of the protection on each phase or mode. If power is removed from any one phase, the indicator lights must continue to indicate the status of the protection on all other phases and protection modes. Diagnostics packages that simply indicate whether power is present on a particular phase shall not be accepted.
    b. Remote Status Monitor - The SPD must include Form C dry contacts (one NO and one NC) for remote annunciation of its status. Both the NO and NC contacts shall change state under any fault condition.
    c. Audible Alarm and Silence Button - The SPD shall contain an audible alarm that will be activated under any fault condition. There shall also be an audible alarm silence button used to silence the audible alarm after it has been activated.
    d. Surge Counter - The SPD shall be equipped with an LCD display that indicates to the user how many surges have occurred at the location. The surge counter shall trigger each time a surge event with a peak current magnitude of a minimum of 50 ± 20A occurs. A reset pushbutton shall also be standard, allowing the surge counter to be zeroed. The reset button shall contain a mechanism to prevent accidental resetting of the counter via a single, short-duration button press. In order to prevent accidental resetting, the surge counter reset button shall be depressed for a minimum of 2 seconds in order to clear the surge count total.
        1) The ongoing surge count shall be stored in non-volatile memory. If power to the SPD is completely interrupted, the ongoing count indicated on the surge counter's display prior to the interruption shall be stored in non-volatile memory and displayed after power is restored. A backup battery may also be utilized in order to achieve this functionality.
6. Overcurrent Protection - The unit shall contain thermally protected MOVs. These thermally protected MOVs shall have a thermal protection element packaged together with the MOV in order to achieve overcurrent protection of the MOV. The thermal protection element shall disconnect the MOV(s) from the system in a fail-safe manner should a condition occur that would cause them to enter a thermal runaway condition.
7. Fully Integrated Component Design - All of the SPD's components and diagnostics shall be contained within one discrete assembly. SPDs or individual SPD modules may be ganged together in order to achieve higher surge current ratings.
8. Safety Requirements:
    a. The SPD shall minimize potential arc flash hazards by containing no user serviceable / replaceable parts and shall be maintenance free. Replaceable modules are

acceptable. SPDs requiring any maintenance of any sort such as periodic tightening of connections shall not be accepted. SPDs requiring user intervention to test the unit via a diagnostic test kit or similar device shall not be accepted.

b. SPDs designed to interface with the electrical assembly via conductors shall require no user contact with the inside of the unit. Such units shall have any required conductors be factory installed.

2.03 SYSTEM APPLICATION

A. The SPD applications covered under this section include distribution and branch panel locations, busway, motor control centers (MCC), switchgear, and switchboard assemblies. All SPDs shall be tested and demonstrate suitability for application within ANSI/IEEE C62.41 Category C, B, and A environments.

B. Surge Current Capacity - The minimum surge current capacity the device is capable of withstanding (based on ANSI/IEEE C62.41 location category) shall be as follows:
   1. Category C (Service Entrance Locations - Switchboards, Switchgear, Motor Control Centers, Main Entrance):
      a. Per Phase - 240 kA
      b. Per Mode - 120 kA
   2. Category B (High Exposure Rooftop Locations - Distribution Panelboards):
      a. Per Phase - 160 kA
      b. Per Mode - 80 kA
   3. Category A (Branch Locations - Panelboards, MCCs, Busways):
      a. Per Phase - 120 kA
      b. Per Mode - 60 kA

C. SPD Type - all SPDs installed on the line side of the service entrance disconnect shall be Type 1 SPDs. All SPDs installed on the load side of the service entrance disconnect shall be Type 1 or Type 2 SPDs.

2.04 LIGHTING AND DISTRIBUTION PANELBOARD REQUIREMENTS

A. The SPD application covered under this section includes lighting and distribution panelboards. The SPD units shall be tested and demonstrate suitability for application within ANSI/IEEE C62.41 Category B environments.
   1. The SPD shall not limit the use of through-feed lugs, sub-feed lugs, and sub-feed breaker options.
   2. SPDs shall be installed immediately following the load side of the main breaker. SPDs installed in main lug only panelboards shall be installed immediately following the incoming main lugs.
   3. The panelboard shall be capable of re-energizing upon removal of the SPD.
   4. The SPD shall be interfaced to the panelboard via a direct bus bar connection. Alternately, an SPD connected to a 30A circuit breaker for disconnecting purposes may be installed using short lengths of conductors as long as the conductors originate integrally to the SPD. The SPD shall be located directly adjacent to the 30A circuit breaker.
   5. The SPD shall be included and mounted within the panelboard by the manufacturer of the panelboard.
   6. Sidemount Mounting Applications Installation (SPD mounted external to electrical assembly): Lead length between the breaker and suppressor shall be kept as short as possible to ensure optimum performance. Any excess conductor length shall be trimmed in order to minimize let-through voltage. The installer shall comply with the manufacturer's recommended installation and wiring practices.

2.05 SWITCHGEAR / SWITCHBOARD, MCC, AND BUSWAY REQUIREMENTS

A. The SPD application covered under this section is for switchgear, switchboard, MCC, and busway locations. Service entrance located SPDs shall be tested and demonstrate suitability for application within ANSI/IEEE C62.41 Category C environments.

1. Locate the SPD on the load side of the main disconnect device, as close as possible to the phase conductors and the ground/neutral bar.
2. The SPD shall be connected through a disconnect (30A circuit breaker). The disconnect shall be located in immediate proximity to the SPD. Connection shall be made via bus, conductors, or other connections originating in the SPD and shall be kept as short as possible.
3. The SPD shall be integral to switchgear, switchboard, MCC, and/or bus plug as a factory standardized design.
4. All monitoring and diagnostic features shall be visible from the front of the equipment.

2.06 ENCLOSURES

A. All enclosed equipment shall have NEMA 1 general purpose enclosures, unless otherwise noted. Provide enclosures suitable for locations as indicated on the drawings and as described below:
   1. NEMA 1 - Constructed of a polymer (units integrated within electrical assemblies) or steel (sidemount units only), intended for indoor use to provide a degree of protection to personal access to hazardous parts and provide a degree of protection against the ingress of solid foreign objects (falling dirt).
   2. NEMA 4 - Constructed of steel intended for either indoor or outdoor use to provide a degree of protection against access to hazardous parts; to provide a degree of protection of the equipment inside the enclosure against ingress of solid foreign objects (dirt and windblown dust); to provide a degree of protection with respect to the harmful effects on the equipment due to the ingress of water (rain, sleet, snow, splashing water, and hose directed water); and that will be undamaged by the external formation of ice on the enclosure. (sidemount units only).
   3. NEMA 4X - Constructed of stainless steel providing the same level of protection as the NEMA 4 enclosure with the addition of corrosion protection. (sidemount units only)

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Surface or Flush Mounted Panelboards with Exterior SPDs: Mount SPDs on the side or bottom of the panelboard, closest to the serving breaker. Make leads as short and straight as possible.

C. Provide multi-pole, 30 Amp breaker as a dedicated disconnect for SPD unless otherwise indicated on drawings. Provide breakers for ALL SPDs.

D. Tighten electrical connectors and terminals according to manufacturer’s published torque-tightening values.

3.02 FIELD QUALITY CONTROL

A. Testing: Perform the following field quality control testing:
   1. After installing the Surge Protection Device, but before electrical circuitry has been energized, test for compliance with requirements.
   2. Complete start-up checks and voltage verifications according to manufacturer’s written instructions.
   3. Perform visual and mechanical inspection on each unit. Certify that units are installed per manufacturer’s recommendations.

B. Repair or replace malfunctioning units. Retest after repairs or replacements are made.

END OF SECTION

SECTION 26 2717
EQUIPMENT WIRING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electrical connections to equipment.

1.02 RELATED REQUIREMENTS

A. Section 26 0534 - Conduit.

B. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables (600 V and Less).

C. Section 26 0537 - Boxes.

D. Section 26 2726 - Wiring Devices.

1.03 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code, 2017 Edition; National Fire Protection Association.

1.04 SUBMITTALS

A. Submit Power Wiring Requirements Tabulation for HVAC equipment, plumbing equipment, and any other motorized or automatic equipment. The tabulation shall have been reviewed by the Contractor against submittals provided for the equipment named above. The Contractor shall make notations regarding discrepancies. Release of electrical gear prior to the submittal and review of the Power Wiring Requirements Tabulation shall be at the Contractor's risk.

1.05 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.06 COORDINATION

A. Obtain and review shop drawings, product data, manufacturer's wiring diagrams, and manufacturer's instructions for equipment furnished under other sections.

B. Determine connection locations and requirements.

C. Sequence rough-in of electrical connections to coordinate with installation of equipment.

D. General: No roughing shall be done until roughing drawings and exact electrical demand of equipment is obtained. Notify Architect of any discrepancies.

1. Mechanical:
    a. Review tabulated sheet of Power Wiring Requirements of all Mechanical Equipment specified in Division 23 of Specifications. Conduit, conductor, and breaker sizes shown for mechanical equipment are based upon the best available information on the equipment specified. The Contractor shall be allowed to provide electrical circuits compatible with the proposed mechanical equipment where the mechanical equipment conforms to Division 23 of the specifications, but does not conform to the electrical criteria of these contract documents . The Contractor shall submit the proposed electrical modifications to the Architect for review prior to roughing. No additional costs to the contract will be allowed for these modifications.
    b. Provide 4" thick concrete housekeeping pad beneath any equipment free standing on concrete floor. Pad shall extend 2" on all sides of equipment and shall be beveled 1 inch on all sides.
    c. Provide conduit, wiring, boxes, adaptors for equipment terminations and disconnect switches. Provide power wiring through primary control device.
    d. Starters, push-button stations, contactors, relays, limit and safety devices, and control items are specified in DIVISION 23 except as shown in Motor Control Center. Unless otherwise noted, all starters shall be mounted between 24" and 80" above finished floor. Push-button stations shall be mounted at switch height except as noted.

e. Owner Furnished Equipment: Provide conduit, wiring, boxes, adaptors for equipment terminations, and disconnect switches. Make all connections indicated.

E. Sequence electrical connections to coordinate with start-up of equipment.

PART 2 PRODUCTS

2.01 MATERIALS

A. Cords and Caps: NEMA WD 6; match receptacle configuration at outlet provided for equipment.
   1. Colors: Conform to NEMA WD 1.
   2. Cord Construction: NFPA 70, Type SO, multiconductor flexible cord with identified equipment grounding conductor, suitable for use in damp locations.
   3. Size: Suitable for connected load of equipment, length of cord, and rating of branch circuit overcurrent protection.

B. Wiring Devices: As specified in Section 26 2726.

C. Flexible Conduit: As specified in Section 26 0534.

D. Wire and Cable: As specified in Section 26 0519.

E. Boxes: As specified in Section 26 0537.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that equipment is ready for electrical connection, wiring, and energization.

3.02 ELECTRICAL CONNECTIONS

A. Make electrical connections in accordance with equipment manufacturer's instructions.

B. Make conduit connections to all equipment using liquidtight flexible metallic conduit, whether indoors or outdoors.

C. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.

D. Provide receptacle outlet to accommodate connection with attachment plug.

E. Provide cord and cap where field-supplied attachment plug is required.

F. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.

G. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.

H. Install terminal block jumpers to complete equipment wiring requirements.

I. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements. Pay close attention to the requirements of DCU's and DAC's. The electrical contractor is responsible for interconnecting the wiring between these two pieces.

END OF SECTION

SECTION 26 2726
WIRING DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall switches.

B. Receptacles.

C. Wall plates.

1.02 RELATED REQUIREMENTS

A. Section 26 0537 - Boxes.

1.03 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code, 2017 Edition; National Fire Protection Association.

B. UL 20 - General-Use Snap Switches; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the placement of outlet boxes with millwork, furniture, equipment, etc. installed under other sections or by others.
   2. Coordinate wiring device ratings and configurations with the electrical requirements of actual equipment to be installed.
   3. Coordinate the installation and preparation of uneven surfaces, such as split face block, to provide suitable surface for installation of wiring devices.
   4. Notify Architect of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

1.05 SUBMITTALS

A. See Section 26 0510 - General Electrical Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.

C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Products: Listed, classified, and labeled as suitable for the purpose intended.

PART 2 PRODUCTS

2.01 GENERAL:

A. Different type devices shall match in color. Receptacles, light switches, low voltage switches, wall mounted occupancy sensors, etc. shall be the same color with the same type of trim or cover. Provide submittals data indicating this color prior to purchasing.

2.02 WIRING DEVICE APPLICATIONS

A. Provide wiring devices suitable for intended use and with ratings adequate for load served.

B. For single receptacles installed on an individual branch circuit, provide receptacle with ampere rating not less than that of the branch circuit.

C. Provide weather resistant GFCI receptacles with specified weatherproof covers for receptacles installed outdoors or in damp or wet locations.

D. Provide tamper resistant receptacles for receptacles installed in dwelling units.

E. Provide GFCI protection for receptacles installed within 6 feet of sinks.

F. Provide GFCI protection for receptacles installed in kitchens.

G. Provide GFCI protection for receptacles serving electric drinking fountains.

H. Unless noted otherwise, do not use combination switch/receptacle devices.

2.03 WIRING DEVICE FINISHES

A. Provide wiring device finishes as described below unless otherwise indicated.

B. Wiring Devices, Unless Otherwise Indicated: White with nylon wall plate.

C. Wiring Devices Installed in Wet or Damp Locations: White with specified weatherproof cover.

2.04 WALL SWITCHES

A. Wall Switches - General Requirements: AC only, quiet operating, general-use snap switches with silver alloy contacts, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 20; types as indicated on the drawings.
   1. Wiring Provisions: Terminal screws for side wiring and screw actuated binding clamp for back wiring with separate ground terminal screw.

B. Standard Wall Switches: Commercial specification grade, 20 A, 120/277 V with standard toggle type switch actuator and maintained contacts; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.

C. Switch Types: Single pole, double pole, 3-way, 4-way, pilot gang, and key.
   1. Single Pole Switches:
      a. Cooper CS120
      b. Hubbell CS1221
      c. Leviton CS120
      d. P&S CSB20AC1
   2. Double Pole Switches:
      a. Cooper CS220
      b. Hubbell CS1222
      c. Leviton CS220
      d. P&S CSB20AC2
   3. 3-Way Switches:
      a. Cooper CS320
      b. Hubbell CS1223
      c. Leviton CS320
      d. P&S CSB20AC3
   4. 4-Way Switches:
      a. Cooper CS420
      b. Hubbell CS1224
      c. Leviton CS420
      d. P&S CSB20AC4

2.05 RECEPTACLES

A. Receptacles - General Requirements: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498; types as indicated on the drawings.
   1. Wiring Provisions: Terminal screws for side wiring or screw actuated binding clamp for back wiring with separate ground terminal screw.
   2. NEMA configurations specified are according to NEMA WD 6.

B. Convenience Receptacles:
   1. Standard Convenience Receptacles: Commercial specification grade, 20A, 125V, NEMA 5-20R; single or duplex as indicated on the drawings.
   2. Weather Resistant Convenience Receptacles: Commercial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as weather resistant type complying with UL 498

Supplement SE suitable for installation in damp or wet locations; single or duplex as indicated on the drawings.

3. Tamper Resistant Convenience Receptacles: Commercial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type; single or duplex as indicated on the drawings.
4. Tamper Resistant and Weather Resistant Convenience Receptacles: Commercial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type and as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations; single or duplex as indicated on the drawings.

C. GFCI Receptacles:
1. GFCI Receptacles - General Requirements: Self-testing, with feed-through protection and light to indicate ground fault tripped condition and loss of protection; listed as complying with UL 943, class A.
2. Standard GFCI Receptacles: Commercial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style.
3. Weather Resistant GFCI Receptacles: Commercial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations.
4. Tamper Resistant GFCI Receptacles: Commercial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as tamper resistant type.
5. Tamper Resistant and Weather Resistant GFCI Receptacles: Commercial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as tamper resistant type and as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations.

D. Outlet Types:
1. Duplex Convenience Receptacles.
   a. Cooper CR5362
   b. Hubbell CR5362
   c. Leviton BR20
   d. P&S CRB5362
2. GFCI Receptacles: Convenience receptacle with integral ground fault circuit interrupter to meet regulatory requirements. Devices shall be UL943 Compliant.
   a. Eaton SGF20
   b. Hubbell GFR5362
   c. Leviton GFTR2-HFG
   d. P&S PT2097

2.06 WALL PLATES

A. Wall Plates: Comply with UL 514D.
1. Configuration: One piece cover as required for quantity and types of corresponding wiring devices.
2. Size: Standard.
3. Screws: Metal with slotted heads finished to match wall plate finish.

B. Nylon Wall Plates: Smooth finish, high-impact thermoplastic.

C. Weatherproof Covers for Wet Locations: Gasketed, cast aluminum, with hinged lockable cover and corrosion-resistant screws; listed as suitable for use in wet locations while in use with attachment plugs connected and identified as extra-duty type.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.

C. Verify that wall openings are neatly cut and will be completely covered by wall plates.

D. Verify that final surface finishes are complete, including painting.

E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

F. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

A. Coordinate locations of outlet boxes provided under Section 26 0537 as required for installation of wiring devices provided under this section.

B. Install wiring devices in accordance with manufacturer's instructions.

C. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

D. Where required, connect wiring devices using pigtails not less than 6 inches long. Do not connect more than one conductor to wiring device terminals.

E. Connect wiring devices by wrapping conductor clockwise 3/4 turn around screw terminal and tightening to proper torque specified by the manufacturer. Where present, do not use push-in pressure terminals that do not rely on screw-actuated binding.

F. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

G. Provide GFCI receptacles with integral GFCI protection at each location indicated. Do not use feed-through wiring to protect downstream devices.

H. Where split-wired duplex receptacles are indicated, remove tabs connecting top and bottom receptacles.

I. Install wiring devices plumb and level with mounting yoke held rigidly in place.

J. Install wall switches with OFF position down.

K. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.

L. Do not share neutral conductor on branch circuits utilizing wall dimmers.

M. Install vertically mounted receptacles with grounding pole on bottom and horizontally mounted receptacles with grounding pole on right.

N. Install wall plates to fit completely flush to wall with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.

O. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.

P. Install receptacles with grounding pole on bottom.

Q. Connect wiring device grounding terminal to branch circuit equipment grounding conductor.

R. Install wall plates on switch, receptacle, and blank outlets.

S. Install decorative plates on switch, receptacle, and blank outlets in finished areas.

T. Connect wiring devices by wrapping conductor around screw terminal.

U. Use jumbo size plates for outlets installed in masonry walls.

V. Install plates with all edges in contact with the finished wall.

W. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.

X. Mount all plates vertically unless otherwise noted.

Y. Where two or more devices are shown adjacent, they shall be mounted in ganged boxes and covered with one faceplate.

Z. Where outlets of different levels are shown adjacent, they shall be installed in one vertical line. Outlets shown back to back on a common wall shall be offset a minimum of 10 inches to dampen sound transmission through the wall.

AA. On all walls with 1 hour or greater fire rating, "back to back" outlets shall be installed a minimum of 24 inches apart. Mount with stud between outlets for gypboard constructed partitions.

AB. Where outlets are installed in unfinished block or tile partitions they shall be installed at the points in the tile to permit the face plate to cover the rough opening. The horizontal and vertical locations indicated may be altered to permit above installation. Contractor shall check the Architectural drawings to prevent conflicts when shifting locations.

AC. Provide GFI receptacles where located within 6' of a water source, and as shown on plans.

3.04 INTERFACE WITH OTHER PRODUCTS

A. Coordinate locations of outlet boxes provided under Section 26 0537 to obtain mounting heights specified.

B. Where outlets are shown above cabinets or casework, install outlet 6 inches above backsplash of counter.

C. Where the mounting height of an outlet is not shown on the plans or specifications, the contractor shall contact the Architect for exact mounting height requirements.

3.05 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Inspect each wiring device for damage and defects.

C. Operate each wall switch and wall dimmer with circuit energized to verify proper operation.

D. Operate each wall switch with circuit energized and verify proper operation.

E. Verify that each receptacle device is energized.

F. Test each receptacle device for proper polarity prior to final inspection.

G. Test each GFCI receptacle for proper tripping operation according to manufacturer's instructions.

H. Correct wiring deficiencies and replace damaged or defective wiring devices.

3.06 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

3.07 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

END OF SECTION

SECTION 26 2813
FUSES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fuses.

1.02 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code, 2017 Edition; National Fire Protection Association.

B. UL 248-1 - Low-Voltage Fuses - Part 1: General Requirements; Current Edition, Including All Revisions.

1.03 SUBMITTALS - NOT REQUIRED

A. See Section 26 0510 - General Electrical Requirements, for submittal procedures.

1.04 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.05 MAINTENANCE MATERIALS

A. Furnish three of each size and type fuse installed.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Cooper Bussmann: www.bussmann.com.

B. Cutler-Hammer: ww.ch.cutler-hammer.com.

C. GE Company.

D. Mersen (formerly Ferraz Shawmut): ferrazshawmut.mersen.com.

E. Littelfuse, Inc.: www.littelfuse.com.

F. Mersen: ep-us.mersen.com.

2.02 FUSES

A. Provide products listed, classified, and labeled as suitable for the purpose intended.

B. Unless specifically indicated to be excluded, provide fuses for all fusible equipment as required for a complete operating system.

