SECTION 00 0101

PROJECT TITLE PAGE

PROJECT NAME:

NCR Hoover Place

Dayton

OWNER:

National Church Residences

2335 North Bank Drive Columbus, OH 43220

ARCHITECT:

Berardi + Partners, Inc., Architects, Engineers

1398 Goodale Blvd., Columbus OH 43212

GENERAL CONTRACTOR:

Brackett Builders

6640 Riverside Dr. Suite 500 Dublin, OH 43017

STRUCTURAL ENGINEER:

Jezerinac Geers and Associates

5640 Frantz Road

Date of Document _____

Revisions:

berardi +

architecture + interior design + engineering

SECTION 00 0102

PROJECT INFORMATION

PART 1 GENERAL

1.01 PROJECT IDENTIFICATION

A. Project Name: NCR Hoover Place , located at Dayton.

B. Project Number: 17192.

C. The Owner, hereinafter referred to as Owner: National Church Residences .

1.02 PROJECT DESCRIPTION

A. Summary Project Description:

B. Contract Scope: Construction, demolition, renovation, hazardous material removal, and facility operations during occupancy.

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

1.03 TAXES

A. The project is subject to all applicable local, state and federal sales taxes.

1.04 OWNER OCCUPANCY

A. Owner intends to continue to occupy adjacent portions of the existing building during the entire construction period.

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

C. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.

D. Schedule the Work to accommodate Owner occupancy.

1.05 CONTRACTOR USE OF SITE AND PREMISES

A. Arrange use of site and premises to allow:
   1. Owner occupancy.
   2. Use of site and premises by the occupants.

B. Provide access to and from site as required by law and by Owner:
   1. Emergency Building Exits During Construction: Keep all exits required by code open during construction period; provide temporary exit signs if exit routes are temporarily altered.
   2. Do not obstruct roadways, sidewalks, or other public ways without permit.

C. Time Restrictions:
   1. Limit conduct of especially noisy exterior work to the hours of 8:00 am. - 5:00 pm...
   2. Limit conduct of especially noisy interior work to the hours of 8:00 am. - 5:00 pm...

D. Utility Outages and Shutdown:
   1. Do not disrupt or shut down life safety systems, including but not limited to fire sprinklers and fire alarm system, without 7 days notice to Owner and authorities having jurisdiction.
   2. Limit shutdown of utility services to 3 hours at a time, arranged at least 48 hours in advance with Owner.
   3. Prevent accidental disruption of utility services to other facilities.

1.06 PROCUREMENT TIMETABLE

A. The Owner reserves the right to change the schedule or terminate the entire procurement process at any time.

1.07 PERFORMANCE REQUIRED DURING BIDDING.

A. By submitting a bid for any Section of the work for this project, each sub-contractor must have actually read all of Divisions 00 & 01 prior to reading the technical specifications covering their specific work and reviewing the drawings.

B. Notify in a timely manner to the Architect/Engineer any discrepancies or inconsistencies in the construction drawings and specifications which will impair or prevent achieving the final design requirements of the Project.

C. Submit any product of equal to or greater performance for prior approval. Review 'Submittal Requirements' identified by this project manual.

1.08 PERFORMANCE REQUIRED DURING CONSTRUCTION.

A. Reread all of Division 00 & 01 and review the drawings prior to submittal of shop drawings and initiating any related construction.

B. Submit shop drawings, product data and other information required to accurately portray the performance of the product in accordance with the Contract Documents.

C. Manufacturer's Installation Requirements (Manuals) are referenced as part of project requirements in order to ensure the accurate installation and safe/efficient operation of their products.

D. Notify Prime Contractor if any work prior to the installation of your work is not at a quality standard to receive your Work.

E. Follow the directions of the Prime Contractor.

F. Complete the Work in a prescribed manner and time frame to achieve the desired results required by the Contract Documents.

1.09 JOB SITE SAFETY.

A. Notify the Prime Contractor of any unsafe conditions.

B. Follow the manufacturer's operations manual for any operation of equipment and required rough-in services for installation of product. Rough-ins services which may not be shown by the drawings will be required to be provided as part of the Contract.

C. Do not drink or consume any matter labeled unsafe or mind altering, while completing the prescribed work for project within your required category of the work.