C. Provide fuses of the same type, rating, and manufacturer within the same switch.

D. Comply with UL 248-1.

E. Use only fuses of voltage, amperage and class compatible with fuse holder or disconnect.

F. Dimensions and Performance: NEMA FU 1, Class as specified or indicated.

G. Voltage: Rating suitable for circuit phase-to-phase voltage.

H. Main Service Switches Larger than 600 amperes: Class L (time delay).

I. Disconnect Switches: 208 or 240V system U.L. Class RK-5, 250 volt rating with minimum interrupting capacity of 200,000 symmetrical amperes.

J. Disconnect Switches: 277/480V or 600V systems U.L. Class RK-5, 600 volt rating with minimum interrupting capacity of 200,000 symmetrical amperes.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that fuse ratings are consistent with circuit voltage and manufacturer's recommendations and nameplate data for equipment.

B. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Do not install fuses until circuits are ready to be energized.

B. Provide fuses in all fused devices. This shall include equipment of other trades.

C. Install fuses with label oriented such that manufacturer, type, and size are easily read without removing the fuse.

END OF SECTION

SECTION 26 2817
ENCLOSED CIRCUIT BREAKERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Enclosed circuit breakers.

1.02 RELATED REQUIREMENTS

A. Section 26 0529 - Hangers and Supports for Electrical Systems.

B. Section 26 0553 - Identification for Electrical Systems.

1.03 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code, 2017 Edition; National Fire Protection Association.

1.04 SUBMITTALS

A. See Section 26 0510 - General Electrical Requirements for submittal procedures.

B. Product Data: Provide catalog sheets showing ratings, trip units, time current curves, dimensions, and enclosure details.

C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

1.05 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Eaton Corporation: www.eaton.com.

B. General Electric Company: www.geindustrial.com.

C. Schneider Electric; Square D Products: www.schneider-electric.us.

D. Siemens Industry, Inc.: www.usa.siemens.com.

2.02 ENCLOSED CIRCUIT BREAKERS

A. Description: Units consisting of molded case circuit breakers individually mounted in enclosures.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
   1. Altitude: Less than 6,600 feet.
   2. Ambient Temperature: Between 23 degrees F and 104 degrees F.

D. Short Circuit Current Rating:
   1. Provide enclosed circuit breakers with listed short circuit current rating equal to the upstream panel rating..

E. Conductor Terminations: Suitable for use with the conductors to be installed.

F. Provide solidly bonded equipment ground bus in each enclosed circuit breaker, with a suitable lug for terminating each equipment grounding conductor.

G. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
   1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
      a. Indoor Clean, Dry Locations: Type 1.
      b. Outdoor Locations: Type 3R.

H. Provide externally operable handle with means for locking in the OFF position.

2.03 MOLDED CASE CIRCUIT BREAKERS

A. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.

B. Interrupting Capacity:
   1. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating equal to upstream panel rating.
   2. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.

C. Conductor Terminations:
   1. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.

D. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.

E. Circuit Breakers: NEMA AB 1.
   1. Enclosure shall be NEMA 1 rated for indoor applications and NEMA 3R where exposed to weather.
   2. Provide with non-teasible, positive, quick-make, quick-break mechanisms.
   3. Minimum interrupting capacity (UL and NEMA) shall match that of the next panelboard upstream.

2.04 TRIP UNITS

A. Field-Changeable Ampere Rating Circuit Breaker: Provide circuit breakers with frame sizes 200 amperes and larger with changeable trip units.

2.05 ACCESSORIES

A. Enclosures: NEMA AB 1, Type 1.
   1. Fabricate enclosures from steel.
   2. Finish: Manufacturer's standard enamel finish, gray color.

B. Undervoltage Trip Device: 120 volts, AC.

C. Electrical Operator: 120 volts, AC.

D. Handle Lock: Include provisions for padlocking.

E. Provide mechanical trip device.

F. Provide grounding lug in each enclosure.

G. Provide products suitable for use as service entrance equipment where so applied.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install enclosed circuit breakers where indicated, in accordance with manufacturer's instructions.

B. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

C. Install enclosed circuit breakers plumb. Provide supports in accordance with Section 26 0529.

D. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed circuit breakers such that the highest position of the operating handle does not exceed 79 inches above the floor or working platform.

E. Provide grounding and bonding in accordance with Section 26 0526.

F. Provide identification nameplates for each enclosed circuit breaker in accordance with Section 26 0553.

G. Provide arc flash warning labels in accordance with NFPA 70.

3.02 FIELD QUALITY CONTROL

A. Correct deficiencies and replace damaged or defective enclosed circuit breakers.

B. Inspect each circuit breaker visually.

C. Perform several mechanical ON-OFF operations on each circuit breaker.

D. Verify circuit continuity on each pole in closed position.

3.03 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.04 CLEANING

A. Clean dirt and debris from circuit breaker enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

SECTION 26 2818
ENCLOSED SWITCHES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fusible switches.

B. Nonfusible switches.

1.02 RELATED REQUIREMENTS

A. Section 26 0526 - Grounding and Bonding for Electrical Systems.

B. Section 26 0529 - Hangers and Supports for Electrical Systems.

C. Section 26 2813 - Fuses.

1.03 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code, 2017 Edition; National Fire Protection Association.

1.04 SUBMITTALS

A. See Section 26 0510 - General Electrical Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for enclosed switches and other installed components and accessories.

1.05 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Eaton Corporation: www.eaton.com.

B. General Electric Company: www.geindustrial.com.

C. Schneider Electric; Square D Products: www.schneider-electric.us.

D. Siemens Industry, Inc.: www.usa.siemens.com.

2.02 COMPONENTS

A. Fusible Switch Assemblies: NEMA KS 1, Type HD enclosed load interrupter knife switch (H.P. Rated).
   1. Externally operable handle interlocked to prevent opening front cover with switch in ON position.
   2. Handle and switching mechanism integral with switch base, with easily recognizable position and lockable in OFF position.
   3. Visible blades.
   4. Non-teasible, positive, quick-make, quick-break mechanism.
   5. Line terminal shields.
   6. Fuse clips: Designed to accommodate NEMA FU1, Class R fuses.

B. Nonfusible Switch Assemblies: NEMA KS 1, Type HD enclosed load interrupter knife switch (H.P. Rated).
   1. Externally operable handle interlocked to prevent opening front cover with switch in ON position.
   2. Handle and switching mechanism integral with switch base, with easily recognizable position and lockable in OFF position.
   3. Visible blades.
   4. Non-teasible, positive, quick-make, quick-break mechanism.
   5. Line terminal shields.

C. Enclosures: NEMA KS 1.
   1. Interior Dry Locations: Type 1.

2. Exterior locations: Type 3R

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings of the enclosed switches are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive enclosed safety switches.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install enclosed switches in accordance with manufacturer's instructions.

B. Install enclosed switches securely, in a neat and workmanlike manner in accordance with NECA 1.

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide required supports in accordance with Section 26 0529.

E. Install enclosed switches plumb.

F. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed switches such that the highest position of the operating handle does not exceed 79 inches above the floor or working platform.

G. Provide grounding and bonding in accordance with Section 26 0526.

H. Provide identification nameplate for each enclosed switch in accordance with Section 26 0553.

I. Provide arc flash warning labels in accordance with NFPA 70.

J. Install fuses in fusible disconnect switches.

K. Apply adhesive tag on inside door of each fused switch indicating NEMA fuse class and size installed.

3.03 FIELD QUALITY CONTROL

A. Correct deficiencies and replace damaged or defective enclosed safety switches or associated components.

3.04 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.05 CLEANING

A. Clean dirt and debris from switch enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

SECTION 26 3213
ENGINE GENERATORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Packaged engine generator system and associated components and accessories:
   1. Engine and engine accessory equipment.
   2. Alternator (generator).
   3. Generator set control system.

B. Packaged engine generator set.

C. Exhaust silencer and fittings.

D. Remote control panel.

E. Battery and charger.

F. Weatherproof enclosure.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Concrete equipment pads.

B. Section 26 0526 - Grounding and Bonding for Electrical Systems.

C. Section 26 0529 - Hangers and Supports for Electrical Systems.

D. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

E. Section 26 3600 - Transfer Switches: Automatic transfer switch.

1.03 REFERENCE STANDARDS

A. ASTM D975 - Standard Specification for Diesel Fuel Oils; 2015b.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

C. NFPA 37 - Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines; 2015.

D. NFPA 70 - National Electrical Code, 2017 Edition; National Fire Protection Association.

E. NFPA 101 - Code for Safety to Life from Fire in Buildings and Structures; National Fire Protection Association, 2000 with all Georgia State modifications.

F. NFPA 110 - Standard for Emergency and Standby Power Systems; 2013.

G. UL 142 - Steel Aboveground Tanks for Flammable and Combustible Liquids; Current Edition, Including All Revisions.

H. UL 1236 - Battery Chargers for Charging Engine-Starter Batteries; Current Edition, Including All Revisions.

I. UL 2200 - Stationary Engine Generator Assemblies; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate compatibility of generator sets to be installed with work provided under other sections or by others.
   2. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment or other potential obstructions within the spaces dedicated for engine generator system.
   3. Coordinate arrangement of equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   4. Coordinate the work to provide electrical circuits suitable for the power requirements of the actual auxiliary equipment and accessories to be installed.
   5. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

B. Preinstallation Meeting: Convene two weeks before starting work of this section; require attendance of all affected installers.

1.05 SUBMITTALS

A. Manufacturer's factory emissions certification.

B. Provide NFPA 110 required documentation from manufacturer where requested by authorities having jurisdiction, including but not limited to:
   1. Certified prototype tests.
   2. Torsional vibration compatibility certification.
   3. NFPA 110 compliance certification.
   4. Certified rated load test at rated power factor.

C. See Section 26 0510 - General Electrical Requirements, for submittal procedures.

D. Shop Drawings: Indicate electrical characteristics and connection requirements. Show plan and elevation views with overall and interconnection point dimensions, fuel consumption rate curves at various loads, ventilation and combustion air requirements, electrical diagrams including schematic and interconnection diagrams.

E. Product Data: Provide data showing dimensions, weights, ratings, interconnection points, and internal wiring diagrams for engine, generator, control panel, battery, battery rack, battery charger, exhaust silencer, vibration isolators, day tank, and remote radiator.

F. Test Reports: Indicate results of performance testing.

G. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

H. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

I. Manufacturer's Field Reports: Indicate procedures and findings.

J. Operation Data: Include instructions for normal operation.

K. Maintenance Data: Include instructions for routine maintenance requirements, service manuals for engine and day tank, oil sampling and analysis for engine wear, and emergency maintenance procedures. Include parts list.

1.06 QUALITY ASSURANCE

A. Comply with the following:
   1. NFPA 70 (National Electrical Code).
   2. NFPA 110 (Standard for Emergency and Standby Power Systems); meet requirements for Level 1 system.
   3. NFPA 37 (Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines).
   4. NFPA 30 (Flammable and Combustible Liquids Code).

B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL).

C. Conform to requirements of NFPA 70.

D. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience with service facilities within 100 miles of Project.

E. Supplier Qualifications: Authorized distributor of specified manufacturer with minimum three years documented experience.

F. Products: Furnish products listed and classified by Underwriters Laboratories as suitable for purpose specified and indicated.

G. This system shall be built, tested, shipped, installed, site load bank tested, and started by one source of supply and responsibility. After start-up and testing, before final inspection, the contractor shall provide the supplier's system certificate to the Owner, with test results.

H. The performance of this generating set shall be certified by an independent testing laboratory as to the sets full power rating, stability and voltage and frequency regulation.

I. For all new natural gas units, the genset shall be factory certified to the current spark ignited NSPS (new source performance standard). In the event factory certification is not an option, the supplier shall confirm and/or provide relevant documentation which shows the genset is capable of achieving field certification. The supplier shall also submit budgetary cost guidance for field certification or provide references of companies capable of providing field certification. If necessary, the supplier shall specifically identify and supply any emissions reduction technology (catalysts) necessary for their genset to meet certification.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store generator sets in accordance with manufacturer's instructions and NECA/EGSA 404.

B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

C. Handle carefully in accordance with manufacturer's instructions to avoid damage to generator set components, enclosure, and finish.

D. Accept unit on site on skids. Inspect for damage.

E. Protect equipment from dirt and moisture by securely wrapping in heavy plastic.

1.08 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.09 MAINTENANCE SERVICE

A. Furnish service and maintenance of engine generator for one year from Date of Material Completion.

B. Service contract shall include one semi-annual inspection and one annual preventive maintenance that includes changing oil, all filters, and 4 hour loadbank test one year after initial startup

1.10 WARRANTY

A. This standby electric power system, furnished completely by the manufacturer, shall be warranted for a period of five years from the date of system acceptance.

B. The warranty shall be comprehensive and include travel, parts, labor, and generator rental on a warranty generator failure.

1.11 MAINTENANCE MATERIALS

A. Furnish one set of tools required for preventative maintenance of the engine generator system. Package tools in adequately sized metal tool box.

1.12 EXTRA MATERIALS

A. Provide two of each fuel, oil and air filter element.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Caterpillar

B. Cummins

C. Detroit Diesel

D. Kohler

E. Generac

2.02 PACKAGED ENGINE GENERATOR SYSTEM

A. Provide new engine generator system consisting of all required equipment, sensors, conduit, boxes, wiring, piping, supports, accessories, system programming, etc. as necessary for a complete operating system that provides the functional intent indicated.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. System Description:
   1. Application: Emergency/standby.
   2. Configuration: Single packaged engine generator set operated independently (not in parallel).

D. Packaged Engine Generator Set:
   1. Type: Diesel (compression ignition).
   2. Power Rating: As indicated on drawings, standby.
   3. Voltage: 480Y/277 V, 3 phase, 60 Hz.

E. Generator Set General Requirements:
   1. Prototype tested in accordance with NFPA 110 for Level 1 systems.
   2. Factory-assembled, with components mounted on suitable base.
   3. List and label engine generator assembly as complying with UL 2200.
   4. Power Factor: Unless otherwise indicated, specified power ratings are at 0.8 power factor for three phase voltages and 1.0 power factor for single phase voltages.
   5. Provide suitable guards to protect personnel from accidental contact with rotating parts, hot piping, and other potential sources of injury.

F. Service Conditions: Provide engine generator system and associated components suitable for operation under the service conditions at the installed location.

G. Starting and Load Acceptance Requirements:
   1. Cranking Method: Cycle cranking complying with NFPA 110 (15 second crank period, followed by 15 second rest period, with cranking limiter time-out after 3 cycles), unless otherwise required.
   2. Cranking Limiter Time-Out: If generator set fails to start after specified cranking period, indicate overcrank alarm condition and lock-out generator set from further cranking until manually reset.
   3. Start Time: Capable of starting and achieving conditions necessary for load acceptance within 10 seconds (NFPA 110, Type 10).
   4. Maximum Load Step: Supports 100 percent of rated load in one step.

H. Exhaust Emissions Requirements:
   1. Comply with federal (EPA), state, and local regulations applicable at the time of commissioning; include factory emissions certification with submittals.
   2. Do not make modifications affecting generator set factory emissions certification without approval of manufacturer and Engineer. Where such modifications are made, provide field emissions testing as necessary for certification.

I. Description: NFPA 110, engine generator system to provide source of power for Level 1 applications .

2.03 ENGINE AND ENGINE ACCESSORY EQUIPMENT

A. Provide engine with adequate horsepower to achieve specified power output at rated speed, accounting for alternator efficiency and parasitic loads.

B. Engine Fuel System - Diesel (Compression Ignition):
   1. Fuel Source: Diesel, ASTM D975 No. 2-D or approved cold weather diesel blends.
   2. Fuel Storage: Sub-base fuel tank.
   3. Engine Fuel Supply: Provide engine-driven, positive displacement fuel pump with replaceable fuel filter(s), water separator, check valve to secure prime, manual fuel priming pump, and relief-bypass valve. Provide fuel cooler where recommended by manufacturer.

4. Engine Fuel Connections: Provide suitable, approved flexible fuel lines for coupling engine to fuel source.
5. Sub-Base Fuel Tank:
   a. Provide sub-base mounted, double-wall fuel tank with secondary containment; listed and labeled as complying with UL 142.
   b. Tank Capacity: Size for minimum of 24 hours of continuous engine generator operation at 100 percent rated load, but not larger than permissible by applicable codes.
   c. Features:
      1) Direct reading fuel level gage.
      2) Normal atmospheric vent.
      3) Emergency pressure relief vent.
      4) Fuel fill opening with lockable cap.
      5) Dedicated electrical conduit stub-up area.

C. Engine Starting System:
1. System Type: Electric, with DC solenoid-activated starting motor(s).
2. Battery(s):
   a. Battery Type: Lead-acid.
   b. Battery Capacity: Size according to manufacturer's recommendations for achieving starting and load acceptance requirements under worst case ambient temperature; capable of providing cranking through two complete periods of cranking limiter time-outs without recharging.
   c. Provide battery rack, cables, and connectors suitable for the supplied battery(s); size battery cables according to manufacturer's recommendations for cable length to be installed.
3. Battery-Charging Alternator: Engine-driven, with integral solid-state voltage regulation.
4. Battery Charger:
   a. Provide dual rate battery charger with automatic float and equalize charging modes and minimum rating of 10 amps; suitable for maintaining the supplied battery(s) at full charge without manual intervention.
   b. Capable of returning supplied battery(s) from fully discharged to fully charged condition within 24 hours, as required by NFPA 110 for Level 1 applications while carrying normal loads.
   c. Recognized as complying with UL 1236.
   d. Furnished with integral overcurrent protection; current limited to protect charger during engine cranking; reverse polarity protection.
   e. Provide integral DC output ammeter and voltmeter with five percent accuracy.
   f. Provide alarm output contacts as necessary for alarm indications.

D. Engine Speed Control System (Governor):
1. Single Engine Generator Sets (Not Operated in Parallel): Provide electronic isochronous governor for controlling engine speed/alternator frequency.
2. Frequency Regulation, Electronic Isochronous Governors: No change in frequency from no load to full load; plus/minus 0.25 percent at steady state.

E. Engine Lubrication System:
1. System Type: Full pressure, with engine-driven, positive displacement lubrication oil pump, replaceable full-flow oil filter(s), and dip-stick for oil level indication. Provide oil cooler where recommended by manufacturer.

F. Engine Cooling System:
1. System Type: Closed-loop, liquid-cooled, with unit-mounted radiator/fan and engine-driven coolant pump; suitable for providing adequate cooling while operating at full load under worst case ambient temperature.
2. Fan Guard: Provide suitable guard to protect personnel from accidental contact with fan.

G. Engine Air Intake and Exhaust System:

1. Air Intake Filtration: Provide engine-mounted, replaceable, dry element filter.
2. Engine Exhaust Connection: Provide suitable, approved flexible connector for coupling engine to exhaust system.

H. Type: Water-cooled inline or V-type, four stroke cycle, electric ignition internal combustion engine.

I. Rating: Sufficient to operate under 10 percent overload for one hour in an ambient of 90 degrees F at elevation of 1000 feet.

J. Governor: Isochronous type to maintain engine speed within 0.5 percent, steady state, and 5 percent, no load to full load, with recovery to steady state within 2 seconds following sudden load changes. Equip governor with means for manual operation and adjustment.

K. Safety Devices: Engine shutdown on high water temperature, low oil pressure, overspeed, and engine overcrank. Limits as selected by manufacturer.

L. Engine Starting: DC starting system with positive engagement, number and voltage of starter motors in accordance with manufacturer's instructions. Include remote starting control circuit, with MANUAL-OFF-REMOTE selector switch on engine-generator control panel.

M. Engine Jacket Heater: Thermal circulation type water heater with integral thermostatic control, sized to maintain engine jacket water at 90 degrees F, and suitable for operation on 120 volts AC. Total wattage shall not exceed 1920 Watts.

N. Radiator: Radiator using glycol coolant, with blower type fan, sized to maintain safe engine temperature in ambient temperature of 110 degrees F. Radiator air flow restriction 0.5 inches of water maximum.

O. Engine Accessories: Fuel filter, lube oil filter, intake air filter, lube oil cooler, fuel transfer pump, fuel priming pump, gear-driven water pump. Include fuel pressure gage, water temperature gage, and lube oil pressure gage on engine/generator control panel.

P. Full pressure lubrication shall be supplied by a positive displacement lube oil pump.

Q. Mounting: Provide unit with suitable spring-type vibration isolators and mount on structural steel base.

2.04 ALTERNATOR (GENERATOR)

A. Alternator: 4-pole, 1800 rpm (60 Hz output) revolving field, synchronous generator complying with NEMA MG 1; connected to engine with flexible coupling; voltage output configuration as indicated, with reconnectable leads for 3 phase alternators.

B. Exciter:
1. Exciter Type: Brushless; provide permanent magnet generator (PMG) excitation system; self-excited (shunt) systems are not permitted.
2. PMG Excitation Short-Circuit Current Support: Capable of sustaining 300 percent of rated output current for 10 seconds.
3. Voltage Regulation (with PMG excitation): Plus/minus 0.5 percent for any constant load from no load to full load.

C. Temperature Rise: Comply with UL 2200.

D. Insulation System: NEMA MG 1, Class H; suitable for alternator temperature rise.

E. Enclosure: NEMA MG 1, drip-proof.

F. Total Harmonic Distortion: Not greater than five percent.

G. Generator: NEMA MG 1, three phase, four pole, reconnectable brushless synchronous generator with brushless exciter.

H. Insulation Class: F.

I. Rated for standby operation.

J. Temperature Rise: 130 degrees C Standby.

K. Voltage Regulation: Include generator-mounted volts per hertz exciter-regulator to match engine and generator characteristics, with voltage regulation plus or minus 1 percent from no load to full load. Include manual controls to adjust voltage drop, voltage level (plus or minus 5 percent) and voltage gain. Voltage regulator shall be a temperature compensated, solid state type device.
   1. The instantaneous voltage dip shall be less than 14 percent of rated voltage when full, 3-phase, load and rated power factor is applied to the alternator.
   2. Recovery to stable operation shall occur within 3 seconds. Stable or steady state operation is defined as operation with terminal voltage remaining constant within plus or minus 1 percent of rate voltage.

L. Frequency regulation shall not exceed 3-hertz from no load to rated load.

M. The starter shall be directly connected to the engine flywheel housing, and the rotor shall be driven through a semiflexible driving flange to insure permanent alignment.

2.05 GENERATOR SET CONTROL SYSTEM

A. Provide microprocessor-based control system for automatic control, monitoring, and protection of generator set. Include sensors, wiring, and connections necessary for functions/indications specified.

B. Control Panel:
   1. Control Panel Mounting: Unit-mounted unless otherwise indicated; vibration isolated.
   2. Generator Set Control Functions:
      a. Automatic Mode: Initiates generator set start/shutdown upon receiving corresponding signal from remote device (e.g. automatic transfer switch).
      b. Manual Mode: Initiates generator set start/shutdown upon direction from operator.
      c. Reset Mode: Clears all faults, allowing generator set restart after a shutdown.
      d. Emergency Stop: Immediately shuts down generator set (without time delay) and prevents automatic restarting until manually reset.
      e. Cycle Cranking: Programmable crank time, rest time, and number of cycles.
      f. Time Delay: Programmable for shutdown (engine cooldown) and start (engine warmup).
      g. Voltage Adjustment: Adjustable through range of plus/minus 5 percent.
   3. Generator Set Status Indications:
      a. Voltage (Volts AC): Line-to-line, line-to-neutral for each phase.
      b. Current (Amps): For each phase.
      c. Frequency (Hz).
      d. Real power (W/kW).
      e. Reactive power (VAR/kVAR).
      f. Apparent power (VA/kVA).
      g. Power factor.
      h. Duty Level: Actual load as percentage of rated power.
      i. Engine speed (RPM).
      j. Battery voltage (Volts DC).
      k. Engine oil pressure.
      l. Engine coolant temperature.
      m. Engine run time.
      n. Generator powering load (position signal from transfer switch).
   4. Generator Set Protection and Warning/Shutdown Indications:
      a. Comply with NFPA 110; configurable for NFPA 110 Level 1 or Level 2, or NFPA 99 systems including but not limited to the following protections/indications:
         1) Overcrank (shutdown).
         2) Low coolant temperature (warning).
         3) High coolant temperature (warning).
         4) High coolant temperature (shutdown).
         5) Low oil pressure (shutdown).

6) Overspeed (shutdown).
7) Low fuel level (warning).
8) Low coolant level (warning/shutdown).
9) Generator control not in automatic mode (warning).
10) High battery voltage (warning).
11) Low cranking voltage (warning).
12) Low battery voltage (warning).
13) Battery charger failure (warning).

b. In addition to NFPA 110 requirements, provide the following protections/indications:
1) High AC voltage (shutdown).
2) Low AC voltage (shutdown).
3) High frequency (shutdown).
4) Low frequency (shutdown).
5) Overcurrent (shutdown).

c. Provide contacts for local and remote common alarm.
d. Provide lamp test function that illuminates all indicator lamps.

5. Other Control Panel Features:
a. Event log.

2.06 OPERATION

A. Upon loss of normal power, the engine shall start, come up to speed/voltage and the load shall be transferred to the emergency source within 10 seconds.

B. Provide a signal to elevator controls 20 seconds before transfer of power from emergency to normal power.

C. Upon power line return, transfer the load back to the line and stop the standby set.

D. Total time from start-up until shutdown shall be adjustable, set for 20 minutes.

E. Refer to Section 26 3600 - Enclosed Transfer Switches for detailed specifications of required transfer switches.

F. The transfer switch shall not transfer from emergency to normal source until the normal source has been restored for 15 minutes unless the emergency source is lost.

G. Automatic load transfer control to provide automatic starting and stopping of the engine and switching of the load.

H. The load transfer control shall be rated for continuous duty and for all classes of load.

I. The ampere rating of the transfer switch shall be of minimum size to handle the generator output or shall be of minimum size shown on the drawings, whichever is larger.

J. The control components shall be compatible with the electrical requirements of the generator set.

2.07 ACCESSORIES

A. All accessories needed for proper operation of the generator shall be furnished.

B. Exhaust Silencer: Critical type silencer, with muffler companion flanges and flexible stainless steel exhaust fitting, sized in accordance with engine manufacturer's instructions.

C. Batteries: Heavy duty, diesel starting type lead-acid storage batteries, 170 ampere-hours minimum capacity. Match battery voltage to starting system. Include necessary cables and clamps.
1. Batteries shall have capacity to provide 40 seconds of continuous cranking power at 32 F.

D. Battery Tray: Treated for electrolyte resistance, constructed to contain spillage.

E. Battery Charger: Current limiting type designed to float at 2.17 volts per cell and equalize at 2.33 volts per cell. Include overload protection, full wave rectifier, DC voltmeter and ammeter, and 120 volts AC fused input. Unit shall provide trickle charging for the batteries at all times and a high rate charging function to fully restore the batteries starting capacity within 6 hours from a

full discharge condition. Provide wall-mounted enclosure to meet NEMA 250, Type 1 requirements.

F. Line Circuit Breaker: Molded case circuit breaker on generator output with integral thermal and instantaneous magnetic trip in each pole, sized in accordance with NFPA 70; UL listed. Include battery-voltage operated shunt trip, connected to open circuit breaker on engine failure. Unit mount in enclosure to meet NEMA 250, Type 1 requirements. Size to allow generator rated output continuously without tripping. Breaker shall be reset manually.

G. Engine-Generator Control Panel: NEMA 250, Type 1 generator mounted control panel enclosure with engine and generator controls and indicators. Panel shall be shock mounted on generator set. Include provision for padlock and the following equipment and features:
   1. Panel Lighting.
   2. Frequency Meter: 45-65 Hz. range, 3.5 inch dial.
   3. AC Output Voltmeter: 3.5 inch dial, 2 percent accuracy, with phase selector switch.
   4. Battery charge rate Ammeter.
   5. AC Output Ammeter (dual range): 3.5 inch dial, 2 percent accuracy, with phase selector switch.
   6. Output voltage adjustment.
   7. Push-to-test indicator lamps, one each for low oil pressure, high water temperature, overspeed, and overcrank.
   8. Engine start/stop/remote selector switch.
   9. Engine shall start upon closing contact and stop upon opening contact. A cranking limiter shall be provided to open the starting circuit in approximately 45 to 90 seconds if the engine is not started within the time.
   10. Engine running time meter.
   11. Oil pressure gage.
   12. Water temperature gage.
   13. Auxiliary Relay: 3PDT, operates when engine runs, with contact terminals prewired to terminal strip.
   14. Additional visual indicators and alarms as required by NFPA 110.
   15. Remote Alarm Contacts: Pre-wire SPDT contacts to terminal strip for remote alarm functions required by NFPA 110.
   16. Provide a signal to the elevator controls 20 seconds before transferring load when operating in test mode.

H. Remote Emergency Power Off (EPO):
   1. Provide a remote manual stop station of a type similar to a break-glass station located outside the room housing the prime mover (generator).
   2. If genset is outdoors, this stop station shall be mounted outside of the genset enclosure.

I. Remote Annunciator Panel: Surface mounted panel with brushed stainless steel. Provide audible and visible indicators and alarms required by NFPA 110.
   1. High battery voltage (alarm).
   2. Low battery voltage (alarm).
   3. Low fuel (alarm).
   4. System ready.
   5. Anticipatory-high water temperature.
   6. Anticipatory-low oil pressure.
   7. Low coolant temperature.
   8. Switch in off position (alarm).
   9. Overcrank (alarm).
   10. Emergency stop (alarm).
   11. High water temperature (alarm).
   12. Overspeed (alarm).
   13. Low oil pressure (alarm).
   14. Line power available.

15. Generator power available.
16. Lamp test and horn silence switch.

J. Weather-Protective Enclosure: Reinforced steel housing allowing access to control panel and service points, with lockable doors and panels. Include fixed louvers, battery rack, and silencer.

PART 3 EXECUTION

3.01 INSTALLATION

A. Perform work in a neat and workmanlike manner in accordance with NECA 1.

B. Install products in accordance with manufacturer's instructions.

C. Install generator sets and associated accessories in accordance with NECA/EGSA 404.

D. Arrange equipment to provide minimum clearances and required maintenance access.

E. Unless otherwise indicated, mount generator set on properly sized 6 inch high concrete pad constructed in accordance with Section 03 3000. Provide suitable vibration isolators, where not factory installed.

F. Provide required support and attachment in accordance with Section 26 0529.

G. Use manufacturer's recommended oil and coolant, suitable for the worst case ambient temperatures.

H. Provide diesel fuel piping and venting in accordance with Section 23 1113, where not factory installed.

I. Provide engine exhaust piping in accordance with Section 23 5100, where not factory installed.
1. Include piping expansion joints, piping insulation, thimble, condensation trap/drain, rain cap, hangers/supports, etc. as indicated or as required.
2. Do not exceed manufacturer's maximum back pressure requirements.

J. Provide grounding and bonding in accordance with Section 26 0526.

K. Identify system wiring and components in accordance with Section 26 0553.

L. The electric generating set shall be equipped with vibration isolators and mounted on a welded steel base which shall provide suitable mounting to any level surface.

M. Provide an 8-inch thick concrete pad with #3 rebar 6-inches on center. Pad shall extend 6-inches on all sides of generator unit.

3.02 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Notify Owner and Architect at least two weeks prior to scheduled inspections and tests.

C. Notify authorities having jurisdiction and comply with their requirements for scheduling inspections and tests and for observation by their personnel.

D. Provide all equipment, tools, and supplies required to accomplish inspection and testing, including load bank and fuel.

E. Preliminary inspection and testing to include, at a minimum:
1. Inspect each system component for damage and defects.
2. Verify tightness of mechanical and electrical connections are according to manufacturer's recommended torque settings.
3. Check for proper oil and coolant levels.

F. Prepare and start system in accordance with manufacturer's instructions.

G. Perform acceptance test in accordance with NFPA 110.

H. Provide field emissions testing where necessary for certification.

I. Correct defective work, adjust for proper operation, and retest until entire system complies with contract documents.

J. Provide full load test utilizing portable test bank for four hours minimum. Simulate power failure including operation of transfer switch, automatic starting cycle, and automatic shutdown and return to normal.

K. Disconnect normal power to simulate an actual power outage. Verify proper operation of all automatic transfer switches. Run test for one hour.

L. Record in 20 minute intervals during four hour test and the one hour test:
   1. Kilowatts.
   2. Amperes.
   3. Voltage.
   4. Coolant temperature.
   5. Room temperature.
   6. Frequency.
   7. Oil pressure.

M. Test alarm and shutdown circuits by simulating conditions.

3.03 MANUFACTURER'S FIELD SERVICES

A. Provide the services of manufacturer's representative to prepare and start system.

3.04 ADJUSTING

A. Adjust generator output voltage and engine speed.

3.05 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.06 CLOSEOUT ACTIVITIES

A. Describe loads connected to emergency system and restrictions for future load additions.

B. Simulate power outage by interrupting normal source, and demonstrate that system operates to provide emergency power.

END OF SECTION

SECTION 26 3600
TRANSFER SWITCHES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Automatic Transfer Switch.

1.02 RELATED REQUIREMENTS

A. Section 26 0526 - Grounding and Bonding for Electrical Systems.

B. Section 26 0529 - Hangers and Supports for Electrical Systems.

C. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

D. Section 26 3213 - Engine Generators: Testing requirements.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.

C. NFPA 70 - National Electrical Code, 2017 Edition; National Fire Protection Association.

D. UL 1008 - Transfer Switch Equipment; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. Manufacturer’s detailed field testing procedures.

B. See Section 26 0510 - General Electrical Requirements for submittal procedures.

C. Product Data: Provide catalog sheets showing voltage, switch size, ratings and size of switching and overcurrent protective devices, operating logic, short circuit ratings, dimensions, and enclosure details.

D. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

E. Operation Data: Instructions for operating equipment under emergency conditions when engine generator is running.

F. Maintenance Data: Routine preventative maintenance and lubrication schedule. List special tools, maintenance materials, and replacement parts.

1.05 QUALITY ASSURANCE

A. Comply with the following:
   1. NFPA 70 (National Electrical Code).

B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL).

C. Conform to requirements of NFPA 70.

D. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience and with service facilities within 200 miles of Project.

E. Supplier Qualifications: Authorized distributor of specified manufacturer with minimum three years documented experience.

F. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.06 MAINTENANCE SERVICE

A. Provide service and maintenance of transfer switches for one year from Date of Material Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. ASCO

B. Cutler-Hammer

C. Russelectric

D. Zenith

E. Same Manufacturer as Gen-Set.

2.02 TRANSFER SWITCHES

A. Provide complete power transfer system consisting of all required equipment, conduit, boxes, wiring, supports, accessories, system programming, etc. as necessary for a complete operating system that provides the functional intent indicated.

B. Provide products listed, classified, and labeled as suitable for the purpose intended; service entrance rated.

C. Construction Type: Either "contactor type" (open contact) or "breaker type" (enclosed contact) transfer switches complying with specified requirements are acceptable.

D. Comply with NEMA ICS 10 Part 1, and list and label as complying with UL 1008 for the classification of the intended application (e.g. emergency, optional standby).

E. Do not use double throw safety switches or other equipment not specifically designed for power transfer applications and listed as transfer switch equipment.

F. Load Classification: Classified for total system load (any combination of motor, electric discharge lamp, resistive, and tungsten lamp loads with tungsten lamp loads not exceeding 30 percent of the continuous current rating) unless otherwise indicated or required.

G. Switching Methods:
   1. Obtain control power for transfer operation from line side of source to which the load is to be transferred.

H. Service Conditions: Provide transfer switches suitable for continuous operation at indicated ratings under the service conditions at the installed location.

I. Enclosures:
   1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
   2. Finish: Manufacturer's standard unless otherwise indicated.

J. Short Circuit Current Rating:
   1. Withstand and Closing Rating: Provide transfer switches, when protected by the supply side overcurrent protective devices to be installed, with listed withstand and closing rating 42 kaic..

2.03 COMPONENTS

A. Indicating Lights: Mount in cover of enclosure to indicate NORMAL SOURCE AVAILABLE.

B. Test Switch: Mount in cover of enclosure to simulate failure of normal source.

C. Return to Normal Switch: Mount in cover of enclosure to initiate manual transfer from alternate source to normal source.

D. Transfer Switch Auxiliary Contacts: 1 normally open; 1 normally closed.

E. Normal Source Monitor: Monitor each line of normal source voltage and frequency; initiate transfer when voltage drops below 85 percent or frequency varies more than 3 percent from rated nominal value.

F. Alternate Source Monitor: Monitor alternate source voltage and frequency; inhibit transfer when voltage is below 85 percent or frequency varies more than 3 percent from rated nominal value.

G. Switched Neutral: Overlapping contacts.

H. Enclosure: ICS 10, Type 1, finished with manufacturer's standard gray enamel.

2.04 AUTOMATIC SEQUENCE OF OPERATION

A. Upon loss of normal power, the engine shall start, come up to speed/voltage and the load associated with the ATS-LS shall be transferred to the emergency source within 45 seconds.

B. The generator output shall be continuously monitored. When the generator output reaches 90% capacity the following shall occur:
   1. ATS shall transfer back to the normal source.
   2. An alarm shall be initiated on the generator annunciator panel (visual and audible).

C. In the event of any generator malfunction which would impair the capacity of the generator to deliver 100% of its rated capacity (e.g. oil pressure, engine temperature, etc. - to be recommended by the generator manufacturer), ATS shall be transferred to normal power to unload the generator.

D. Upon power line return, transfer the load back to the line and stop the standby set.

E. Total time from start-up until shutdown shall be adjustable, set for 20 minutes.

F. The transfer switch shall not transfer from emergency to normal source until the normal source has been restored for 15 minutes unless the emergency source is lost.

G. Automatic load transfer control to provide automatic starting and stopping of the engine and switching of the load.

H. The load transfer control shall be rated for continuous duty and for all classes of load.

I. The ampere rating of the transfer switch shall be of minimum size to handle the generator output or shall be of minimum size shown on the drawings, whichever is larger.

J. The control components shall be compatible with the electrical requirements of the generator set.

K. Engine Exerciser: Start engine every 7 days; run for 30 minutes before shutting down. Bypass exerciser control if normal source fails during exercising period.

L. Alternate System Exerciser: Transfer load to alternate source during engine exercising period.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that the ratings and configurations of transfer switches are consistent with the indicated requirements.

C. Verify that rough-ins for field connections are in the proper locations.

D. Verify that mounting surfaces are ready to receive transfer switches.

E. Verify that conditions are satisfactory for installation prior to starting work.

F. Provide housekeeping pads under the provisions of Section 03 3000.

3.02 INSTALLATION

A. Perform work in a neat and workmanlike manner in accordance with NECA 1.

B. Install transfer switches in accordance with manufacturer's instructions.

C. Arrange equipment to provide minimum clearances and required maintenance access.

D. Provide required support and attachment in accordance with Section 26 0529.

E. Install transfer switches plumb and level.

F. Unless otherwise indicated, mount floor-mounted transfer switches on properly sized 3 inch high concrete pad constructed in accordance with Section 03 3000.

G. Provide grounding and bonding in accordance with Section 26 0526.

H. Identify transfer switches and associated system wiring in accordance with Section 26 0553.

I. Provide engraved plastic nameplates under the provisions of Section 26 0553.

3.03 FIELD QUALITY CONTROL

A. Provide services of a manufacturer's authorized representative to observe installation and assist in inspection and testing. Include manufacturer's detailed testing procedures and field reports with submittals.

B. Prepare and start system in accordance with manufacturer's instructions.

C. Correct defective work, adjust for proper operation, and retest until entire system complies with contract documents.

3.04 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.05 MANUFACTURER'S FIELD SERVICES

A. Provide the services of the manufacturer's technical representative to check out transfer switch connections and operations and place in service.

3.06 CLOSEOUT ACTIVITIES

A. Demonstrate operation of transfer switch in bypass, normal, and emergency modes.

3.07 PROTECTION

A. Protect installed transfer switches from subsequent construction operations.

END OF SECTION

SECTION 26 5100
INTERIOR LIGHTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Interior luminaires.

B. Emergency lighting units.

C. Exit signs.

D. Ballasts and drivers.

E. Lamps.

1.02 RELATED REQUIREMENTS

A. Section 26 0537 - Boxes.

B. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

C. Section 26 2726 - Wiring Devices: Manual wall switches and wall dimmers.

1.03 REFERENCE STANDARDS

A. ANSI C82.11 - American National Standard for Lamp Ballasts - High Frequency Fluorescent Lamp Ballasts - Supplements; 2011.

B. IESNA LM-63 - ANSI Approved Standard File Format for Electronic Transfer of Photometric Data and Related Information; 2002 (Reaffirmed 2008).

C. IES LM-80 - Approved Method: Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays, and Modules; Illuminating Engineering Society; 2015.

D. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

E. NECA/IESNA 500 - Standard for Installing Indoor Commercial Lighting Systems; 2006.

F. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility; 2012.

G. NFPA 70 - National Electrical Code, 2014 Edition; National Fire Protection Association.

H. NFPA 101 - Life Safety Code; 2015.

I. UL 924 - Emergency Lighting and Power Equipment; Current Edition, Including All Revisions.

J. UL 1598 - Luminaires; Current Edition, Including All Revisions.

K. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the installation of luminaires with mounting surfaces installed under other sections or by others. Coordinate the work with placement of supports, anchors, etc. required for mounting. Coordinate compatibility of luminaires and associated trims with mounting surfaces at installed locations.
2. Coordinate the placement of luminaires with structural members, ductwork, piping, equipment, diffusers, fire suppression system components, and other potential conflicts installed under other sections or by others.
3. Coordinate the placement of exit signs with furniture, equipment, signage or other potential obstructions to visibility installed under other sections or by others.
4. Notify Architect of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

1.05 SUBMITTALS

A. See Section 26 0510 - General Electrical Requirements, for submittal procedures.

B. Shop Drawings:
   1. Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
   2. Provide photometric calculations where luminaires are proposed for substitution upon request.

C. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, installed accessories, and ceiling compatibility; include model number nomenclature clearly marked with all proposed features.
   1. LED Luminaires:
      a. Include estimated useful life, calculated based on IES LM-80 test data.
   2. Provide electronic files of photometric data in IESNA LM-63 standard format upon request.
   3. Ballasts: Include wiring diagrams and list of compatible lamp configurations.
   4. Lamps: Include rated life, color temperature, color rendering index (CRI), and initial and mean lumen output.

D. Samples:
   1. Provide two sample(s) of each product finish illustrating color and texture upon request.

E. Certificates for Dimming Ballasts: Manufacturer's documentation of compatibility with dimming controls to be installed.

F. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

G. Operation and Maintenance Data: Instructions for each product including information on replacement parts.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.07 DELIVERY, STORAGE, AND PROTECTION

A. Receive, handle, and store products according to NECA/IESNA 500 (commercial lighting) and manufacturer's written instructions.

B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

1.08 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.09 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide three year manufacturer warranty for all LED luminaires, including drivers.

C. See Section 26 0510 for additional warranty requirements.

D. Provide five year warranty for batteries for emergency lighting units.

E. Provide five year warranty for batteries for self-powered exit signs.

F. Provide five year warranty for fluorescent emergency power supply units.

PART 2 PRODUCTS

2.01 LUMINAIRE TYPES

A. Furnish products as indicated in luminaire schedule included on the drawings.

B. Substitutions: See Section 26 0510.

2.02 LUMINAIRES

A. Provide products that comply with requirements of NFPA 70.

B. Provide products that are listed and labeled as complying with UL 1598, where applicable.

C. Provide products listed, classified, and labeled as suitable for the purpose intended.

D. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.

E. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, supports, trims, accessories, etc. as necessary for a complete operating system.

F. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

G. Recessed Luminaires:
   1. Ceiling Compatibility: Comply with NEMA LE 4.
   2. Luminaires Recessed in Insulated Ceilings: Listed and labeled as IC-rated, suitable for direct contact with insulation and combustible materials.
   3. Luminaires Recessed in Sloped Ceilings: Provide suitable sloped ceiling adapters.

H. LED Luminaire Components: UL 8750 recognized or listed as applicable.

I. Track Lighting Systems: Provide track compatible with specified track heads, with all connectors, power feed fittings, dead ends, hangers and canopies as necessary to complete installation.

J. Luminaires Mounted in Continuous Rows: Provide quantity of units required for length indicated, with all accessories required for joining and aligning.

K. The Contractor shall verify all voltages to fixtures and shall furnish fixtures, ballasts, etc. compatible with voltages from panels serving fixtures.

L. Manufacturers names and series are shown to indicate the general type fixture and quality. The functional and material criteria of the specifications for the fixture "types" shall take precedence and no fixture shall be provided which does not comply with the criteria. Listing of a manufacturer does NOT constitute a waiver of ANY of the functional and material criteria.

2.03 EMERGENCY LIGHTING UNITS

A. Description: Emergency lighting units complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.

B. Informally known as "Emergency Wall-packs".

C. Operation: Upon interruption of normal power source or brownout condition exceeding 20 percent voltage drop from nominal, solid-state control automatically switches connected lamps to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.

D. Battery:
   1. Sealed maintenance-free lead calcium unless otherwise indicated.
   2. Size battery to supply all connected lamps, including emergency remote heads where indicated.

E. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.

F. Provide low-voltage disconnect to prevent battery damage from deep discharge.

2.04 EXIT SIGNS

A. Description: Exit signs and similar signs for special purpose applications such as area of refuge/rescue assistance.

B. Description: Internally illuminated exit signs with LEDs unless otherwise indicated; complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.
   1. Number of Faces: Single or double as indicated or as required for the installed location.
   2. Directional Arrows: As indicated or as required for the installed location.

C. Self-Powered Exit Signs:
   1. Operation: Upon interruption of normal power source or brownout condition exceeding 20 percent voltage drop from nominal, solid-state control automatically switches connected lamps to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.
   2. Battery: Sealed maintenance-free nickel cadmium unless otherwise indicated.
   3. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.
   4. Provide low-voltage disconnect to prevent battery damage from deep discharge.

2.05 BALLASTS AND DRIVERS

A. Manufacturers:
   1. General Electric Company/GE Lighting: www.gelighting.com/#sle.
   2. Osram Sylvania: www.sylvania.com/#sle.
   3. Philips Lighting Electronics/Advance: www.advance.philips.com.
   4. Universal Lighting Technologies: www.unvlt.com.
   5. Manufacturer Limitations: Where possible, for each type of luminaire provide ballasts produced by a single manufacturer.
   6. Where a specific manufacturer or model is indicated elsewhere in the luminaire schedule or on the drawings, substitutions are not permitted unless explicitly indicated.

B. Ballasts - General Requirements:
   1. Provide ballasts containing no polychlorinated biphenyls (PCBs).
   2. Minimum Efficiency/Efficacy: Provide ballasts complying with all current applicable federal and state ballast efficiency/efficacy standards.

C. Dimmable LED Drivers:
   1. Dimming Range: Continuous dimming from 100 percent to five percent relative light output unless dimming capability to lower level is indicated, without flicker.
   2. Control Compatibility: Fully compatible with the dimming controls to be installed.
      a. Wall Dimmers: See Section 26 2726.

2.06 EMERGENCY POWER SUPPLY UNITS IN FIXTURES

A. Manufacturers:
   1. Iota Engineering, LLC: www.iotaengineering.com/#sle.
   2. Lithonia Lighting: www.lithonia.com/#sle.
   3. Philips Emergency Lighting/Bodine: www.bodine.com/#sle.
   4. Cooper-Surelite.
   5. Emergi-Lite.
   6. Dual-Lite.
   7. Chloride.
   8. Manufacturer Limitations: Where possible, for each type of luminaire provide fluorescent emergency power supply units produced by a single manufacturer.
   9. Where a specific manufacturer or model is indicated elsewhere in the luminaire schedule or on the drawings, substitutions are not permitted unless explicitly indicated.

B. Description: Self-contained emergency power supply units suitable for use with indicated luminaires, complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.

C. Item may also be referred to elsewhere in the documents as "battery backup ballast" or "emergency battery backup".

D. Compatibility:
   1. Ballasts: Compatible with electronic, standard magnetic, energy saving, and dimming AC ballasts, including those with end of lamp life shutdown circuits.

E. Operation: Upon interruption of normal power source, solid-state control automatically switches connected lamp(s) to the emergency power supply for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.

F. Battery: Sealed maintenance-free high-temperature nickel cadmium unless otherwise indicated.

G. Diagnostics: Provide accessible and visible multi-chromatic combination test switch/indicator light to display charge, test, and diagnostic status and to manually activate emergency operation.

H. Operating Temperature: From 32 degrees F to 122 degrees F unless otherwise indicated or required for the installed location.

2.07 LAMPS

A. Manufacturers:
   1. General Electric Company/GE Lighting: www.gelighting.com/#sle.
   2. Osram Sylvania: www.sylvania.com/#sle.
   3. Philips Lighting Company: www.lighting.philips.com.
   4. Manufacturer Limitations: Where possible, provide lamps produced by a single manufacturer.
   5. Where a specific manufacturer or model is indicated elsewhere in the luminaire schedule or on the drawings, substitutions are not permitted unless explicitly indicated.

B. Lamps - General Requirements:
   1. Unless explicitly excluded, provide new, compatible, operable lamps in each luminaire.
   2. Verify compatibility of specified lamps with luminaires to be installed. Where lamps are not specified, provide lamps per luminaire manufacturer's recommendations.
   3. Minimum Efficiency: Provide lamps complying with all current applicable federal and state lamp efficiency standards.
   4. Color Temperature Consistency: Unless otherwise indicated, for each type of lamp furnish products which are consistent in perceived color temperature. Replace lamps that are determined by the Architect to be inconsistent in perceived color temperature.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.

C. Verify that suitable support frames are installed where required.

D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

A. Coordinate locations of outlet boxes provided under Section 26 0537 as required for installation of luminaires provided under this section.

B. Install products according to manufacturer's instructions.

C. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 1 (general workmanship) and NECA 500 (commercial lighting).

D. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.

E. Suspended Ceiling Mounted Luminaires:
   1. Do not use ceiling tiles to bear weight of luminaires.
   2. Secure surface-mounted, recessed, and pendant-mounted luminaires to building structure.
   3. Secure lay-in luminaires to ceiling support channels using listed safety clips at four corners.
   4. In addition to ceiling support wires, provide two galvanized steel safety wire(s), minimum 18 gauge, connected from diagonal corners of each recessed luminaire to building structure.
   5. See appropriate Division 9 section where suspended grid ceiling is specified for additional requirements.

F. Recessed Luminaires:
   1. Install trims tight to mounting surface with no visible light leakage.
   2. Non-IC Rated Luminaires: Maintain required separation from insulation and combustible materials according to listing.
   3. Luminaires Recessed in Fire-Rated Ceilings: Install using accessories and firestopping materials to meet regulatory requirements for fire rating.
   4. Downlights: Use fixtures supports provided by manufacturer.
   5. For recessed flanged fixtures in hard ceilings (i.e. wood, gypboard, etc.), support the fixture from structure with two 3/8" threaded rods.

G. Suspended Luminaires:
   1. Unless otherwise indicated, specified mounting heights are to bottom of luminaire.
   2. Install using the suspension method indicated, with support lengths and accessories as required for specified mounting height.
   3. Stems shall not be less than 8-inches in length.
   4. Fixtures shall be supported from structure.
   5. Provide minimum of two supports for each luminaire, with no more than 4 feet between supports.
   6. Install canopies tight to mounting surface.
   7. Unless otherwise indicated, support pendants from swivel hangers.
   8. No fixture shall be suspended using chain, unless specifically indicated on the plans.

H. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to bottom of luminaire.

I. Install accessories furnished with each luminaire.

J. Bond products and metal accessories to branch circuit equipment grounding conductor.

K. Emergency Lighting Units:
   1. Unless otherwise indicated, connect unit to unswitched power from circuit indicated. Bypass local switches, contactors, or other lighting controls.

L. Exit Signs:
   1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.

M. Emergency Power Supply Units inside fixtures:
   1. For field-installed units, install inside luminaire unless otherwise indicated. Where installation inside luminaire is not possible, install on top of luminaire or in remote location not exceeding manufacturer's recommended maximum conductor length to luminaire.

2. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal ballast(s) in luminaire. Bypass local switches, contactors, or other lighting controls.

N. Remote Ballasts: Install in accessible location as indicated or as required to complete installation, using conductors per manufacturer's recommendations not exceeding manufacturer's recommended maximum conductor length to luminaire.

O. Identify luminaires connected to emergency power system in accordance with Section 26 0553.

P. Install lamps in each luminaire.

Q. Locating Light Fixtures in Mechanical Equipment Spaces: The Contractor shall adjust fixture locations to avoid conflicts with ducts, piping, and equipment. Locate fixtures below and clear of ducts, pipes, and equipment. Fixtures shall not conflict with required access to duct, piping, and equipment, including but not limited to valves, instruments, and access doors. The Contractor shall relocate fixtures deemed to have conflicts at the discretion of the Design Professional.

R. Wall mounted exit signs shown over doors:
1. Atriums, lobbies or corridors with high ceilings, storefront: Confirm location and mounting height with A/E prior to rough-in of these areas.
2. Other locations:
   a. If the ceiling is 12' or lower, locate the exit sign centered between the top of the door frame and the ceiling. All exit signs mounted over doors in the same space shall be at the same height.
   b. If the ceiling is greater than 12', mount the exit sign such that the bottom of the sign is 7'-6" above finished floor.

S. Any luminaire larger than 2' x 4' shall be supported independent of ceiling framing.

T. The Contractor shall verify all ceiling types and configuration prior to ordering fixtures. The Contractor shall review the reflected ceiling plan, including any changes or modifications to the documents made during construction. The Contractor shall furnish fixtures compatible with the ceiling type being installed.

U. Locate recessed ceiling luminaires as indicated on the reflected ceiling plan.

V. Install surface mounted luminaries and exit signs plumb and adjust to align with building lines and with each other. Secure to prevent movement.

W. Install recessed luminaires to permit removal from below.

X. Install wall mounted fixtures at height indicated. Request this information prior to rough-in if no height is indicated.

Y. Connect luminaires to branch circuit junction boxes provided under Section 26 0537 using flexible conduit. Support flexible conduit from structure. Flexible conduit shall not rest on ceiling tiles, and shall not rest on ceiling grid supports. Do not support flexible conduit from ceiling support wires. Do not support flex conduit from luminaire support wires.

Z. Structural system attachments, unless noted otherwise:
1. Poured-in-place concrete or precast solid masonry: Concrete expandable anchors.
2. Steel Bar Joists or Steel Beams: 1 5/8-inch x 3/4-inch x 12 gauge channel bolted to top chords. Drill channel and secure threaded rod to channel
3. Along bar joist or steel beam center line: Malleable iron beam clamp.

3.04 FIELD QUALITY CONTROL

A. See Division 1 for additional quality requirements.

B. Inspect each product for damage and defects.

C. Operate each fixture after installation and connection. Inspect for proper connection and operation.

D. Test self-powered exit signs, emergency lighting units, and fluorescent emergency power supply units to verify proper operation upon loss of normal power supply.

E. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Architect.

3.05 ADJUSTING

A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Architect. Secure locking fittings in place.

B. Aim and position adjustable emergency lighting unit lamps to achieve optimum illumination of egress path as required or as directed by Architect.

C. Exit Signs with Field-Selectable Directional Arrows: Set as indicated or as required to properly designate egress path as directed by Architect.

3.06 CLEANING

A. Clean surfaces according to NECA 500 (commercial lighting) and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

B. Clean electrical parts to remove conductive and deleterious materials.

C. Remove dirt and debris from enclosures.

D. Clean photometric control surfaces as recommended by manufacturer.

E. Clean finishes and touch up damage.

F. Replace any cracked or bent lenses or louvers. Replace any lenses or louvers with deficiencies as noted by the Design Professional.

3.07 CLOSEOUT ACTIVITIES

A. Demonstration: Demonstrate proper operation of luminaires to Architect, and correct deficiencies or make adjustments as directed.

B. Just prior to Substantial Completion, replace all lamps that have failed .

3.08 PROTECTION

A. Protect installed luminaires from subsequent construction operations.

END OF SECTION

SECTION 26 5200
SENSOR LIGHTING CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Occupancy Sensors.

B. Outdoor Type Photoelectric Switches.

1.02 RELATED SECTIONS

A. Section 26 5100 - Interior Lighting.

1.03 REFERENCES

A. NFPA 70 - National Electrical Code, 2017 Edition; National Fire Protection Association.

1.04 SYSTEM DESCRIPTION

A. The objective of this section is to ensure the proper installation of the occupancy sensor based lighting control system so that lighting is turned off automatically after reasonable time delay when a room or area is vacated by the last person to occupy said room or area.

B. The occupancy sensor based lighting control shall accommodate all conditions of space utilization and all irregular work hours and habits.

C. Where applicable, occupancy sensors shall be wired in a "Manual ON/ Auto OFF" configuration.

D. Set the factory default to Auto OFF at 20 minutes.

1.05 SUBMITTALS

A. See Section 26 0510 - General Electrical Requirements, for submittal procedures.

B. Product Data: Provide product data sheets for all equipment to be used. Provide circuit diagrams of each type of device. Circuit diagrams shall indicate type of control wire and/or line voltage wire used.

C. Shop Drawings: Indicate layout of each interior space showing proper placement and aiming of occupancy sensor shown on the plans. Notify the Architect immediately of any possible conflicts with equipment / room layout shown on the plans. These drawings shall be produced using a CAD based program and submitted on full size (minimum "D" size) prints.

D. Product data shall clearly indicate method used to handle inrush current for all wall switch products.

E. Product data shall clearly state any load restrictions when used with electronic ballasts.`

F. Project Record Documents: Record actual locations of installed sensors and controls. Drawings shall include location of all power packs and low voltage wiring.

1.06 QUALITY ASSURANCE

A. The Contractor shall schedule an onsite meeting with an authorized factory agent to instruct the Contractor in proper mounting, adjustments and aiming of the occupancy sensors. This meeting shall take place prior to start of sensor installation.

B. Perform work in accordance with NFPA 70.

C. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years of documented experience.

D. All products shall be from the same manufacturer.

E. All components shall be U.L. listed.

F. Products shall be manufactured by an ISO 9002 certified manufacturing facility.

G. Wall switch products shall be capable of withstanding the effects of inrush current.

1.07 WORK INCLUDED

A. The Contractor shall provide all labor, materials, tools, appliances, control hardware, sensors, wiring, junction boxes and equipment necessary for and incidental to the delivery, installation and furnishing of a completely operational occupancy sensor lighting control system, as shown on the plans and as described herein.

B. The Contractor shall coordinate all work described in this section with all other applicable plans and specifications, including but not limited to wiring, conduit, luminaires, HVAC systems and building management systems.

1.08 WARRANTY

A. Provide five year manufacturer warranty for all components.

B. Any equipment found to be damaged, defective or non-conforming shall be replaced at no additional cost to the owner.

1.09 EXTRA MATERIALS

A. Supply two additional power packs and one additional sensor of each type used for Owner's use in maintenance of project.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Occupancy Sensors:
   1. The WattStopper
   2. Mytech
   3. Leviton
   4. Hubbell
   5. Pass & Seymour
   6. Lutron
   7. Lightolier
   8. Novitas
   9. Lithonia

B. Outdoor Type Photoelectric Switches:
   1. Paragon
   2. Tork
   3. Intermatic
   4. Precision
   5. Ripley

2.02 OCCUPANCY SENSORS

A. NOTE: 360 degree sensors are typically shown in the center of the space on the plans. Where ceiling mounted sensors are shown in the corners of spaces, these sensors should not be 360 degree, rather they should be designed for corner-room operation. The contractor and manufacturer shall coordinate this requirement and shall not provide a single type sensor for all applications. The plans show the type (infrared, ultrasonic, or combination) only. The location in the space should provide guidance as to the exact product to be chosen. Where sensors are to be mounted in the ceiling above 15 ft., use high density lenses to maintain sensitivity.

B. Note: Wall mounted occupancy sensors shall match line voltage switches in color. Provide decora style covers to match line voltage covers.

C. Note: Ceiling mounted occupancy sensors shall be white.

D. The passive infrared sensors shall be capable of detecting presence, in the control area, by detecting changes in the Infrared energy. Small movements shall be detected such as when a person is writing while seated at a desk.

E. All sensors shall have readily accessible, user adjustable settings for time delay and sensitivity. Settings shall be located on the sensor (not the control unit) and shall be recessed to limit tampering.

F. Wall switch sensors shall be capable of detection of occupancy at desktop level up to 300 square feet, and gross motion up to 1000 square feet.

G. Wall switch sensors shall accommodate loads from 0 to 800 watts at 120 volts; 0 to 1200 watts at 277 volts and shall have a 180 degree coverage capability.

H. Wall switch sensors shall include means of protecting the internal relay from the effects of inrush current.

I. Wall switch sensors shall have no leakage current to load, in manual or in Auto/Off mode for safety purposes and shall have voltage drop protection.

J. If an open circuit occurs in the AC line (such as a ballast or lamp failure), the sensor shall automatically switch to OFF mode.

K. In the event of a sensor failure, a bypass manual override shall be provided on each sensor. When bypass is utilized, lighting shall remain ON constantly or control shall divert to a wall switch until sensor is replaced. This control shall be recessed to prevent tampering.

L. Wall switch sensor shall have 2 positions only, OFF and AUTO, for normal operation.

M. Wall switch sensors shall provide a field selectable option to convert sensor operation from automatic-ON to manual-ON. Manual ON shall be the default.

N. Where specified, vandal resistant wall switch sensors shall utilize a hard lens with a minimum 1.0mm thickness. Products utilizing a soft lens will not be considered.

O. Passive infrared sensors shall have a multiple segmented Fresnel lens, in a multiple-tier configuration, with grooves-in to eliminate dust and residue build-up. The lens shall filter short wavelength IR such as those emitted by the sun and other visible light sources.

P. Ultrasonic sensing shall utilize Advanced Signal Processing to adjust the detection threshold dynamically to compensate for constantly changing levels of activity and airflow throughout controlled space.

Q. Ultrasonic operating frequency shall be crystal controlled to within plus or minus 0.01% tolerance to assure reliable performance and eliminate sensor cross-talk. Sensors using multiple frequencies are not acceptable.

R. Dual technology sensors shall consist of passive infrared and ultrasonic technologies for occupancy detection. Products that react to noise or ambient sound will not be considered.

S. For dual technology sensors, detection verification of BOTH technologies must occur in order to activate lighting systems. Upon verification, detection by either shall hold lighting on.