1.10 REFERENCE STANDARDS.

A. All common standards, laws and protocols which represent quality and are within the boundaries of the common understanding within the industry shall be applied to the project. If you don't know what the limits of your work scope are ask before preparing a bid.

1.11 DOCUMENTATION REQUIRED PRIOR TO CONSTRUCTION START

A. The following must be documented by the Prime Contractor to the Architect that prior to proceeding with the Work they have contracted with sub-contractors and suppliers that they possess the ability to:

B. read, comprehend and speak the English language

C. understand that their contractual obligation to perform the Work is governed by both the Project Manual (Specifications) and Drawings, together with all referenced instructions and those formats common to the Construction Industry;

D. understand the difference between the right way and the wrong way - ask if you don't know the difference;

E. know that it costs more to do it twice than do it right the first time;

F. don't make promises via your bid that you may later determine are impossible to deliver.

1.12 PROCUREMENT DOCUMENTS

A. Availability of Documents: Complete sets of procurement documents may be obtained:
   1. Documents may be downloaded from the Architect's File Transmission Protocol (FTP) site or Cloud. Contact the Architect for specific requirements for access.
   2. From Owner at the Project Manager's address listed above.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 00 0110

TABLE OF CONTENTS

END OF SECTION

SECTION 00 3100

AVAILABLE PROJECT INFORMATION

PART 1 GENERAL

1.01 EXISTING CONDITIONS

A. Site and Utility Survey: Included in the drawings, to provide location and sizes for all utlities of public record, location of and existing improvements, and detailed topographic information.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

3.01 PERMITS

A. The following permits are known to be required and shall be obtained by the Contractor:
   1. Full / Blanket Building Permit including all trade / subcontractor permits..

END OF SECTION

SECTION 00 5200
AGREEMENT FORM

PART 1 GENERAL

1.01 FORM OF AGREEMENT

A. Copy of the Contract Form is on file in the Architect's office and available upon request through the Architect, if not otherwise bound immediately following this page of the Project Manual.

1.02 RELATED REQUIREMENTS

A. Section 00 7200 - General Conditions.

B. Section 00 7300 - Supplementary Conditions.

C. Section 01 4216 - Definitions.

D. Documents used for project processing shall be American Institute of Architects Documents, latest editions, and referenced by the following document numbers.

E. When alternate Owner/Contractor Agreement forms are adopted for the project by the Owner, othr than Standard American Institute of Architect Document forms, the Owner shall include AIA Document A201-2007 General Conditions to the Contract for Construction, and other applicable Supplementary Conditions.

1.03 FORMS

A. Use the following forms for the specified purpose unless otherwise indicated elseehwere in the Contract Documents.

B. Clarification and Modification Forms
   1. Supplementary Instruction Form: AIA G710
   2. Construction Change Difrective Form: AIA G714
   3. Contract Chnage Order Form: AIA G701

C. Closeout Forms:
   1. Certificate of Substantial Completion Form: AIA G704

D. Certificates of Payments
   1. Application and Certificate for Payment Form: AIA G702
   2. Continuation Sheet for AIA G702: AIA G703

1.04 REFERENCE STANDARDS

A. AIA G704 - Certificate of Substantial Completion; 2000

B. AIA G710 - Architect's Supplemental Instructions; 1992

C. AIA G704 - Construction Change Directive; 2007

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF AGREEMENT FORM

SECTION 00 7100
CONTRACTING DEFINITIONS

PART 1 GENERAL

1.01 APPLICABILITY:

A. These definitions are integral to the Agreemenet, for the portions of the work which are managed throughout the process of construction, or inthe casr of 'design assit' by the Contractor Contractor in conjunction withthe Owner, the Architect and Project Engineers.

1.02 DEFINITIONS - DESIGN-BUILD DOCUMENTS

A. Contract Documents: As defined in the Conditions of the Contract and as follows:
   1. At the time of execution of the Agreement, the Contract Documents consist of the following:
      a. The Agreement and Conditions of the Contract, and other documents listed on the Table of Contents under the heading Contracting Requirements.
      b. The Proposal and Proposal Exhibits, except for provisions that contradict the requirements of the Conceptual Documents and that are not specifically accepted by the Owner by means of written Modification prior to execution of the Agreement.
   2. From time to time after execution of the Agreement, upon approval by the Owner, the following types of documents will be incorporated into the Contract Documents:
      a. Drawings and other documents documenting the design.
      b. Construction drawings and specifications detailing the execution of the design. All drawings, plans, specifications, other instructions including manufacturer's requirements for installation and any other documents which provides direction for completing the work schedules for the completion of the project.

B. Project Program: The Owner's requirements for size, arrangement, organization, and location of functional spaces, description of space functions, identification of fittings, equipment, and furnishings, description of the physical and environmental requirements for each space, together with a description of the image, goals, or "mission" of the project.

C. Proposal: The Proposal Form and Exhibits, which comprise the information prepared by the prospective Design-Builder to show their method of complying with the Conceptual Documents.

1.03 DEFINITIONS - TIME PERIODS AND MILESTONE DATES

A. Proposal Period: The time period during which prospective Proposers prepare their Proposals.
   1. Substantiation specified to occur during the Proposal period are intended to accompany the Proposal.

B. Preliminary Design: The time period during which the design criteria are finalized and preliminary drawings and written descriptions are prepared to illustrate the proposed design of the work or a portion of the work to the Owner, as described in the Conditions of the Contract.

C. Design Development: The time period during which the form, arrangement, size, and materials of the work or a portion of the work are determined as described in the Conditions of the Contract..

D. Construction Documents: The time period during which process working drawings, specifications, and other documents describing the work or a portion of the work are prepared in sufficient detail to allow accurate and complete construction.

E. Construction: The time period from the beginning of work on the project site until final payment as defiend in the Conditions of the Contract..

F. Substantial Completion: The date as defined in the Conditions of the Contract. Date of Substantial Completion is the due date for the following:
   1. Design-Builder or Architect's complete punchlist of items to be completed.
   2. Owner's complete punchlist of items to be completed.

3. Compliance with requirements of governing authorities, for submittals, inspections, and permits.
4. Compliance with Owner's requirements for access to areas occupied by the Owner.
5. Final cleaning.
6. Maintenance manuals.
7. Warranties.
8. Spare parts and extra materials.
9. Maintenance supplies and tools.
10. Project record documents.
11. Final site survey.

G. Closeout: The time period during which all details of both construction and commissioning are completed.
1. The Closeout period is the time from Date of Substantial Completion until final payment, both as defined by the Conditions of the Contract.
2. Before and during the Closeout period, the Owner will ascertain whether the completed project complies with the the Contract Documents.
3. Contractor is responsible for operation and maintenance of the project until the end of the Closeout period; except for those areas the owner has moved into. Once the owner has moved into an area the contractor's responsibilities for operation and maintenance of that area will decease.
4. Training of Owner's personnel in operation and maintenance occurs during the Closeout period, unless specifically indicated otherwise for certain items.

H. Occupancy: The time period during which the project is occupied for its intended purpose.
1. The Occupancy period begins at Date of Substantial Completion, as defined by the Conditions of the Contract.
2. Move-in will occur before the end of the Closeout period.
3. Design-Builder is responsible for operation and maintenance of the project until the end of the Closeout period.

I. Correction Period: The time period defined by the Conditions of the Contract.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 00 7200

GENERAL CONDITIONS

FORM OF GENERAL CONDITIONS

1.01 REGARDLESS IF PUBLISHED IN FULL AS PART OF THIS SPECIFICATION OR NOT, THE "GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION," AIA DOCUMENT A201, 2007 EDITION, SHALL BE CONSIDERED PART OF THE CONTRACT DOCUMENTS EXECPT AS MAY BE MODIFIED BT SECTION 00 8000 SUPPLEMENTARY CONDITIONS OR OTHER SPCIFIC CONSDITIONS OF THE CONTRACT DOCUMENTS.

1.02 COPY OF THE GENERAL CONDITIONS IS ON FILE IN THE ARCHITECT'S OFFICE AND AVAILABLE UPON REQUEST THROUGH THE ARCHITECT, IF NOT OTHERWISE BOUND WITHIN THIS PROJECT MANUAL.