T. Dual technology sensors shall have a retrigger feature in which detection by either technology shall retrigger the lighting system on within 5 seconds of being switched off.

U. All sensors used in the center of a space shall provide for 360 degrees of coverage.

V. Sensors shall be capable of being wired in parallel to allow coverage of large areas.

W. To avoid false ON activations and to provide high sensitivity to minor motion, Pulse Count Processing and Detection Signature Analysis shall be used to examine the frequency, duration, and amplitude of a signal, to respond only to those signals caused by human motion.

X. Sensor shall incorporate field-selectable logic configurations which allows for space utilization changes and/or other special field conditions.

Y. Where specified, passive infrared and dual technology sensors shall offer daylighting foot candle adjustment control and be able to accommodate dual level lighting.

Z. All sensors shall be capable of operating normally with electronic ballasts, PL lamp systems and rated motor loads.

AA. Coverage of sensors shall remain constant after sensitivity control has been set. No automatic reduction shall occur in coverage due to the cycling of air conditioner or heating fans.

AB. All sensors shall provide an LED as a visual means of indication at all times to verify that motion is being detected during both testing and normal operation.

AC. Power packs for sensors shall have an internal, additional isolated relay with Normally Open, Normally Closed and Common outputs for use with HVAC control, Data Logging and other control options. Sensors utilizing separate components or specially modified units to achieve this function are not acceptable.

2.03 CIRCUIT CONTROL HARDWARE (POWER PACKS)

A. Control units shall be capable of external mounting through a 1/2" knock-out on a standard electrical enclosure. Unit shall be rated for plenum installation.

B. The control unit shall be an integrated, self-contained unit consisting internally of an isolated load switching control relay and a transformer to power the sensor.

C. Each control unit shall be capable of powering a minimum of two occupancy sensors.

D. Relay contacts shall have ratings of:
   1. 13A - 120 VAC Tungsten
   2. 20A - 120 VAC Ballast
   3. 20A - 277 VAC Ballast

E. Control wiring between sensors and control units shall be Class II, 18-24 AWG, stranded U.L. Classified, PVC insulated or TEFLON jacketed cable suitable for use in plenums.

F. Minimum acceptable wire gauge from the circuit control hardware relays shall be #14 AWG.

2.04 OUTDOOR TYPE PHOTOELECTRIC SWITCH

A. Photoelectric switch shall be single pole, single throw, with hot/neutral/switched conductors. Switch shall be rated 20 amps. Switch shall be weatherproof, designed for temperature range of -30F to +140F.

B. PE switch shall turn on at 1.5 footcandles and off at 10 footcandles. PE switch shall contain a 20 second time delay.

C. PE switch shall fail with the switch closed.

D. Mount the PE switch facing generally north, adjusted to avoid interaction with nearby artificial lighting. Nipple the PE switch to hole in cast fixture or box with double locknuts and double gaskets. Mount PE switch to a box hub with sealant. Provide a waterproof installation.

E. Where PE switch is mounted on top of a building, provide a cast FS box with conduit hubs. Orient the box with side opening gasketed WP lid, with PE switch on top, and homerun conduit out the bottom. Seal the conduit entries into the box. Duct-seal the homerun from inside the box.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Locate and aim sensors to provide complete and proper volumetric coverage within the manufacturer's specified range of coverage.

C. Spaces shall have 90% - 100% coverage to completely cover the controlled area, accommodating all occupancy habits of single or multiple occupants at any location within the room(s).

D. The location of sensors shown on the plans are diagrammatic only. Locate sensors to avoid interference with possible obstructions.

E. Locate sensors a minimum of 6 feet from and HVAC supply diffuser or return grille.

F. Provide all power/switch packs required to make the system fully functional. Usually, a minimum of one power/switch pack is required per circuit and/or area of control. However in

some cases additional power/switch packs may be required. Contact manufacturer for final determination of power/switch packs required for this project.

G. Locate power/switch packs on wall above ceiling directly over the standard wall switch where possible.

H. Wall switches shown in spaces with occupancy sensors shall be wired to override the sensor so that the lights can be switched off manually.

I. In spaces shown with multiple sensors, wire the sensors in parallel so that either sensor can control all of the fixtures on that circuit.

J. Mount ceiling type devices in the center of a ceiling tile.

3.02 STARTING EQUIPMENT AND SYSTEMS

A. Occupancy Based Lighting Control - System Commissioning:
   1. Upon completion of the installation, the system shall be completely commissioned by the manufacturer's factory authorized technician who will verify all adjustments and sensor placement to ensure a trouble-free occupancy-based lighting control system.
   2. If multiple trips by the factory technician is required because the system is not operational or completely installed - it is the contractors responsibility to pay for additional service trips.
   3. The Contractor shall provide both the manufacturer and the Architect a written notice of the scheduled commissioning date at least 15 working days prior to the scheduled date.
   4. Upon completion of the system fine tuning the factory authorized technician shall provide proper training to the Owner in the adjustment and maintenance of the sensors.
   5. The Contractor shall provide all lifts and/or ladders and one technician to assist in the commissioning.
   6. Prior to commissioning, the Contractor shall verify that all sensors and associated power supplies/relays are installed and all wiring properly terminated.
   7. The manufacturer's factory authorized technician shall, upon completion of the commissioning, provide a written report to the Contractor and the Architect indicating completion of the work. This report shall also indicate any corrective actions required on the part of the Contractor.

END OF SECTION

SECTION 27 1005

STRUCTURED CABLING FOR VOICE AND DATA - INSIDE-PLANT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Communications system design requirements.

B. Communications pathways.

C. Copper cable and terminations.

D. Fiber optic cable and interconnecting devices.

E. Communications identification.

F. Cabling and pathways inside building(s).

G. Distribution frames, cross-connection equipment, enclosures, and outlets.

H. Grounding and bonding the telecommunications distribution system.

I. Administration and Labeling

J. Testing

1.02 RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.

B. Section 26 0526 - Grounding and Bonding for Electrical Systems: Electrical system grounding and bonding.

C. Section 26 0529 - Hangers and Supports

D. Section 26 0534 - Conduit.

E. Section 26 0536 - Cable Trays for Electrical Systems.

1.03 REFERENCE STANDARDS

A. NECA/BICSI 568 - Standard for Installing Building Telecommunications Cabling; National Electrical Contractors Association; 2006.

B. NFPA 70 - National Electrical Code, 2014 Edition; National Fire Protection Association.

C. TIA-568 (SET) - Commercial Building Telecommunications Cabling Standard Set; 2015.

D. TIA-568-C.1 - Commercial Building Telecommunications Cabling Standard; Telecommunications Industry Association; Rev C, 2009 (with Addenda; 2012).

E. TIA-568-C.2 - Balanced Twisted-Pair Telecommunications Cabling and Components Standards; Rev C, 2009 (with Addenda; 2014).

F. TIA/EIA-568-B.3 - Commercial Building Telecommunications Cabling Standard - Part 3: Optical Fiber Cabling Components Standard, and Addendum 1 - Additional Transmission Performance Specifications for 50/125 um Optical Fiber Cables

G. TIA-569-C - Commercial Building Standard for Telecommunications Pathways and Spaces; Rev C, 2012 (with Addenda; 2013).

H. TIA-606-B - Administration Standard for the Telecommunications Infrastructure; Rev B, 2012.

I. TIA-607-B - Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises; Rev B, 2012 (with Addenda; 2013).

J. ANSI/J-STD-607 - Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications; Rev A, 2002.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate requirements for service entrance and entrance facilities with Communications Service Provider.

2. Coordinate the work with other trades to avoid placement of other utilities or obstructions within the spaces dedicated for communications equipment.
3. Coordinate arrangement of communications equipment with the dimensions and clearance requirements of the actual equipment to be installed.
4. Notify the Design Professional of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Storage and handling requirements and recommendations.
   2. Installation methods and instructions.

B. Shop Drawings: Show compliance with requirements on isometric schematic diagram of network layout, showing cable routings, telecommunication closets, rack and enclosure layouts and locations, service entrance, and grounding, prepared and approved by BICSI Registered Communications Distribution Designer (RCDD).

C. Shop Drawings shall also include outlet numbering and identifier assignments.

D. Manufacturer Qualifications.

E. Test Plan: Complete and detailed plan, with list of test equipment, procedures for inspection and testing, and intended test date; submit at least 60 days prior to intended test date.

F. Field Test Reports.

G. Test results verifying that all equipment has been tested for compatibility as part of a structured cabling system.

H. Project Record Documents (shall be prepared and approved by a RCDD):
   1. Provide copy of all approved submittals.
   2. Provide full size as-built drawings (minimum "D" size).
   3. As-built drawings shall accurately record location of service entrance conduit, termination backboards, outlet boxes, cable raceways, cable trays, pull boxes, and equipment racks electronically and on full size prints.
   4. The LVLTC shall prepare 11"X17" as-built serving zone drawings for each Telecommunications Room (TR). The drawings shall be laminated, framed and secured to the wall in the Main Equipment Room (MER) and Telecommunications Room (TR).
   5. Provide copy of all test reports.
   6. Copper cable records shall include the status of each copper pair. Optical fiber cable records shall include strand allocation, test results, and identification of media and protocol used.
   7. Record actual locations of outlet boxes and distribution frames.
   8. Show as-installed color coding, pair assignment, polarization, and cross-connect layout.
   9. Identify distribution frames and equipment rooms by room number on contract drawings.
   10. Provide three copies, complete and bound.
   11. Provide copies of all manufacturer's warranties.

I. Operation and Maintenance Data: List of all components with part numbers, sources of supply, and operation and maintenance instructions; include copy of project record documents.

J. Other Required Project Information (To be provided prior to Pre-Final of the building, for each of the specified media):
   1. Cable identification numbers.
   2. Cable design makeup.
   3. Cable lengths between splice points and terminations.
   4. Exact routing of cable.
   5. Strand count, mode of installed fiber, loss per splice in dB, and total amount of optical fibers installed.
   6. Bonding and grounding.
   7. Location and description of all associated structures and obstructions.

8. Cable entrance locations and penetration details.
9. Terminal information, outlet numbering, and pair count information at each distribution frame.
10. Schematic drawings of riser.
11. Routing of cable and termination information.
12. Cable pair counts per connector block.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: At least 3 years' experience manufacturing products of the type specified.

B. Installer Qualifications:
1. The telecommunications installation contractor shall be licensed in the State of Georgia as a Low Voltage Licensed Telecommunications Contractor (LVLTC).
2. The Contractor shall provide an on-site, full-time Project Manager who will act as a single point of contact for all activities regarding this project.
3. The LVLTC Project Manager shall make on-site decisions regarding the scope of the work and any changes required by the work.
4. The Project Manager shall be on the job any time work is being performed or workers are present. The PM shall get written approval prior to committing.
5. The Project Manager shall be totally responsible for all aspects of the work.
6. The selected LVLTC shall be fully capable and experienced in the telecommunications distribution system to be installed.
7. The LVLTC shall have a minimum of five (5) years of experience installing Structured Cabling Systems and be a certified installer of the approved cable/component system solution.
8. The LVLTC shall have a Registered Communications Distribution Designer (RCDD) on staff that will be ultimately responsible for the project. The credentials (current BICSI certification stamp) of the responsible RCDD shall be attached to the LVLTC's response for evaluation by the State.
9. A BICSI Certified installer shall be employed by the LVLTC and be on site as the installation manager.
10. The LVLTC shall provide a minimum of three (3) projects where similar work, both in scope and design, have been completed by the LVLTC within the last two (2) years.

1.07 WARRANTY

A. The LVLTC shall furnish a warranty of products, applications and workmanship for fifteen (15) years from the date of acceptance by the State. All other products and workmanship shall carry warranties equal to or greater than the warranty from the date of acceptance by the State.

B. Materials and workmanship shall be fully guaranteed by the LVLTC for fifteen (15) years from the date of acceptance by the State. Defects which may occur, as the result of faulty materials or workmanship, within fifteen (15) years after installation and acceptance by the Owner shall be corrected by the LVLTC at no additional cost to the Owner.

C. The period of the LVLTC's warranty (ies) for any items herein are not exclusive remedies, and the Owner has recourse to any warranties of additional scope given by LVLTC to the Owner and all other remedies available at law or in equity.

D. The LVLTC shall pass along to the Owner any additional warranties offered by the manufacturers, at no additional costs to the Owner.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Cabling:
1. Superior Essex
2. General Cable
3. CommScope

4. Belden
5. Hitachi
6. Draka
7. Mohawk
8. Berk-Tek

B. Connectivity:
1. Panduit
2. Hubbell
3. Siemon
4. Ortronics
5. Leviton
6. Molex
7. CommScope
8. Hellermann Tyton

C. Racks:
1. X-Mark
2. Chatsworth
3. Homaco
4. Great Lakes
5. Eaton Cooper B-Line

D. The system used shall be a certified systems solution comprised of the manufacturers listed above. Manufacturers offering their system solution using their cable and components shall be acceptable.

2.02 SYSTEM DESIGN

A. Provide a complete permanent system of cabling and pathways for telecommunications, including cables, conduits and wireways, pull wires, support structures, enclosures and cabinets, and outlets.
1. Comply with TIA-568 (SET) (cabling) and TIA-569-C (pathways), latest editions (commercial standards).
2. Provide fixed cables and pathways that comply with NFPA 70 and TIA-607-B and are UL listed or third party independent testing laboratory certified.
3. Provide connection devices that are rated for operation under conditions of 32 to 140 degrees F at relative humidity of 0 to 95 percent, noncondensing.
4. In this project, the term plenum is defined as return air spaces above ceilings, inside ducts, under raised floors, and other air-handling spaces.
5. Comply with the latest adopted version of the GTDM.

B. Telecommunications cabling, jacks, patch panels, punch down blocks and other equipment shall be certified for Category 6 operation.

C. All UTP copper cables shall be terminated in rack mounted patch panels. There is no distinction between voice and data cables in a structured cabling system.

D. Products including, but not limited to, cabling, jacks, patch panels, and cabinets shall be consistent throughout the project. All equipment shall have been tested for compatibility as part of a structured cabling system.

E. Active equipment (handsets, hubs, switches, media converters, etc.) is not included in this contract unless otherwise noted.

F. Main Equipment Room (MER): Centrally located support structure for terminating backbone cables, functioning as point of presence to external service provider.
1. Locate main distribution frame as indicated on the drawings.
2. Capacity: As required to terminate all cables required by design criteria plus minimum 25 percent spare space.

G. Telecommunications Rooms (TRs): Support structures for terminating horizontal cables that extend to telecommunications outlets.
   1. Locate telecommunications rooms as indicated on the drawings.

H. Backbone Cabling: Cabling, pathways, and terminal hardware connecting telecommunications rooms (TRs) with the main equipment room (MER), wired in star topology with the MER at center hub of star.

I. Cabling to Outlets: Specified horizontal cabling, wired in star topology to distribution frame located at center hub of star; also referred to as "links".

J. Copper Horizontal Cable (defined as cable from the Work Area to the patch panel): TIA/EIA-568 Category 6 solid conductor unshielded twisted pair (UTP), 24 AWG, 100 ohm; 4 individually twisted pairs; covered with blue jacket and complying with all relevant parts of and addenda to latest edition of TIA/EIA-568 and UL 444. Cables routed in conduit that goes below the slab shall be listed for wet locations. These cables must terminate directly in the data room and shall not be routed exposed in the building.

2.03 PATHWAYS

A. Conduit: Refer to Section 26 0534 for general conduit specifications regarding routing. This does not mean conduit shall be 1/2" in size; data conduits shall not be less than 1". provide pull cords in all conduit.
   1. Conduit for horizontal cable distribution shall be minimum 1" trade size. This is considered conduit from the work area outlet, up and out of the wall over to the cable tray. Do not stub the conduit just out of the wall and then J hook over to the cable tray - this is unacceptable. Conduit must be routed to the nearest cable tray.
   2. Provide insulated bushings at each end of all conduits.
   3. All riser and entrance conduits shall be minimum 4" in diameter.
   4. All conduits to receive fiber optic cable shall be provided with three 1-1/4" innerducts.

B. Cable Trays: As specified in Section 26 0536.

C. Sleeves: Minimum 4" threaded galvanized rigid steel conduit with plastic insulating bushing on each end.

D. Ladder Rack:
   1. Shall be tubular side bar type nominally 3/8" thick by 1-1/2" high (minimum) with 1/2" x 1" welded rungs spaced 9" on center.
   2. Shall be powder coated and black in color.
   3. Shall include connecting and all other support hardware for a complete installation.
   4. Shall include equipment rack to runway mounting plates, wall angle support brackets, butt splice swivels, junction splice connections and grounding kits.

E. Vertical Ladder Rack:
   1. Provide ladder rack as required for backbone cables passing vertically through TRs and/or ERs.
   2. Include connecting hardware and all other support hardware for a complete installation.
   3. Provide with grounding lug to allow for bonding connection.
   4. Shall be tubular side bar type nominally 3/8" thick by 1-1/2" high (minimum) with 1/2" x 1" welded rungs spaced 9" on center.
   5. Shall be powder coated and black in color.

2.04 COPPER CABLE AND TERMINATIONS

A. Copper Backbone Cable: TIA/EIA-568 Category 6 solid conductor unshielded twisted pair (UTP), 24 AWG, 100 ohm; 100 pairs formed into 25-pair binder groups; covered with gray thermoplastic jacket and complying with all relevant parts of and addenda to latest editions of TIA/EIA-568 and ICEA S-90-661, and UL 444.
   1. In locations other than in plenums, provide NFPA 70 type CMR riser-rated or type CMP plenum-rated cable, except as described below.
   2. In plenums, provide NFPA 70 type CMP plenum-rated cable.

3. All cable routed under slab on grade shall be wet location listed for that condition. Cable shall transition to the type described above as soon as practicable upon penetrating the slab. The transition shall NOT be in a plenum.
4. Provide cable having conductors twisted at minimum rate of two per foot; actual length and frequency of twists at manufacturer's option.
5. Color code conductors in accordance with ICEA S-90-661.

B. Copper Backbone Cable:
1. The cable shall be available in 25, 50, 100, 150, 200, 300, 400, 600, 900, and 1200 pair counts. See plans for required strand count.
2. All cable shall be UL Listed for Fire Safety.
3. Provide cable having conductors twisted at minimum rate to two per foot (six per meter); actual length and frequency of twists at manufacturer's option.
4. Shall be gray in color.
5. Shall comply with all relevant parts of and addenda to latest editions of TIA/EIA-568 and ICEA S-90-661, and UL 444.
6. Copper Backbone Cable: All UTP copper backbone cable supporting voice communications requirements shall be standard 24-gauge, paired dual, semi-rigid CMP rated as per NEC, except as described below.
7. Copper Vertical Backbone Cables: Shielded or unshielded 24 AWG CMP rated, multi-pair copper cables shall be used as the vertical backbone riser cables.
8. All cable routed under slab on grade shall be wet location listed for that condition. Cable shall transition to the type described above as soon as practicable upon penetrating the slab. The transition shall NOT be in a plenum.
9. Shielded Copper Vertical Backbone Cables: Shielded multi-pair plenum cable shall consist of solid-copper conductors insulated with expanded polyethylene covered by a PVC skin, be conformance tested to meet EIA/TIA 568 for Category 6 cable, be UL listed as CMP. The core shall be 100% shielded with Aluminum-Mylar and have a drain wire as per manufacturer's specifications.

C. Copper Horizontal Cable (defined as cable from the Work Area to the patch panel): TIA/EIA-568 Category 6 solid conductor unshielded twisted pair (UTP), 24 AWG, 100 ohm; 4 individually twisted pairs; covered with blue jacket and complying with all relevant parts of and addenda to latest edition of TIA/EIA-568 and UL 444. Cables routed in conduit that goes below the slab shall be listed for wet locations. These cables must terminate directly in the data room and shall not be routed exposed in the building.
1. All cable shall be NFPA 70 type CMP plenum-rated, except as described below.
2. All cable routed under slab on grade shall be wet location listed for that condition. Cable shall transition to the type described above as soon as practicable upon penetrating the slab. The transition shall NOT be in a plenum.
3. Testing: Furnish factory reel tests.
4. Cables shall be marked with the manufacturer's name, cable type/catalog number and the latest adopted NEC code compliance.

D. Copper Cable Terminations: Insulation displacement connection (IDC) type using appropriate tool.

E. Jacks and Connectors: Modular RJ-45, non-keyed, terminated with 110-style insulation displacement connectors (IDC); high impact thermoplastic housing; suitable for and complying with same standard as specified horizontal cable; UL 1863 listed.
1. Performance: 500 mating cycles.
2. Outlet Jacks: 4-pair, pre-wired to T568B configuration, with color-coded indications for T568B configuration.

2.05 FIBER OPTIC CABLE AND INTERCONNECTING DEVICES

A. Fiber Optic Interconnecting Devices:
1. Connector Type: Type SC.
2. Connector Performance: 500 mating cycles, when tested in accordance with TIA-455-21.