RELATED REQUIREMENTS

2.01 SECTION 00 7300 - SUPPLEMENTARY CONDITIONS.

2.02 SECTION 01 4216 - DEFINITIONS.

END OF SECTION

SECTION 00 7300

SUPPLEMENTARY CONDITIONS

PART 1 GENERAL

1.01 SUMMARY

A. These Supplementary Conditions amend and supplement the General Conditions defined in Document 007200 - General Conditions and other provisions of the Contract Documents as indicated below. Provisions that are not so amended or supplemented remain in full force and effect.

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

1.02 MODIFICATIONS TO GENERAL CONDITIONS

A. ARTICLE 1 - GENERAL PROVISIONS
   1. CORRELATION AND INTENT DOCUMENTS
      a. Add the following changes:
      b. 1) 1.2.4: 1) Sections of Division 1 – General Requirements, govern the execution of all sections of the specifications.
      c. 2) 1.2.5: 2) Compute dimensions; do not obtain dimensions by scaling Drawings. In the case of any discrepancy between Drawings and Specifications, consult Architect before proceed with the work.
   2. OWNERSHIP AND USE OF DRAWINGS, SPECIFICATIONS AND OTHER INSTRUMENTS OF SERVICE:
      a. Add the following Clauses 1.6.1.1, 1.6.1.2 to 1.3.1:
         1) 1.5.3 Reproduction of any portion of the Architect's Construction Documents for use as Submittals for Shop Drawings is not acceptable.
         2) 1.5.4 Documents provided by the Owner for reference may be excluded within the contract documents. These reference documents are intended as supplementary information as to the nature of the existing field conditions, and are not contract documents. The Architect did not participate in preparation of the reference documents and does not assume any responsibility for the accuracy or completeness of the reference information provided. Use of these reference documents does not preclude the contractor from visiting the project site for confirm the actual existing conditions.

B. ARTICLE 3 - CONTRACTOR
   1. 3.1 GENERAL
      a. Add the following paragraph:
         1) 3.1.4 Undocumented Workers. Contractor warrants that no individuals who are unlawfully present in the United States (“Undocumented Workers“) will be employed on the Project. Contractor acknowledges that the use of Undocumented Workers on the Project will constitute a breach of this Agreement and could result in the imposition of sanctions on the Owner by applicable governmental authorities. Prior to performance of any Work, the Contractor shall require all laborers and mechanics employed on construction of the Project to submit a completed Form I-9. In accordance with the requirements set forth in Form I-9, the Contractor shall examine the evidence of identity and employment eligibility within three (3) business days of the date employment begins (the “Form I-9 Protocol“). The completion of the Form I-9 Protocol is a condition precedent to the right of any laborer or mechanic to work on the Project. The Contractor shall cooperate with the Owner and any applicable government authority which may monitor the Contractor’s and Subcontractors’ compliance with the Form I-9 Protocol, whether through on-site inspections, document reviews, or spot interviews of laborers and mechanics,

and shall provide such documentation as the Owner may require to verify compliance with the Form I-9 Protocol. The Contractor shall include the Form I-9 Protocol in all subcontracts issued to Subcontractors involved in the Project."

2. SUPERVISION AND CONSTRUCTION PROCEDURES
    a. Add the following to Subparagraph 3.3.1:
        1) 3.3.1.1 The Contractor shall review any specified construction and/or installation procedure, including those recommended by manufacturers and shall advise the Architect:
            (a) If the specified procedure deviates from good construction practice.
            (b) If following the procedure, will affect any warranties, including the Contractor's general warranty.
            (c) Of any objections the Contractor may have to the procedure.
            (d) If the Contractor proposes any alternative procedure, which the Contractor is willing to warrant.
3. LABOR AND MATERIALS
    a. Add the Subparagraphs 3.4.4, 3.4.5 and 3.4.6 to 3.4:
    b. General Contractors Financial Interest:
        1) The Contractor shall disclose the existence and extent of any financial interest, whether direct or indirect, he has in Subcontractors or Material Suppliers which he may propose for this project.
    c. All manufactured articles, materials and equipment shall be supplied, installed, connected, erected, used, cleaned and conditioned as directed by the manufacturer unless herein specified to the contrary.