3. Maximum Attenuation/Insertion Loss: 0.3 dB.

B. Single Mode Fiber Optic Backbone Cables:
1. See plans for required strand count.
2. Shall be NFPA 70 type OFNP nonconductive-plenum-rated.
3. Class IVa dispersion - un-shifted single mode optical fibers complying with ANSI/EIA/TIA-492BAAA.
4. The zero dispersion wavelength shall be between 1300 nm and 1324 nm. The ANSI/EIA/TIA-455-168 maximum value of the dispersion slope shall be no greater than 0.093 ps/km-nm2.
5. Dispersion measurements shall be made in accordance with ANSI/EIA/TIA-455-169 or ANSI/EIA/TIA-455-175.
6. The nominal mode field diameter shall be 8.7 um.
7. Maximum attenuation dB/Km @ 1310/1550 nm: 1.0/1.0.
8. The cutoff wavelength shall <1279 nm when measured in accordance with ANSI/EIA/TIA-455-170.
9. Shall be 900 um tight buffer.
10. Shall have 2.0 mm sub-unit diameter.
11. Shall be suitable for indoor installations.
12. Strength members shall be all dielectric.
13. Shall incorporate secondary thermoplastic type buffer over each fiber.
14. Shall have individual fiber tube colors per ANSI/TIA/EIA-606A with an overall orange jacket.
15. Provide stiff central member with cables stranded around center.
16. Provide ripcord for overall jacket.
17. The operating temperature range shall be between -20 to 70 degrees centigrade.
18. Shall be factory certified per reel. The certification shall consist of instrument readings from an Optical OTDR noting dB loss per meter, fiber index of refraction and laser wave length. An OTDR test data sheet shall be provided with photograph of graphical output showing display, cable reflectometer trace and all settings.

C. Fiber Optic Adapters and Connectors: Duplex SC, push-on-push-off type, multimode adaptors with zirconia ceramic alignment sleeves; complying with relevant parts and addenda to latest edition of TIA/EIA-568 and with maximum attenuation of 0.3 dB at 1300 nm with less than 0.2 dB change after 500 mating cycles when tested in accordance with TIA-455-21.
1. The 568SC connectors shall meet TIA/EIA-604-3 standards.
2. The total optical attenuation through the cross-connect from any terminated optical fiber to any other terminated fiber shall not exceed 1.0 dB.
3. The connectors shall have a return loss greater than or equal to 20 dB for multimode fiber and greater than or equal to 26 dB for single mode fiber.

2.06 IDENTIFICATION PRODUCTS

A. Comply with TIA-606-B.

2.07 CROSS-CONNECTION EQUIPMENT

A. Connector Blocks for Category 5e and Up Cabling: Type 110 insulation displacement connectors; capacity sufficient for cables to be terminated plus 25 percent spare.
1. The connecting hardware block shall facilitate cross-connection and/or inter-connection using either approved cross-connect wire or patch cords.
2. Blocks shall be UL Verified.
3. Shall be TIA/EIA-568 Category 6 compliant.
4. Shall be made of flame-retardant thermoplastic.
5. Shall be 50, 100 or 300 pair sizes, as required for the actual cables being terminated.
6. Blocks shall include means to identify cables/services per TIA/EIA-606A.
7. Shall have connecting blocks used for either the termination of cross-connect (jumper) wire or patch cords. The connecting blocks shall be available in 3, 4 and 5 pair sizes. All

connecting blocks shall have color-coded tip and ring designation markers and be of single piece construction.
8. Shall support wire sizes: Solid or 7-strand 22-26 AWG.

B. Patch Panels for Copper Cabling: Sized to fit EIA standard 19 inch wide equipment racks; 0.09 inch thick aluminum; cabling terminated on Type 110 insulation displacement connectors; printed circuit board interface.
1. Jacks: Eight position non-keyed RJ-45, suitable for and complying with same standard as cable to be terminated; maximum 48 ports per standard width panel. No 24 port patch panels allowed.
a. Shall be modular type.
b. Shall be available in universal wiring schemes (Use T568B).
c. Housing shall be fire retardant UL 94VO rated thermoplastic and tin lead solder plated IDC.
d. Housing shall be fully encased to protect printed circuit board and IDC fields.
e. Modular jack contacts shall accept a minimum of 2500 plug insertions without degradation of electrical or mechanical performance.
f. Modular jack contacts shall be constructed of Beryllium copper.
g. Shall utilize a paired punch down sequence. Cable pairs and sheath shall be maintained up to the IDC.
h. Shall be compatible with single conductor, industry standard 110 type impact termination tools.
i. Shall include means to hold terminated wires in place.
j. Shall have an attached color-coded wiring label.
k. Shall be UL Verified and listed for TIA/EIA Category 6 electrical performance.
2. Shall accommodate 48 ports for each rack mount space. No high density port configurations allowed.
3. Panel circuit boards shall be fully enclosed front and rear for physical protection.
4. Capacity: Provide ports sufficient for cables to be terminated plus 25 percent spare.
5. Labels: Factory installed laminated plastic nameplates above each port (front and back), numbered consecutively; comply with TIA/EIA-606 using encoded identifiers.
6. Panels shall provide wiring identification and color code and maintain a paired punch down sequence that does not require the overlapping of cable pairs.
7. Panels shall be Category 6 compliant.
8. Provide incoming cable strain relief and routing guides on back of panel.

C. Rack Mounted Patch Panels for Fiber Optic Cabling: Sized to fit EIA standard 19 inch wide equipment racks; 0.09 inch thick aluminum.
1. Adaptors: As specified above; maximum of 24 duplex adaptors per standard panel width.
2. Shall be available in 12, 24, 48, 72, and 96 port configurations.
3. Labels: Factory installed laminated plastic nameplates above each port, numbered consecutively; comply with TIA/EIA-606 using encoded identifiers.
4. Provide incoming cable strain relief and routing guides on back of panel.
5. Provide rear cable management tray at least 8 inches deep with removable cover.
6. Provide dust covers for unused adaptors.
7. Provide for cross-connections or inter-connections.
8. Provide with front access design with hinged bulkhead plate. Front cover shall be removable.
9. Panels shall accommodate stackable splice trays, which manage up to 24 splices per tray.

2.08 ENCLOSURES

A. Backboards: Interior grade plywood without voids, 3/4 inch thick.
1. Size: 48 inches wide by 96 inches high.
2. Do not paint over UL label.

B. Equipment Racks and Cabinets: CEA-310 standard 19 inch wide component racks.
1. Floor Mounted Equipment Racks:

a. Shall be standard 84" in height.
b. Shall have a universal junction hole pattern.
c. Shall have #12-24 panel mounting holes.
d. Shall be capable of supporting a maximum load of 600 Lbs.
e. Shall be constructed of aluminum alloy.
f. Shall be finished with flat black powder coat paint.
g. Cable management units shall be black metal.
h. Provide with both vertical and horizontal cable management.
i. Shall be provided with grounding lug.
    1) Vertical cable management panels shall have front and rear channels, both with removable covers.
    2) A horizontal manager shall be provided at the top of each rack, with a minimum height of 2 rack units each.
    3) Horizontal cable management panels shall also have front and rear channels.
    4) Provide horizontal managers above and below each patch panel, with a minimum height of 2 rack units each.

2. Wall Mounted Cabinets:
    a. Shall be 48" high with 24 mounting spaces.
    b. Shall be of lightweight, high strength steel construction.
    c. Shall be provided with a 19" Equipment Grounding Bar (as per manufacturer's recommendations to comply with NEC).
    d. Shall have a black powder coat finish.
    e. Shall have a minimum 100 lb. loading capacity.
    f. Shall be of 16 gauge welded steel construction.
    g. Static weight capacity shall be 800 Lbs. minimum.
    h. Shall have minimum 45 available rack units.
    i. Plexi-glass window.
    j. Removable vented side covers.
    k. With 19" power strip.
    l. With #10-32 x 5/8" screws for mounting equipment.
    m. Integrated vertical cable management.
    n. One horizontal wire management panel (minimum 3") above and below each piece of equipment.
    o. Universal mounting rails with 10/32 AND 12/24 tapped holes.
    p. 5/8" and 1/2" EIA standard hole pattern.
    q. 19" Equipment Grounding Bar (as per manufacturer's recommendations to comply with NEC).
    r. Black powder coat finish.
    s. Knockouts in top and bottom for cable access.
    t. Both front and rear access shall be lockable.

C. Outlet Boxes: For flush mounting in walls; depth as required to accommodate cable manufacturer's recommended minimum conductor bend radius.
    1. Size, Unless Otherwise Indicated: 4 inches square by 2-1/8 inches deep. Provide with single gang plaster ring.
    2. Faceplates: Type 302 stainless steel, complying with system design standards and UL 514C.
        a. Shall accept up to six jacks in a single gang configuration.
        b. Jacks to be installed in wet or corrosive environments shall be installed in faceplates designated for that purpose.
    3. Modular Furniture Adapter Plates:
        a. Plates shall be made of high impact UL 94VO rated thermoplastic.
        b. Plates shall be UL listed.
        c. Plates shall snap into the modular furniture opening and be retained by integral latching tabs.

4. Multimedia Housings:
    a. Outlet shall be capable of accommodating up to 12 cables, of any combination of media.
    b. Outlet ports shall be located on the bottom when the outlet is mounted to a vertical surface.
    c. Outlet base shall have mounting holes that will allow it to be mounted to a double-gang wall box.
    d. Outlet shall be UL listed.
    e. Outlets shall be made of high impact UL 94VO rated thermoplastic.
    f. Outlet shall be field configurable for use with multiple cable types and shall have brackets for UTP, BNC, F, and RCA connectors, and small form factor optical fiber connectors.
5. All jacks shall be installed in faceplates.
6. Where different media is shown to terminate in the same location, provide in the same faceplate.

2.09 GROUNDING AND BONDING

A. Telecommunications Grounding Busbar (TGB):
    1. Copper Ground Bar (Minimum 1/4"x4"x23")
    2. Provide with insulators and a support bracket for isolation.
    3. Provide lugs for each bonding conductor and the telecommunications bonding backbone. Terminals shall be solderless compression type, copper long barrel NEMA two bolt.

B. Ground Lugs:
    1. Hardware (bolts), bonding connectors and clamps shall be silicone bronze.
    2. The copper alloy lug shall be sized for connecting to the Telecommunications Main Grounding Busbar (TMGB) with the Bonding Conductor (BC) and the Telecommunications Bonding Backbone (TBB).

C. Rack Mounted Equipment Ground Bar:
    1. Provide a 3/16"x3/4"x18-5/16" bar for attachment to the 19" mounting rails of equipment racks and cabinets.
    2. Provide #6-32 silicon bronze screws, ground lugs and other mounting hardware to serve as a splice plate for attachment to multiple racks (if applicable).

2.10 ADMINISTRATION AND LABELING

A. Horizontal Cables: Self-adhesive, self-laminating, mechanically printed with a clear protective laminating over-wrap or mechanically printed heat shrink tubing.

B. Cable Trays: Minimum three inch square surface area tag, mechanically stamped. Acceptable tagging materials are copper, brass or 1/16 inch plastic.

C. Equipment Bonding Conductor: Self-adhesive, self-laminating, mechanically printed with a clear protective laminating over-wrap or mechanically printed heat shrink tubing.

D. Entrance Conduits: Minimum three inch square surface area tag, mechanically stamped. Acceptable tagging materials are copper, brass or 1/16 inch plastic.

E. Telecommunications Grounding Busbar (TGB): Minimum three inch square surface area tag, mechanically stamped. Acceptable tagging materials are copper, brass or 1/16 inch plastic.

F. Equipment Racks and Cabinets: Nameplates shall be white with black core laminated phenolic nameplates with 3/8 inch lettering etched through the outer covering.

G. UTP Patch Panels: Nameplates shall be white with black core laminated phenolic nameplates with 3/8 inch lettering etched through the outer covering.

H. Pull Boxes: Provide 3/4" black stenciled letters on a painted orange rectangular background.

I. Telecommunications Main Grounding Busbar (TMGB): Minimum three inch square surface area tag, mechanically stamped. Acceptable tagging materials are copper, brass or 1/16 inch plastic.

J. Work Area Outlets: White 3/8" self-adhesive Mylar tape with 1/4" black, mechanically produced lettering.

PART 3 EXECUTION

3.01 INSTALLATION - GENERAL

A. Comply with latest editions and addenda of TIA-568 (SET) (cabling), TIA-569-C (pathways), TIA-607-B (grounding and bonding), NECA/BICSI 568, NFPA 70, and SYSTEM DESIGN as specified in PART 2.

B. Comply with Communication Service Provider requirements.

C. Grounding and Bonding: Perform in accordance with TIA-607-B and NFPA 70.

D. The Licensed Low Voltage Telecommunications Contractor (LVLTC) shall install work in accordance with the BICSI Cabling Installation Manual and the latest GTDM.

3.02 BACKBOARDS

A. Install backboards 6" above finished floor to 8'-6" above finished floor.

B. Attach plywood to the wall with 1/4 inch toggle bolts.

C. Coat frame and backboard with two coats of white enamel paint with fire retardant additive.

D. Provide on all walls of Telecommunications Rooms (TRs) and Main Equipment Room (MER).

E. Install distribution rings for the cross-connect fields above all wall mounted blocks. Provide two rings per vertical row of blocks. Mount rings with two hex head screws per ring.

3.03 INSTALLATION OF PATHWAYS

A. Install pathways with the following minimum clearances:
   1. 48 inches from motors, generators, frequency converters, transformers, x-ray equipment, and uninterruptible power systems.
   2. 12 inches from power conduits and cables and panelboards.
   3. 5 inches from fluorescent and high frequency lighting fixtures.
   4. 6 inches from flues, hot water pipes, and steam pipes.

B. Conduit:
   1. Do not install more than 2 (two) 90 degree bends in a single horizontal cable run.
   2. Runs exceeding 100 feet or 180 degrees total bends shall be broken with suitable sized pull boxes. Pull boxes shall not be located at bends.
   3. Factory made large radius sweeps shall be used for 1" trade size and larger.
   4. Conduit for horizontal cables shall extend to within 1 inch of top edge of cable tray.
   5. Conduit runs to work areas shall serve no more than one Work Area Outlet (WAO).
   6. Leave pull cords in place where cables are not initially installed.
   7. Conceal conduit under floor slabs and within finished walls, ceilings, and floors except where specifically indicated to be exposed.
      a. Conduit may remain exposed to view in mechanical rooms, electrical rooms, and telecommunications rooms.
      b. Treat conduit in crawl spaces and under floor slabs as if exposed to view.
      c. Where exposed to view, install parallel with or at right angles to ceilings, walls, and structural members.
      d. Under floor slabs, locate conduit at 12 inches, minimum, below vapor retarder; seal penetrations of vapor retarder around conduit.

C. Sleeves:
   1. For horizontal cable distribution, provide 4-inch conduit sleeves from the MER and each TR into the adjacent corridor above the room entrance door and to any other adjacent high cable count entry point.
   2. Provide a minimum four 4" sleeves at each location described above.
   3. Attach cored sleeves on each side of the floor/wall using 1.25" support struts and the appropriate conduit clamps to support the sleeves.

4. Cored sleeves shall extend a minimum of 3-inches AFF and 3-inches below the poured concrete structure.
5. Cored holes shall be sealed as a barrier to prevent smoke and water infiltration between the cored hole and the conduit.
6. Place vertical ladder rack on the wall below or above all sleeves from the floor to the ceiling above.

D. Ladder Rack:
1. Provide in all TRs and MER to support cables not on racks.
2. Shall be installed on all walls around the perimeter of TRs and MER.
3. Shall be mounted to the plywood backboard at 7'-0" AFF and attached to the top of all equipment racks in the space.
4. Support at three foot intervals from either the ceiling, walls, floor, or rack/cabinet.
5. Cable radius drops (waterfalls) shall be attached to the ladder rack stringers or rungs to facilitate cable entering and exiting the runway while protecting the physical properties of the cable.
6. Cables shall be secured to the runway using reusable cable ties to arrange cable in logical bundles.

E. Vertical Ladder Rack:
1. Install on plywood backboard and/or wall above/below all sleeves from the floor to ceiling above.
2. Stand-offs shall be installed as necessary to support the required ladder rack.
3. The anchoring system provided shall be suitable for the type of wall and the weight to be supported by the ladder rack.

F. Grounding and Bonding: Perform in accordance with ANSI/J-STD-607 and NFPA 70.

3.04 INSTALLATION OF EQUIPMENT AND CABLING

A. Cabling:
1. Do not bend cable at radius less than manufacturer's recommended bend radius; for unshielded twisted pair (horizontal) use bend radius of not less than 4 times cable diameter.
2. Do not over-cinch or crush cables.
3. Do not exceed manufacturer's recommended cable pull tension.
4. Cables shall not be bound tightly by plastic straps in a manner that distorts cables or jackets. Use VELCRO ties only - no cable ties allowed.
5. Install in accordance with the BICSI Installation Manual.

B. Service Loops (Slack or Excess Length): Provide the following minimum extra length of cable, looped neatly:
1. At Distribution Frames: 180 inches.
2. At Outlets - Copper: 12 inches.
3. At Outlets - Optical Fiber: 39 inches.

C. Copper Backbone Cabling:
1. Cable bend radius shall be maintained to at least 10 times the diameter of the cable.
2. Cable feeder guides shall be used between the cable reel and the conduit.
3. Cable shall be inspected for sheath defects as it is spooled off of the reel. Pulling operation shall be stopped if a defect or any other irregularity is found. Spool cable off from the top of the reel.
4. Use a line tension meter during cable pull to provide accurate measurement of the force exerted on cable. The meter shall have controls to disengage the cable puller if an overload condition occurs.
5. Ground and bond all cable shields per the NEC and TIA/EIA-607.
6. All installed pairs shall be terminated on both ends.

D. Copper Horizontal Cabling:
1. Maintain cable geometry; do not untwist more than 1/2 inch from point of termination.

2. Jacks shall be installed such that cables terminated to the jacks maintain a minimum bend radius of at least 4 times the cable diameter.
3. Cables shall be terminated on jacks such that there is no tension on the conductors in the termination contacts.
4. Provide one cable per jack. No sharing of pairs is allowed.
5. All horizontal UTP cables shall be terminated in patch panels.
6. All horizontal UTP cables concealed in walls or soffits shall be installed in metal conduits.
7. All horizontal UTP cables shall be installed in wire management systems consisting of conduit and/or cable tray continuous from the work area outlet to the TR or MER.
8. Maximum installed horizontal UTP cable length shall not exceed 250 feet.
9. For 4-pair cables in conduit, do not exceed 25 pounds pull tension.
10. Copper Cabling Not in Conduit: Use only type CMP plenum-rated cable as specified.
11. Maintain the following clearances from EMI sources:
    a. Power - 12 inches
    b. Fluorescent Lights - 12 inches
    c. Transformers - 36 inches

E. Fiber Optic Backbone Cabling:
1. Prepare for pulling by cutting outer jacket for 10 inches from end, leaving strength members exposed. Twist strength members together and attach to pulling eye.
2. Support vertical cable at intervals as recommended by manufacturer.
3. No fiber optic cable splices are allowed. All fiber strands shall be terminated using connectors specified herein.
4. All fiber optic cables shall be installed in plenum rated innerduct. All innerducts shall be in metal conduits.
5. A pulling lubricant which is compatible with the low density sheath may be used to minimize friction of the optical fiber cable within the innerduct walls.
6. If mechanical or electrical winching devices are used to pull the cable, the cable tension shall be monitored with a commercial dynamometer or load-cell to ensure that the manufacturer's pulling specifications are not exceeded.
7. Use kellum type pulling grips and swivel designed for fiber optic cable pulling.
8. Pulling wheels shall be used when pulling around sharp corners in conduits.
9. The cable jacket shall not be cut or damaged in any way that would expose fiber strands inside.
10. Vertical runs shall be pulled from the top down. Tension shall be relieved for cables which are to continue to the next floor by looping the cable (two feet diameter) on each floor on the backboards with cable ties.
11. Install buffered tubing (from fan-out kit) over the fiber, secure the buffered tubing to the splice tray, run the fan-out tubing up into the fiber enclosure, and install the connectors.
12. Provide maximum length of excess fan-out cable for termination.
13. Neatly tie all cables in loose bundles as they enter the fiber optic patch panel.
14. Install fiber cables paired 1-2, 3-4, 5-6 top down in fiber optic patch panels.
15. Where fiber optic cables pass vertically through slots and sleeves, secure the cable every 18" to the vertical ladder rack.
16. Fiber optic cables shall be labeled per TIA/EIA-606A standards.
17. Connectors shall be installed according to manufacturer's instructions and properly mounted in plates, frames, housings or other appropriate mounting device.
18. Fibers shall be terminated such that there is no tension on the conductors in the termination contacts.
19. Install blank adapter panels in all positions not used in fiber optic patch panels.

F. Floor-Mounted Racks and Enclosures: Permanently anchor to floor in accordance with manufacturer's recommendations.
1. Racks shall be assembled such that mounting rails are perpendicular to the base.
2. Shall be secured to the ladder rack as per the ladder rack manufacturer's recommendations.