C. ARTICLE 5 - SUBCONTRACTORS
1. Add the following Clause 5.1.1.1 to 5.1.1:
    a. 5.1.1.1 Add material and equipment suppliers whenever a reference to Subcontractors is intended to also apply to suppliers. Wherever relevant, the term "Subcontractor" shall also include a person or entity who supplies material or equipment for the Project.
2. Add the following Clause 5.1.2.1 to 5.1.2:
    a. 5.1.2.1 Add material and equipment suppliers whenever a reference to Sub-subcontractors is intended to also apply to suppliers. Wherever relevant, the term "Sub-subcontractor" shall also include a person or entity who supplies material or equipment for the Project.
3. AWARD OF SUBCONTRACTS AND OTHER CONTRACTS FOR PORTIONS OF THE WORK
    a. In Subparagraph 5.2.1, delete the words "as soon as practicable" in the first sentence and insert "within 20 days."
    b. In Subparagraph 5.2.1, add the following:
        1) If requested, the Contractor shall furnish evidence satisfactory to the Architect, showing each proposed Subcontractor is competent to execute the Work covered by his Subcontract. Subcontractors listed on the Bid Envelope for the Project shall be used only in the capacity listed.

D. ARTICLE 7 - CHANGES IN THE WORK
1. CHANGE ORDERS
    a. In subparagraph 7.2.2 revised the word "may" to "shall."
2. CONSTRUCTION CHANGE DIRECTIVES
3. a. Revise 7.3.8 as follows: The amount of credit to be allowed by the Contractor to the Owner for a deletion or change that results in a net decrease in the Contract Sum shall be actual net cost and profit as confirmed by the Architect. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on the basis of net increase, if any, with respect to that change.

E. ARTICLE 9 - PAYMENTS AND COMPLETION
   1. SUBSTANTIAL COMPLETION
   2. a. Add the following to Subparagraph 9.8.2:
      a. If the initial inspection requested by the Contractor to establish Substantial Completion determines the Project is not substantially complete, the Contractor shall pay for additional re-inspections by the Architect, at no expense to the Owner.

F. ARTICLE 11 - INSURANCE AND BONDS
   1. 11.1.1.1 Liability Insurance shall include all major divisions of coverage and be on comprehensive basis including:
      a. Premise/Operations
      b. Owner's and Contractor's Protective
      c. Products and completed operations
      d. Contractual: Including Specified Provision for the Contractor's Obligations under Paragraph 3.18.
      e. Owned, Non-owned and Hired Motor Vehicles
      f. Broad Form Coverage for Property Damage
   2. 11.1.2 Add the following:
      a. a. Workmen's Compensation: Statutory
         1) Employer's Liability: $500,000 (Each Accident)
            (a) $500,000 (Disease-Policy Limits)
            (b) $500,000 (Disease-Each Employee)
      b. Commercial General Liability:
         1) General Aggregate: $2,000,000
         2) Products - Completed Operations Aggregate: $1,000,000
         3) Personal and Advertising Injury - $1,000,000
         4) Each Occurrence - $1,000,000
         5) Fire Damage Liability (Any one fire) - $50,000
         6) Medical Expenses (Any one person): $10,000
         7) Owners and Contractors protective coverage
         8) Per location limit of liability applies
      c. Automobile Liability: Coverage will extend to "Any Auto" and non-owned and hired exposures, with a combined single limit of no less than $1,000,000.
      d. Umbrella Liability: Limits of not less than $5,000,000 per occurrence, $5,000,000 in the aggregate.
      e. All independent contractors, subcontractors and sub-subcontractors will carry limits equal to above
      f. Commercial General Liability coverages will remain in effect no less than 5 years after the completion of said project, as it relates to products and completed operations exposures.
      g. The Owner will be an additional insured on these policies, and proper evidence of insurance/endorsements to the policy will be provided prior to the engaging of services.
      h. All coverages will be affected with an insurance carrier licensed to conduct business in the State and obtaining an A.M. Best rating of A IX or greater.
   3. 11.1.4 Furnish one copy of Certificates herein required for each copy of the Agreement, specifically set forth evidence of all coverage required by Subparagraphs 11.1.1 and 11.1.2. The form of Certificate shall be AIA Document G705. Furnish the Owner copies of any endorsements that are subsequently issued amending Coverage or Limits.

G. ARTICLE 13 - MISCELLANEOUS PROVISIONS
   1. Where compliance with two or more industry standards or sets of requirements is specified or where conflicting products are indicated on Drawings and Specifications, and overlapping of those different or conflicting minimums or levels of quality, the most

stringent requirements (which generally recognized to be also the most costly) is intended and will be enforced. Refer apparently-equal-but-different requirements, and uncertainties as to which of two levels of quality is the most stringent, to the Architect/Engineer for a decision before processing.

H. ARTICLE 15 – CLAIMS AND DISPUTES
   1. 1. ADD 15.1.7 RESOLUTION OF CLAIMS AND DISPUTES
      a. Add the following subparagraph:
         1) Any controversy or Claim arising out of or related to the Contract, or the breach thereof, shall be settled by legal litigation in accordance with the laws and statutes having jurisdiction for the project location. However prior to litigation, the parties shall endeavor to settle disputes by mediation under the Construction Industry Mediation Rules of the American Arbitration Association currently in effect. Mediation shall commence, unless otherwise agreed, when 45 days have passed after a claim has been referred to the Architect as provided in Paragraph 4.3 and no decision has been rendered.
   2. ARBITRATION
      a. Delete 5.4 and all paragraphs and subparagraphs in its entirety.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF DOCUMENT

SECTION 01 1000
SUMMARY OF WORK

PART 1

1.01 SCOPE

A. The scope of work includes all labor, tools, equipment, materials and supervision to complete the work as follows:

B. (Insert Project Scope here)

PART 2

2.01 JOB REQUIREMENTS:

A. The requirements set forth in Division I shall apply to all Contractors and/or Subcontractors. Throughout the body of the specifications, the terms “General Contractor”, “Contractor”, “Plumbing Contractor”, “HVAC Contractor”, “Mechanical Contractor”, “Electrical Contractor”, “Subcontractor”, etc., are used and these terms shall indicate general and specific areas of responsibility. No “request for extra” will be entertained from any Contractor which arise out of interpretation of this language. The work will be bid and pursued under one (1) general construction contract. Products not specified but meeting the specification may be incorporated in the work provided they are approved in advance by the Architect. Refer to specification Section 01630 SUBSTITUTIONS AND PRODUCT OPTIONS.

B. Throughout the body of the specifications, from time to time, work required in one section and/or division of work is referred to from another section and/or division of work. Contractors are required to refer to all divisions of these specifications. The Contractor shall notify the Architect of the existence of any discrepancies found between the information contained in these plans and specification and actual field conditions. Notification shall be in writing seven (7) business days prior to the Initiation of Work. Failure to do so indicates acceptance by the Contractor of the information listed.

2.02 SPECIAL REQUIREMENTS

A. The Contractor will submit a work schedule.

B. All work, except as noted otherwise, shall be performed between 7:00 a.m. to 5:00 p.m., Monday through Friday, excluding official state holidays. At each building and at the end of each day, remove all waste material, e.g., boxes, packing, debris, etc., and leave the area broom clean. Nails, sheet metal cut-offs and other sharp material shall be cleaned up regularly during the work. No such material shall remain at the end of the day

C. Workman shall park their vehicles where directed. No parking will be permitted on access roads and mobilization areas. Fire lanes shall be kept clear at all times to maintain access to the existing buildings on the site.

D. All Contractors shall be licensed as required by local and state agencies. Contractors shall verify these requirements with the respective governing agencies.

END OF SECTION

SECTION 01 2000

PRICE AND PAYMENT PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

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

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

C. Change procedures.

1.02 RELATED REQUIREMENTS

A. Section 00 5200 - Agreement Form: Contract Sum, retainages, payment period, monetary values of unit prices.

B. Document 00 7200 - General Conditions and Document 00 7300 - Supplementary Conditions: Additional requirements for progress payments, final payment, changes in the Work.

C. Document 00 7300 - Supplementary Conditions: Percentage allowances for Contractor's overhead and profit.

D. Section 01 2100 - Allowances: Payment procedures relating to allowances.

E. Section 01 2200 - Unit Prices: Monetary values of unit prices; Payment and modification procedures relating to unit prices.

1.03 SCHEDULE OF VALUES

A. Form to be used:
   1. For HUD projects use HUD form 2328.
   2. For conventional projects use AIA Document G703 and the Project Manual table of contents as a guide to establish line items for the Schedule of Values.

B. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit draft to Architect for approval.