3. Mount with a minimum of 36" clear access behind and in front of each rack or enclosure.

G. Identification:
1. Use wire and cable markers to identify cables at each end.

H. Faceplates and Adapter Plates:
1. Sufficient cable slack shall be stored behind the faceplate in such a way that allows the manufacturer's specified minimum bend radius of the cables to be maintained.
2. Shall be securely mounted to the mounting bracket.
3. Patch Panels: Label each jack as to its type and function, with a unique numerical identifier.

3.05 GROUNDING AND BONDING

A. Perform in accordance with TIA J-STD-607 and NFPA 70.

B. Install a grounding busbar in each telecommunications Equipment Room and Telecommunications Room.

C. Provide a minimum #6 AWG copper, insulated ground wire from the TGB to the main building grounding electrode system.

D. All metallic equipment racks, conduits, cable trays, ladder racks, etc. shall be bonded to the grounding busbar using minimum #6 AWG copper.

E. Bond the shield of shielded cable to the ground bar in communications rooms and spaces, per applicable code and manufacturers recommended practices.

3.06 ADMINISTRATION AND LABELING

A. All labeling shall be per TIA/EIA-606A standards.

B. Hand written labels are not acceptable.

C. Horizontal Cables:
1. Permanently secure the label within 6 inches from both ends of the cable and at all pull boxes.
2. Label shall indicate TR (or MER), patch panel and port to which the horizontal cable is terminated.

D. Cable Trays: Permanently secure the labels on both sides of the cable tray at 10 foot intervals and at both ends of the cable tray.

E. Equipment Bonding Conductor: Permanently secure the tag within 6 inches from both ends of the equipment bonding conductor.

F. Service Entrance Conduits: Permanently secure the tag within 6 inches from both ends of the entrance conduit and at all access points.

G. Telecommunications Grounding Busbar (TGB): Permanently secure the label within 6 inches of the busbar.

H. Equipment Racks and Cabinets: Permanently secure the labels to the top center portion of the front of the rack/cabinet.

I. Patch Panels: Fiber and copper patch panels shall come labeled from the factory with port number designations.

J. Pull Boxes: Permanently mark all pull boxes on the cover and on at least one side.

K. Telecommunications Main Grounding Busbar (TMGB): Permanently secure the label to the wall or backboard within 6 inches of the TMGB.

L. Work Area Outlets (WAO):
1. Copper UTP cables terminated in a WAO shall be labeled to indicate the following: TR or MER designation, patch panel, and port number to which that cable is terminated.
2. Fiber optic cables terminated in a WAO shall be labeled to indicate the following: the origination and destination TRs or MER, and the individual strand ID.
3. Permanently secure the label to the WAO.

3.07 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Comply with inspection and testing requirements of specified installation standards.

C. Visual Inspection:
   1. Inspect cable jackets for certification markings.
   2. Inspect cable terminations for color coded labels of proper type.
   3. Inspect outlet plates and patch panels for complete labels.
   4. Inspect patch cords for complete labels.

D. Testing - Copper Cabling and Associated Equipment:
   1. Test backbone cables after termination but before cross-connection.
   2. Test backbone cables for DC loop resistance, shorts, opens, intermittent faults, and polarity between connectors and between conductors and shield, if cable has overall shield.
   3. Test operation of shorting bars in connection blocks.
   4. Category 6 Backbone: Perform near end cross talk (NEXT) and attenuation tests.
   5. Category 6 Links: Perform tests for wire map, length, DC continuity, attenuation, NEXT, PSNEXT, ELFEXT, PSELFEXT, return loss, and propagation delay.
   6. Utilize a Level IIe tester for Category 6 link compliance. If any part of the installed system results in a "FAIL" indicator on the tester, the problem shall be analyzed and corrected.
   7. Testers shall be correctly set to test the type and manufacturer of the horizontal cable used in the link being tested, including the correct NVP.

E. Testing - Fiber Optic Cabling:
   1. Backbone: Perform optical fiber end-to-end attenuation test using an optical time domain reflectometer (OTDR) and manufacturer's recommended test procedures; perform verification acceptance tests and factory reel tests.
   2. Multimode Backbone: Perform tests in accordance with TIA-526-14.
   3. Single Mode Backbone: Perform tests in accordance with TIA-526-7 Method B.
   4. Links: Perform optical fiber end-to-end attenuation tests and field reel tests.

F. Complete testing at least two weeks before the scheduled final site observation. Provide test results prior to the final.

G. The manufacturer providing the system warranty shall certify the test results.

H. Replace work considered unacceptable to the Design Professional as a prerequisite to system acceptance.

I. As part of the submitted test report, provide a sheet stating the acceptable limits for each test, and the Standard Agency and reference where that limit is stated.

J. Identify each test by the WAO identifier.

K. All testing shall be done in accordance with TIA/EIA TSB67.

END OF SECTION

SECTION 27 5116
SOUND REINFORECEMENT SYSTEM

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Amplifier and control equipment.

B. Input equipment.

C. Reproducer equipment.

D. Sound system cable.

1.02 RELATED REQUIREMENTS

A. Section 26 0526 - Grounding and Bonding for Electrical Systems.

B. Section 26 0537 - Boxes.

1.03 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

B. NFPA 70 National Electrical Code, 2017 Edition.

1.04 SYSTEM DESCRIPTION

A. Public address system for voice, in the large meeting room. Contractor shall provide all components and wire for a complete and fully functional sound reinforcement system for the large meeting room.

B. Provide interface and connections to the video display system to provide sound reinforcement of displayed materials (videos, etc.).

C. Input components:
   1. Compact disc player.
   2. AM/FM tuner.
   3. Microphone.
   4. MP3

1.05 SUBMITTALS

A. Shop Drawings: Indicate electrical characteristics and connection requirements. Indicate layout of equipment mounted in racks and cabinets, component interconnecting wiring, and wiring diagrams of field wiring to speakers and remote input devices.

B. Product Data: Provide data showing electrical characteristics and connection requirements for each component.

C. Test Reports: Indicate satisfactory completion of each test recommended by the manufacturer.

D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

F. Manufacturer's Field Reports: Indicate that installation is complete and system performs according to specified requirements.

G. Project Record Documents: Record actual locations of speakers, control equipment, and outlets for input/output connectors.

H. Operation Data: Include instructions for adjusting, operating, and extending the system.

I. Maintenance Data: Include repair procedures and spare parts documentation.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70 and Federal Communications Commission.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience with service facilities within 100 miles of Project.

C. Supplier Qualifications: Authorized distributor of specified manufacturer with minimum three years documented experience.

D. Installer Qualifications: Authorized installer of specified manufacturer with service facilities within 100 miles of Project.

E. Products: Listed, classified, and labeled as suitable for the purpose intended.

F. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Bogen Communications, Inc: www.bogen.com/#sle.

B. Toa Electronics, Inc: www.toaelectronics.com/#sle.

C. Approved Equal..

2.02 AMPLIFICATION AND CONTROL EQUIPMENT

A. Microphone Inputs: Two low impedance inputs with 600 microvolt sensitivity and noise level at least 55 dB below rated output.

B. Auxiliary Inputs: One high impedance input with 0.4 volt sensitivity and noise level at least 70 dB below rated output.

C. System Frequency Response: 50 to 15,000 Hz, plus or minus 2 dB.

D. System Distortion: Less than 1.5 percent, 100 to 100,000 Hz at rated power.

E. System Output Power: 2000 rms watts.

F. System Output: 4 ohms 25 volts.

G. Volume Controls: One for each input and one master volume.

H. Bass Control: Plus 8 dB to minus 12 dB at 50 Hz.

I. Treble Control: Plus 8 dB to minus 12 dB at 10,000 Hz.

J. Program Selector: Provide program and mode selector switches.

K. System Cabinet: Rack mounted.

2.03 COMPONENTS

A. Compact Disc Player: _____.

B. AM/FM Tuner: Tuner with 525 to 1605 kHz AM and 88 to 108 MHz FM tuning range.

C. Microphone: Two hand-held wireless

D. Speakers: 2x2 layin speaker array - see drawings

E. Equipment Rack: Wall mounted equipment rack.
   1. Equipment Mounting Width: 19 inch.
   2. Finish: Black enamel finish.
   3. Include front and rear hinged and latched doors.
   4. Include six receptacle multioutlet assembly inside rack.

2.04 WIRE AND CABLE

A. Input Cable: 22 AWG copper conductor, 300 volt insulation, rated 60 degrees C, paired conductors twisted together, shielded, and covered with a PVC jacket.

B. Speaker Wire and Cable: 22 AWG copper conductor, 300 volt insulation, rated 60 degrees C, paired conductors twisted together shielded and covered with a PVC jacket.

C. Plenum Cable for Speaker Circuits: 22 AWG copper conductor, 300 volt insulation, rated 200 degrees C, paired conductors twisted together shielded and covered with a nonmetallic jacket; suitable for use for Class 2 circuits in air handling ducts, hollow spaces used as ducts, and plenums.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Splice cable only in accessible junction boxes or at terminal block units.

C. Make cable shields continuous at splices and connect speaker circuit shield to equipment ground only at amplifier.

D. Install input circuits in separate cables and raceways from output circuits.

E. Provide protection for exposed cables where subject to damage.

F. Use armored cable for outside speaker circuits.

G. Support cables above accessible ceilings to keep them from resting on ceiling tiles. Use spring metal clips or plastic cable ties to support cables from structure for ceiling suspension system. Include bridle rings or drive rings.

H. Use suitable cable fittings and connectors.

I. Connect reproducers to amplifier with matching transformers.

J. Ground and bond equipment and circuits in accordance with Section 26 0526.

3.02 FIELD QUALITY CONTROL

A. Provide the services of manufacturer's technical representative to prepare and start system.
   1. Include making of final wiring connections, inspection and adjusting of completed installation, and systems demonstration.
   2. Certify that installation is complete and performs according to specified requirements.

B. Measure and record sound power levels at designated locations.

3.03 ADJUSTING

A. Adjust transformer taps for appropriate sound level.

B. Adjust devices and wall plates to be flush and level.

3.04 CLOSEOUT ACTIVITIES

A. Demonstration: Demonstrate operation of system to Owner's personnel.
   1. Use operation and maintenance data as reference during demonstration.
   2. Briefly describe function, operation, and maintenance of each component.

B. Training: Train Owner's personnel on operation and maintenance of system.
   1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
   2. Provide minimum of two hours of training.
   3. Instructor: Manufacturer's training personnel.
   4. Location: At project site.

3.05 MAINTENANCE

A. Provide service and maintenance of public address and music system for one year from Date of Substantial Completion.

END OF SECTION

SECTION 28 3100
FIRE ALARM SYSTEM

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fire alarm system design and installation, including all components, wiring, and conduit.

B. Transmitters for communication with supervising station.

1.02 RELATED SECTIONS

A. Section 07 8400 - Firestopping: Materials and methods for work to be performed by this installer.

B. Section 21 1300 - Fire-Suppression Sprinkler Systems: Supervisory, alarm, and actuating devices installed in sprinkler system.

1.03 REFERENCES

A. NFPA 70 - National Electrical Code, 2017 Edition; National Fire Protection Association.

B. NFPA 72 - National Fire Alarm Code, 2013 Edition.

C. NFPA 101 - Life Safety Code, 2012 Edition with all Georgia State Modifications.

1.04 SUBMITTALS

A. See Section 26 0510 - General Electrical Requirements, for submittal procedures.

B. Shop Drawings: Submit all information required for plan review and permitting, including but not limited to floor plans, riser diagrams, and description of operation:

1. Notify the State Fire Marshal’s Office, via SFM Form 354A, prior to beginning of installation of fire alarm system and submit three copies of complete information regarding system, in compliance with NFPA 72, National Fire Alarm and Signaling Code, 2013 Edition, Chapters 7 and 10.
2. NFPA 72 "System Record of Completion", filled out to the extent known at the time.
3. System zone boundaries and interfaces to fire safety systems.
4. Location of all components, circuits, and raceways; mark components with identifiers used in control unit programming.
5. Circuit layouts; number, size, and type of raceways and conductors; conduit fill calculations; spare capacity calculations; notification appliance circuit voltage drop calculations.
6. List of all devices on each signaling line circuit, with spare capacity indicated.
7. Manufacturer's detailed data sheet for each component, including wiring diagrams, installation instructions, and circuit length limitations.
8. Description of power supplies; if secondary power is by battery include calculations demonstrating adequate battery power.
9. Certification by either the manufacturer of the control unit or by the manufacturer of each other component that the components are compatible with the control unit.
10. Certification by the manufacturer of the control unit that the system design complies with the contract documents.
11. Certification by Contractor that the system design complies with the contract documents.

C. Evidence of installer qualifications.

D. Evidence of instructor qualifications; training lesson plan outline.

E. Inspection and Test Reports:

1. Submit inspection and test plan prior to closeout demonstration.
2. Submit documentation of satisfactory inspections and tests.
3. Submit NFPA 72 "System Record of Inspection and Testing," filled out.

F. Operating and Maintenance Data: See Section 01 7800 for additional requirements; revise and resubmit until acceptable; have one set available during closeout demonstration:

1. Complete set of specified design documents.
2. Additional printed set of project record documents and closeout documents, bound or filed in same manuals.
3. Contact information for firm that will be providing contract maintenance and trouble call-back service.
4. List of recommended spare parts, tools, and instruments for testing.
5. Replacement parts list with current prices, and source of supply.
6. Detailed troubleshooting guide and large scale input/output matrix.
7. Preventive maintenance, inspection, and testing schedule complying with NFPA 72; provide printed copy and computer format acceptable to Owner.
8. Detailed but easy to read explanation of procedures to be taken by non-technical administrative personnel in the event of system trouble, when routine testing is being conducted, for fire drills, and when entering into contracts for remodeling.

G. Project Record Documents: See Section 01 7800 for additional requirements; have one set available during closeout demonstration:
1. Complete set of floor plans showing actual installed locations of components, conduit, and zones.
2. "As installed" wiring and schematic diagrams, with final terminal identifications.
3. "As programmed" operating sequences, including control events by device, updated input/output chart, and voice messages by event.

H. Closeout Documents:
1. Certification by manufacturer that the system has been installed in compliance with his installation requirements, is complete, and is in satisfactory operating condition.
2. NFPA 72 "System Record of Completion", filled out completely and signed by installer and authorized representative.
3. Report on training results.

1.05 QUALITY ASSURANCE

A. Copies of Shop Drawings: Maintain at the project site for the duration of the project, bound together, an original copy of NFPA 72, the relevant portions of applicable codes, and instructions and guidelines; deliver to Owner upon completion.

B. Installer Qualifications: Firm with minimum 3 years documented experience installing fire alarm systems of the specified type and providing contract maintenance service as a regular part of their business.
1. Authorized representative of control unit manufacturer; submit manufacturer's certification that installer is authorized; include name and title of manufacturer's representative making certification.
2. Installer Personnel: At least 2 years of experience installing fire alarm systems.
3. Supervisor: NICET level IV (4) certified fire alarm technician; furnish name and address.
4. Contract maintenance office located within 50 miles of project site.
5. Certified in Georgia as fire alarm installer.

C. Maintenance Contractor Qualifications: Same entity as installer or different entity with specified qualifications.

D. Instructor Qualifications: Experienced in technical instruction, understanding fire alarm theory, and able to provide the required training; trained by fire alarm control unit manufacturer.

E. All components of the Fire Alarm System shall be cross-listed by Underwriter's Laboratories, Inc., for installation in a common system.

F. All control equipment shall be listed under UL category UOJZ as a single control unit.

1.06 EXTRA MATERIALS AND TOOLS

A. Provide spare parts of same manufacturer and model as those installed; deliver in original packaging, labeled in same manner as in operating and maintenance data and place in spare parts cabinet.

B. In addition to the items in quantities indicated in PART 2, provide the following:
   1. All tools, software, and documentation necessary to modify the fire alarm system using Owner's personnel; minimum modification capability to include addition and deletion of devices, circuits, and zones, and changes to system description, operation, and evacuation and instructional messages.
   2. CD-ROM copies, 2, of all software not resident in read-only-memory.
   3. Provide documentation cabinet adjacent to FACP as required per NFPA72 Paragraph 7.7.2.1.

1.07 WARRANTY

A. Provide control panel manufacturer's warranty that system components other than wire and conduit are free from defects and will remain so for 1 year after date of Substantial Completion.

B. Provide installer's warranty that the installation is free from defects and will remain so for 1 year after date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fire Alarm Control Units:
   1. Notifier
   2. G.E.
   3. Firelite
   4. Silent Knight
   5. or approved equal

B. Initiating Devices, and Notification Appliances:
   1. Same manufacturer as control units.

2.02 FIRE ALARM SYSTEM

A. Fire Alarm System: Provide a new automatic fire detection and alarm system:
   1. Provide all components necessary, regardless of whether shown in the contract documents or not.
   2. Protected Premises: Entire building shown on drawings.
   3. Comply with the following; where requirements conflict, order of precedence of requirements is as listed:
      a. The Americans With Disabilities Act (ADA).
      b. The requirements of the State Fire Marshall.
      c. Applicable local codes.
      d. The contract documents (drawings and specifications).
      e. NFPA 101.
      f. NFPA 72; where the word "should" is used consider that provision mandatory; where conflicts between requirements require deviation from NFPA 72, identify deviations clearly on design documents.
   4. Voice Notification: Provide emergency voice/alarm communications with multichannel capability; digital.
   5. Program notification zones and voice messages as directed by Owner.
   6. Hearing Impaired Occupants: Provide visible notification devices in all public areas and in dwelling units.
   7. Master Control Unit (Panel): New, located at as indicated on the drawings.

B. Supervising Stations and Fire Department Connections:
   1. Public Fire Department Notification: By on-premises supervising station.
   2. Remote Supervising Station: UL-listed central station under contract to facility.
   3. Means of Transmission to Remote Supervising Station: Combination IP/GSM Cellular Communicator..

C. Circuits: Provide class and style wiring as required for this type of construction and facility.

D. Spare Capacity:

1. Initiating Device Circuits: Minimum 25 percent spare capacity.
2. Notification Appliance Circuits: Minimum 25 percent spare capacity.
3. Master Control Unit: Capable of handling all circuits utilized to capacity without requiring additional components other than plug-in control modules.

E. Power Sources:
1. Primary: Dedicated branch circuits of the facility power distribution system.
2. Secondary: Storage batteries.
3. Capacity: Sufficient to operate entire system for period specified by NFPA 72.
4. Each Computer System: Provide uninterruptible power supply (UPS).

F. Operation:
1. The system alarm operation subsequent to the activation of any manual station, automatic detection device, or sprinkler flow switch shall be as follows:
   a. All audible alarm indicating devices shall sound an alarm signal until silenced by the alarm silence switch at the control panel.
   b. All visible alarm indicating devices shall flash continuously until the Alarm Silence Switch is operated.
   c. Subsequent zone alarms shall reactivate the alarm indicating devices.
   d. A supervised signal to notify the local fire department shall be activated.
   e. Supervised relays interlocked with mechanical controls shall initiate the air handling/ventilation sequence in accordance with NFPA 90 and as specified elsewhere in these specifications and as shown on the plans. Provide relays adjacent starting/control devices in separate enclosure painted red.
   f. Where smoke control dampers are installed, when the smoke detector associated with it activates, smoke dampers shall close as described in the mechanical specifications.
2. The alarm shall be displayed on a multi-character LCD display. The characters shall identify the alarm zone and the device type. The system alarm LED shall flash on the control panel until the alarm has been acknowledged. Once acknowledged, the LED shall latch on. A subsequent alarm received from another zone shall flash the system alarm LED on the control panel. The LCD display shall show the new alarm information.
3. An alarm tone shall occur within the control panel until the event has been acknowledged.
4. The activation of any space type smoke detector shall initiate an Alarm Verification operation whereby the panel will reset the activated detector and wait for a second alarm activation. If, within one (1) minute after resetting, a second alarm is reported from the same or any other smoke detector, the system shall process the alarm. If no second alarm occurs within one minute the system shall resume normal operation. The Alarm Verification shall operate only on smoke detector alarms. Other activated initiating devices shall be processed immediately. Smoke detectors with analog sensitivity, adjustable from the control panel may be used in lieu of alarm verification. The activation of any duct type smoke detector shall send the entire system into a supervisory alarm and shall activate a visual and audible supervisory signal at a constantly attended location.
5. The system shall have a function that will allow the operator to display all alarms, troubles, and supervisory service conditions including the time of each occurrence.
6. Provisions for a future printer to record all events with corresponding times shall be provided.

G. Supervision:
1. The incoming power to the system shall be supervised so that any power failure shall be audibly and visually indicated at the control panel. A "power on" LED shall be displayed continuously while incoming power is present.
2. The system batteries shall be supervised so that a low battery condition or disconnection of the battery shall be audibly and visually indicated on the control panel.
3. All devices, detectors, and all wiring within the system shall be supervised.

H. Power Requirements:
1. The control panel shall receive 120 VAC power.

2. The system shall be provided with sufficient battery capacity to operate the entire system upon loss of normal 120 VAC power in a normal supervisory mode for a period of twenty-four (24) hours with five (5) minutes of alarm operation at the end of this period. The system shall automatically transfer to the standby batteries upon power failure. All battery charging and recharging operations shall be automatic.

I. Peripheral Network:
   1. Communication and Addressable Devices: The system must provide communication with initiating devices individually. All of these devices will be individually annunciated at the control panel. Annunciation shall include the following conditions for each point:
      a. Alarm
      b. Trouble
      c. Open
      d. Device missing / failed
   2. All addressable devices shall have the capability of being disabled or enabled individually.
   3. The system shall have the capability to multidrop up to 400 addressable devices. Systems that require factory reprogramming to add or delete devices are unacceptable.
   4. Format: The communication format must be a digital poll/response protocol to allow t-tapping of the circuit wiring. Communication reliability shall be obtained by using parity data bit error checking routines for address codes and check sum routines for the data transmission portion of the protocol.
   5. Identification of Addressable Devices: Each addressable device must be uniquely identified by an address code. Device identification schemes that do not use unique set addresses but rely on electrical position along the communication channel are unacceptable.
   6. Wiring Type, Distances, Survivability and Configurations: Wiring types will be approved by the equipment manufacturer. Existing wiring will be utilized in retrofit applications. The system shall allow a line distance of up to 2,500 feet to the furthest addressable device on a Class B circuit. To minimize wire routing and to facilitate future additions, t-tapping of the communications channel will be utilized.

2.03 FIRE SAFETY SYSTEMS INTERFACES

A. Supervision: Provide supervisory signals in accordance with NFPA 72 for the following:
   1. Sprinkler water control valves.
   2. Fire pump(s): Trouble signals shall be generated for the following conditions (See NFPA 20, Paragraph 7-4.7, 1999 edition):
      a. Controller has operated into a motor running condition.
      b. Loss of line power on line side of motor starter in any phase.
      c. Phase reversal on line side of motor starter.
      d. Provide 3 (or number required) addressable detector bases and connect to fire pump controller contacts as required.
   3. Elevator shut-down control circuits.

B. Alarm: Provide alarm initiation in accordance with NFPA 72 for the following:
   1. Sprinkler water flow. See below for interface details.
   2. Elevator lobby, elevator hoistway, and elevator machine room smoke detectors.
   3. Duct smoke detectors.
   4. Area smoke detectors.
   5. Pullstations.

C. Elevators:
   1. Elevator lobby, hoistway, and machine room smoke detectors: Elevator recall for fire fighters' service.
   2. Sprinkler pressure or waterflow: Shut down elevator power prior to hoistway sprinkler activation.

D. HVAC:
   1. Duct Smoke Detectors: Close dampers indicated; shut down air handlers indicated.

2. Provide smoke detectors where smoke control dampers are shown on the mechanical plans. Provide duct detectors where the dampers are located in ductwork, provide area detectors in the plenum where dampers are located in return air openings. The SCDs associated with these detectors shall close as described in the mechanical specifications. Duct type smoke detectors used in this application shall be of the type that do NOT require a minimum air flow to operate.

E. Sprinkler System Interface:
1. Water flow switches, valve position indicator switches for sprinkler service valves, and zone control valves shall be provided under Division 21 of specifications.
2. Two separate and distinct signals shall be initiated: one indicating movement of the valve from its normal position and the other indicating restoration of the valve to its normal position.
3. The OFF-NORMAL signal shall be initiated during the first two revolutions of the hand wheel or during one-fifth of the travel distance of the valve control apparatus from its normal position.
4. The OFF-NORMAL signal shall not be restored at any valve position except normal.
5. The main sprinkler control valve(s) and each area/zone valve shall be on a separate fire alarm address.
6. Each flow switch shall be on a separate address. Provide addressable detector bases as previously described.

F. Post Indicator Valve (PIV) and Backflow Preventer (BFP):
1. Connect the PIV and BFP switches to the fire alarm system.
2. Provide waterproof flexible conduit from the switch body, through a WP condulet, to rigid conduit. Route the rigid conduit underground and up into the building, into an accessible ceiling plenum. Conduit size underground shall be minimum 3/4" RGC, coated as specified for underground conduits. Provide conduit inside building as required in other sections of this specification.
3. Provide all required interconnections to building main Fire Alarm Control Panel. Provide addressable interface devices as required for interconnection. Label each addressable device POST INDICATOR VALVE or BACKFLOW PREVENTER as appropriate.
4. Smoke Detectors for Smoke Dampers:
   a. Provide duct mounted smoke detectors within 5' (up or down stream) of the smoke dampers shown on the mechanical plans. Interlock this detector with the smoke damper such that activation of the smoke detector closes the damper, shuts down the serving air handler AND sounds the general alarm. Provide relays as required to make this sequence occur.

2.04 COMPONENTS

A. General:
1. Provide flush mounted units where installed in finish areas; in unfinished areas, surface mounted unit are acceptable.
2. Provide legible, permanent labels for each control device, using identification used in operation and maintenance data.

B. Fire Alarm Control Units, Initiating Devices, and Notification Appliances: Analog, addressable type; listed by Underwriters Laboratories as suitable for the purpose intended.

C. Master Control Unit:
1. Control unit construction shall be modular with solid state, microprocessor based electronics. It shall display the controls and displays essential to operation during a fire alarm condition.
2. A local audible device shall sound during Alarm, Trouble, or Supervisory conditions. This audible device shall sound differently during each condition to distinguish one condition from another without having to view the panel.
3. The following controls shall be visible at the control panel:
   a. Multi-character liquid crystal display.

b. System alarm LED.
c. Supervisory service LED.
d. Trouble LED.
e. "Power on" LED.
f. Alarm Acknowledge key/switch.
g. Supervisory Acknowledge key/switch.
h. Trouble Acknowledge key/switch.
i. Alarm Silence key/switch.
j. System reset key/switch.

4. The following controls and LED's shall be available at the control panel:
   a. Manual evacuation (drill).
   b. Elevator bypass.
   c. Door holder release bypass.
5. Primary Keys, LED's and LCD Display:
   a. The Control Panel shall have a multi-character liquid crystal display.
   b. The Control Panel shall have the capability of handling at least 400 alarm initiation devices.
6. Under normal condition the panel shall display a System is Normal message and the current time and date.
7. Should an abnormal condition be detected the appropriate LED (Alarm, Supervisory or Trouble) shall flash. The panel audible signal shall sound for alarm conditions and for trouble and supervisory conditions.
8. The LCD shall display the following information relative to the abnormal condition of a point in the system.
   a. Specific location label.
   b. Type of device (i.e. smoke, pull station, waterflow).
   c. Point status(i.e. alarm, trouble).
9. After all points have been acknowledged, the LEDs shall glow steady and the audible annunciator will be silenced. The total number of alarms, supervisory and trouble conditions shall be displayed along with a prompt to review each list chronologically. The end of the list shall be indicated by an end of list message.
10. When the "Alarm Silence" button is pressed all alarm signals shall cease operation.
11. System Reset:
    a. The SYSTEM RESET button/switch shall be used to return the system to its normal state after an alarm condition has been remedied. The LCD display shall step the user thru the reset process with simple English language messages where multiple steps are required for reset.
    b. Should an alarm condition continue to exist a message will be issued and the system will remain in an abnormal state. System control relays shall not reset. The Alarm LED will be on. The display will indicate the total number of alarms and troubles present in system.
12. History Logging: The system shall be capable of logging and storing a minimum of 50 events in an alarm log and 50 events in a trouble log. These events shall be stored in a battery protected random access memory. Each recorded event shall include the time and date of that event's occurrence.
13. Silent Walktest with History Logging:
    a. The system shall be capable of being tested by one person. While in the testing mode the alarm activation of an initiating device circuit shall be silently logged as an alarm condition in the historical data file. The panel shall automatically reset itself after logging of the alarm.
    b. Should the walktest feature be on for an inappropriate amount of time it shall revert to the normal mode automatically.
14. The fire alarm control unit shall allow for loading and editing operating instructions and sequences.

15. The control unit shall be capable of onsite programming to accommodate system expansion and facilitate changes in operation.
16. All software operations shall be stored in a non-volatile programmable memory. Loss of primary and secondary power shall not erase the instructions stored in memory.
17. The control unit shall have the capability of recalling alarms and trouble conditions in chronological order for the purpose of recreating an event history.

D. Remote Annunciators:.
   1. LCD Annunciators:
      a. Provide LCD annunciator where shown on plans.
      b. Annunciator shall identify device initiating alarm or trouble signal.
      c. Provide alarm and trouble silence switches (and drill switch) in annunciator panel.

E. Initiating Devices:
   1. Manual Pull Stations:
      a. Manual pull stations shall be addressable. Pull stations shall contain electronics that communicate the station's status (alarm, normal) to the transponder over two wires which also provide power to the pull station. The address shall be set on the station. The station shall mechanically latch upon operation and remain so until manually reset by opening with a key common to all system locks.
      b. The addressable manual station shall be capable of field programming of its "address" location.
      c. There shall be no limit to the number of stations, detectors or Zone Adapter modules, which may be activated or "in alarm" simultaneously.
   2. Photoelectric Detector Head:
      a. The photoelectric type detector shall be a plug-in unit which mounts to a twist-lock base, and shall be UL approved.
      b. The detectors shall be of the solid state photoelectric type and shall contain no radioactive material. They will use a pulsed infrared LED light source and be sealed against rear air flow entry.
      c. There shall be no limit to the number of detectors which may be activated or "in alarm" simultaneously.
   3. Addressable Photoelectric Duct Detector:
      a. The detector shall be a non-polarized 24VDC type which is compatible with the Fire Alarm Panel. Provide and install all detectors referenced in Division 23.
      b. See Photoelectric Detector Head for unit operation. Detector located in air handling unit(s) supplying operating suites within a Health Care Facility shall contain auxiliary contacts (SPST, 3 amps, 125 volts minimum. Refer to Instruments and Controls in Division 23 for additional information.
      c. Removal of the detector head shall interrupt the supervisory circuit of the fire alarm detection loop and cause a trouble signal at the control panel. Detector design shall provide compatibility with other fire alarm detection loop devices (heat detectors, pull stations, etc.)
      d. For maintenance purposes, it shall be possible to clean the duct housing sampling tubes by accessing them through the duct housings front cover. Install detectors as required by NFPA 90A.
      e. To minimize false alarms, voltage and RF transient suppression techniques shall be employed as well as an insect screen.
      f. Provide duct detectors anywhere a smoke control damper is installed. See the mechanical plans.
      g. The detector shall be of the type that does NOT require minimum air flow to operate.
   4. Heat Detectors: Thermal detector heads must be UL listed. They will be a combination rate-of-rise and fixed temperature (135 F) type, automatically restorable.
   5. Addressable Detector Bases: All addressable smoke detector heads as specified below will be pluggable into their bases. The base will contain electronics that communicate the detector status (normal, alarm, trouble) to the control panel over two wires. The same two

wires shall also provide power to the base and detector. Upon removal of the head, a trouble signal will be transmitted to the control panel.

F. Notification Appliances:
   1. Audible and/or Visual Units:
      a. Audible horn sound level shall be a minimum 90dBA at 10 feet.
      b. Provide speakers and amplifiers as required for voice evacuation where required. See plans for speaker locations.
      c. Any two visual strobes placed in the same field of view shall flash in synchronization.
      d. Note: Strobe lenses may not be lower than 80" AFF. This does not mean the backbox may be at 80", as this would have the strobe lens below 80". Where indicated as "at 80"", this means the bottom of the LENS, strobe lens may be no higher than 96". Strobes may be located higher than 80" AFF if intensity of strobe is increased to the point that effective intensity is the same as a 75 candela strobe placed at 80" AFF. Wall mounted strobes shall still be located minimum 6 inches below ceiling. Contractor shall submit calculations from fire alarm vendor showing no change in effective intensity for strobes mounted higher than 80" AFF.
      e. Use minimum 75 candela intensity strobes. Strobes shall be xenon type or equivalent.
      f. Flash rate of strobe shall be in the 1 to 2 Hz. range.
      g. Maximum pulse duration of strobe shall be 0.2 seconds, with a maximum duty cycle of 40 percent.

G. Circuit Conductors: Copper or optical fiber; provide 200 feet extra; color code and label.
   1. Individual conductors shall be numbered utilizing permanently attached markers at all terminations and junction boxes.
   2. Detailed wiring diagrams shall be provided showing color coding and numbering of conductors.

H. Surge Protection: In accordance with IEEE C62.41 B3 combination waveform and NFPA 70; except for optical fiber conductors.
   1. Provide surge protection devices at the control panel for all power, signal, and control cables/conductors leaving the control panel.
   2. Equipment Connected to Alternating Current Circuits: Maximum let through voltage of 350 V(ac), line-to-neutral, and 350 V(ac), line-to-line; do not use fuses.
   3. Initiating Device Circuits, Notification Appliance Circuits, and Communications Circuits: Provide surge protection at each point where circuit exits or enters a building; rated to protect applicable equipment; for 24 V(dc) maximum dc clamping voltage of 36 V(dc), line-to-ground, and 72 V(dc), line-to-line.
   4. Signaling Line Circuits: Provide surge protection at each point where circuit exits or enters a building, rated to protect applicable equipment.
   5. In addition to above, provide surge protection for any circuit exceeding 1000 feet in length.

I. Locks and Keys: Deliver keys to Owner.

J. Instruction Charts: Printed instruction chart for operators, showing steps to be taken when a signal is received (normal, alarm, supervisory, and trouble); easily readable from normal operator's station.
   1. Frame: Stainless steel or aluminum with polycarbonate or glass cover.
   2. Provide one for each control unit where operations are to be performed.
   3. Obtain approval of Owner prior to mounting; mount in location acceptable to Owner.
   4. Provide extra copy with operation and maintenance data submittal.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with applicable codes, NFPA 72, NFPA 70, and the contract documents.

B. All wiring shall be installed in strict compliance with all of the provisions of the NEC Article 760.

C. Fire conductor installation:

1. Inside partitions, install in EMT
2. Underground, install in RGS
3. Exposed in mechanical/electrical rooms, install in EMT with red marking tape 5-inches wide every 10 feet. For exposed areas other than mechanical/electrical rooms, contractor shall get prior approval from Design Professional before installation.
4. Above accessible ceilings, install in J-hooks, free run, using plenum rated fire alarm cable.

D. Conceal all wiring, conduit, boxes, and supports where installed in finished areas.

E. Obtain Owner's approval of locations of devices, before installation.

F. Install instruction cards and labels.

G. The manufacturer's authorized representative shall provide onsite supervision of installation and shall provide a Certificate prior to the Final Observation certifying proper operation of the system and all devices.

H. Elevators:
1. Provide relays and contact operations for signaling the elevator controls of initiation of any fire alarm condition and identifying the alarming device.
2. Provide a 1-inch, IMC raceway to the elevator control room.

I. Where NFPA 101 requires acceptance of "equivalent performance", the contractor shall perform all testing and shall make any changes to gain acceptance by the Georgia State Fire Marshal.

3.02 INSPECTION AND TESTING FOR COMPLETION

A. Notify Owner 7 days prior to beginning completion inspections and tests.

B. Notify the State Fire Marshal and comply with their requirements for scheduling inspections and tests and for observation by their personnel.

C. Provide the services of the installer's supervisor or person with equivalent qualifications to supervise inspection and testing, correction, and adjustments.

D. Prepare for testing by ensuring that all work is complete and correct; perform preliminary tests as required.

E. Provide all tools, software, and supplies required to accomplish inspection and testing.

F. Perform inspection and testing in accordance with NFPA 72 and requirements of local authorities; document each inspection and test.

G. Demonstrate the operation of all components of the Fire Alarm System at the final inspection. There shall be a representative from the fire alarm contractor on site for the final inspection. The Architect shall witness all tests.

H. The Contractor shall arrange for a worker to remain at the fire alarm control panel for the duration of the test to report status and reset alarms. The Contractor shall arrange for another worker to accompany the Architect to each initiating device and to perform all tests. All items required to test the detectors, such as canned smoke, shall be provided by the Contractor. The Contractor shall also demonstrate that each audible and/or visual strobe is functioning properly.

I. Correct defective work, adjust for proper operation, and retest until entire system complies with contract documents.

3.03 PERSONNEL INSTRUCTION

A. Provide the following instruction to designated Owner personnel:
1. Hands-On Instruction: On-site, using operational system.
2. Classroom Instruction: Owner furnished classroom, on-site or at other local facility.
3. Factory Instruction: At control unit manufacturer's training facility.

B. Administrative: One-hour session(s) covering issues necessary for non-technical administrative staff; classroom:
1. Initial Training: 1 session pre-closeout.

C. Basic Operation: One-hour sessions for attendant personnel, security officers, and engineering staff; combination of classroom and hands-on:
   1. Initial Training: 1 session pre-closeout.

D. Detailed Operation: Two-hour sessions for engineering staff; assume NICET level I qualifications or equivalent; combination of classroom and hands-on:
   1. Initial Training: 1 session pre-closeout.
   2. Refresher Training: 1 session post-occupancy.

E. Maintenance Technicians: Detailed training for electrical technicians, on programming, maintaining, repairing, and modifying; factory training:
   1. Initial Training: One 3-day session, pre-closeout.
   2. Refresher Training: One 1-day session post-occupancy.

F. Furnish the services of instructors and teaching aids; have copies of operation and maintenance data available during instruction.

3.04 CLOSEOUT

A. Closeout Demonstration: Demonstrate proper operation of all functions to Owner.
   1. Be prepared to conduct any of the required tests.
   2. Have at least one copy of operation and maintenance data, preliminary copy of project record drawings, input/output matrix, and operator instruction chart(s) available during demonstration.
   3. Have authorized technical representative of control unit manufacturer present during demonstration.
   4. Demonstration may be combined with inspection and testing required by the State Fire Marshal; notify authority having jurisdiction in time to schedule demonstration.
   5. Repeat demonstration until successful.

B. Substantial Completion of the project cannot be achieved until inspection and testing is successful and:
   1. Approved operating and maintenance data has been delivered.
   2. Spare parts, extra materials, and tools have been delivered.
   3. All aspects of operation have been demonstrated to Owner.
   4. Final acceptance of the fire alarm system has been given by the State Fire Marshal.
   5. Specified pre-closeout instruction is complete.

3.05 MAINTENANCE

A. Coordinate with Owner for preferred maintenance agreement.

END OF SECTION

PART 1 GENERAL

1.01 SUMMARY

A. Section includes:
   1. Soil treatment.

1.02 SUBMITTALS

A. Product Data:
   1. For each type of product. Include the EPA-Registered Label for termiticide products.

B. Product certificates.

C. Soil Treatment Application Report: Include the following:

   1. Date and time of application.
   2. Moisture content of soil before application.
   3. Termiticide brand name and manufacturer.
   4. Quantity of undiluted termiticide used.
   5. Dilutions, methods, volumes used, and rates of application.
   6. Areas of application.
   7. Water source for application.

1.03 QUALITY ASSURANCE

A. Installer Qualifications: A specialist who is licensed according to regulations of authorities having jurisdiction to apply termite control treatment and products in jurisdiction where Project is located and who employs workers trained and approved by manufacturer to install manufacturer's products.

1.04 WARRANTY

A. Soil Treatment Special Warranty: Manufacturer's standard form, signed by Applicator and Contractor, certifying that termite control work consisting of applied soil termiticide treatment will prevent infestation of subterranean termites, including Formosan termites (Coptotermes formosanus). If subterranean termite activity or damage is discovered during warranty period, re-treat soil and repair or replace damage caused by termite infestation.

   1. Warranty Period: Five years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 SOIL TREATMENT

A. Termiticide: EPA-Registered termiticide acceptable to authorities having jurisdiction, in an aqueous solution formulated to prevent termite infestation.

   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.
      b. Bayer Environmental Science.
      c. Ensystex, Inc.
      d. Syngenta.

2. Service Life of Treatment: Soil treatment termiticide that is effective for not less than five years against infestation of subterranean termites.

PART 3 EXECUTION

3.01 PREPARATION

A. Remove extraneous sources of wood cellulose and other edible materials, such as wood debris, tree stumps and roots, stakes, formwork, and construction waste wood from soil within and around foundations.

B. Soil Treatment Preparation: Remove foreign matter and impermeable soil materials that could decrease treatment effectiveness on areas to be treated.

3.02 APPLYING SOIL TREATMENT

A. Application: Mix soil treatment termiticide solution to a uniform consistency. Distribute treatment uniformly. Apply treatment at the product's EPA-Registered Label volume and rate for maximum specified concentration of termiticide to the following so that a continuous horizontal and vertical termiticidal barrier or treated zone is established around and under building construction.

1. Slabs-on-Grade and Basement Slabs: Under ground-supported slab construction, including footings, building slabs, and attached slabs as an overall treatment. Treat soil materials before concrete footings and slabs are placed.

2. Foundations: Soil adjacent to and along the entire inside perimeter of foundation walls; along both sides of interior partition walls; around plumbing pipes and electric conduit penetrating the slab; around interior column footers, piers, and chimney bases; and along the entire outside perimeter, from grade to bottom of footing.

3. Masonry: Treat voids.
4. Penetrations: At expansion joints, control joints, and areas where slabs and below-grade walls will be penetrated.

B. Post warning signs in areas of application.

C. Reapply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.

END OF SECTION