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

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

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

F. Revise schedule to list approved Change Orders, with each Application for Payment.

1.04 APPLICATIONS FOR PROGRESS PAYMENTS

A. Payment Period: Monthly unless otherwise stipulated in the contract agreement. .

B. Form to be used:
   1. For HUD projects use HUD form 2328.
   2. For conventional projects use AIA Document G703 and the Project Manual table of contents as a guide to establish line items for the Schedule of Values.

C. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit sample to Architect for approval.

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

E. For each item, provide a column for listing each of the following:
   1. Item Number.
   2. Description of work.
   3. Scheduled Values.
   4. Previous Applications.

5. Work in Place and Stored Materials under this Application.
6. Authorized Change Orders.
7. Total Completed and Stored to Date of Application.
8. Percentage of Completion.
9. Balance to Finish.
10. Retainage.

F. Execute certification by signature of authorized officer.

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

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

I. Submit one electronic and three hard-copies of each Application for Payment.

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

K. When Architect requires substantiating information, submit data justifying dollar amounts in question. Provide one copy of data with cover letter for each copy of the submittal. Show application number and date, and line item by number and description.

1.05 MODIFICATION PROCEDURES

A. For minor changes not involving an adjustment to the Contract Price or Contract Time, Architect will issue instructions directly to Contractor.

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

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

D. Contractor may propose a change by submitting a request for change to Architect, describing the proposed change and its full effect on the work, with a statement describing the reason for the change, and the effect on the Contract Price and Contract Time with full documentation and a statement describing the effect on Work by separate or other contractors. Document any requested substitutions in accordance with Section 01 6300.

E. Computation of Change in Contract Amount: As specified in the Agreement and Conditions of the Contract.
1. For change requested by Architect for work falling under a fixed price contract, the amount will be based on Contractor's approved price quotation.
2. For change requested by Contractor, the amount will be based on the Contractor's request for a Change Order as approved by Architect.
3. For pre-determined unit prices and quantities, the amount will based on the fixed unit prices.
4. For change ordered by Architect without a quotation from Contractor, the amount will be determined by Architect based on the Contractor's substantiation of costs and pricing consistent with line item costs already established by the contract.

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

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

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

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

J. Promptly enter changes in Project Record Documents.

1.06 APPLICATION FOR FINAL PAYMENT

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

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

END OF SECTION

SECTION 01 2100

ALLOWANCES

GENERAL

1.01 THE FOLLOWING CASH ALLOWANCE(S) SHALL BE INCLUDED IN THE BASE BID. OVERHEAD, PROFIT AND OTHER EXPENSES CONTEMPLATED FOR THE STATED ALLOWANCE AMOUNT SHALL BE INCLUDED IN THE BASE BID AND NOT IN THE ALLOWANCE.

1.02 ALLOWANCE AMOUNTS

A. (Insert Project Allowances here)

END OF SECTION

SECTION 01 2300
ALTERNATES

PART 1

1.01 GENERAL

A. State the amount that shall be added to or deducted from the Base Bid for each of the following alternates. Alternates may be accepted for 90 days after receipt of bids.

PART 2

2.01 ALTERNATES

A. [List applicable Alternates here]

PART 3

3.01 VOLUNTARY ALTERNATES:

A. Contractor is encouraged to submit voluntary alternates for procedures, materials or equipment that provide savings for the Owner. Each voluntary alternate is to be accompanied by necessary brochures, shop drawings, engineering, etc., for the Architect's and Owner's use in evaluating such alternates. The Owner may award contracts taking into account any and all voluntary alternates received. Any voluntary alternate submitted may be used to the benefit of the Owner even though the Bidder submitting the alternate may not be awarded the contract.

B. Each voluntary alternate is to be accompanied by necessary brochures, shop drawings, engineering, etc., for the Architect's and Owner's use in evaluating such alternates. The Owner may award contracts taking into account any and all voluntary alternates received. Any voluntary alternate submitted may be used to the benefit of the Owner even though the Bidder submitting the alternate may not be awarded the contract.

END OF SECTION

SECTION 01 2700

UNIT PRICES

PART 1

1.01 THE FOLLOWING UNIT PRICES SHALL BE INCLUDED IN EACH CONTRACTOR'S BID AND SHALL BE USED TO ADD TO OR DEDUCT FROM THE CONTRACTOR'S BASE BID. ALL PRICES SHALL BE FOR COMPLETE COST OF ITEM FULLY INSTALLED. REFER TO SEPARATE SPECIFICATION SECTIONS FOR DETAILED DESCRIPTIONS. UNIT PRICES WILL NOT BE USED FOR ADDITIONAL WORK IF, IN THE OPINION OF THE ARCHITECT, THE VALUES SEEM OUT OF LINE WITH CURRENT COSTS.

A. Unit Price 1
   1. On-site excavation of earth: $_____/cu.yd.

B. Unit Price 2:
   1. Off-site borrow, clean granular backfill material, in place and compacted: $_____/cu.yd.

C. Unit Price 3:
   1. (Insert Unit Prices as applicable)

END OF SECTION

SECTION 01 3000
ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General administrative requirements.

B. Electronic document submittal service.

C. Preconstruction meeting.

D. Site mobilization meeting.

E. Progress meetings.

F. Construction progress schedule.

G. Coordination drawings.

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

I. Number of copies of submittals.

J. Submittal procedures.

1.02 RELATED REQUIREMENTS

A. Section 01 3216 - Construction Progress Schedule: Form, content, and administration of schedules.

B. Section 01 7000 - Execution and Closeout Requirements: Additional coordination requirements.

C. Section 01 7800 - Closeout Submittals: Project record documents; operation and maintenance data; warranties and bonds.

1.03 GENERAL ADMINISTRATIVE REQUIREMENTS

A. Conform to requirements of Section 01 7000 - Execution and Closeout Requirements for coordination of execution of administrative tasks with timing of construction activities.

1.04 PROJECT COORDINATOR

A. Project Coordinator: tbd.

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

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

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

E. Comply with instructions of the Project Coordinator for use of temporary utilities and construction facilities. Responsibility for providing temporary utilities and construction facilities is identified in Section 01 1000 - Summary.

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

G. Make the following types of submittals to Architect through the Project Coordinator:

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 ELECTRONIC DOCUMENT SUBMITTAL SERVICE

A. All documents transmitted for purposes of administration of the contract are to be in electronic (PDF, MS Word, or MS Excel) format, as appropriate to the document, and transmitted via an Internet-based submittal service that receives, logs and stores documents, provides electronic stamping and signatures, and notifies addressees via email.

1. Besides submittals for review, information, and closeout, this procedure applies to Requests for Interpretation (RFIs), progress documentation, contract modification documents (e.g. supplementary instructions, change proposals, change orders), applications for payment, field reports and meeting minutes, Contractor's correction punchlist, and any other document any participant wishes to make part of the project record.
2. Contractor and Architect are required to use this service.
3. It is Contractor's responsibility to submit documents in allowable format.
4. Subcontractors, suppliers, and Architect's consultants will be permitted to use the service at no extra charge.
5. Users of the service need an email address, internet access, and PDF review software that includes ability to mark up and apply electronic stamps (such as Adobe Acrobat, www.adobe.com, or Bluebeam PDF Revu, www.bluebeam.com), unless such software capability is provided by the service provider.
6. Paper document transmittals will not be reviewed; emailed electronic documents will not be reviewed.
7. All other specified submittal and document transmission procedures apply, except that electronic document requirements do not apply to samples or color selection charts.

B. Submittal Service: The selected service is:
   1. tbd.

C. Training: One, one-hour, web-based training session will be arranged for all participants, with representatives of Architect and Contractor participating; further training is the responsibility of the user of the service.

D. Project Closeout: Architect will determine when to terminate the service for the project and is responsible for obtaining archive copies of files for Owner.

3.02 PRECONSTRUCTION MEETING

A. Project Coordinator will schedule a meeting after Notice of Award.

B. Attendance Required:
   1. Owner.
   2. Architect.
   3. Contractor.

C. Agenda:
   1. Submission of list of subcontractors, list of products, schedule of values, and progress schedule.
   2. Designation of personnel representing the parties to Contract, Owner and Architect.
   3. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
   4. Scheduling.

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

3.03 SITE MOBILIZATION MEETING

A. Project Coordinator will schedule meeting at the Project site prior to Contractor occupancy.

B. Attendance Required:
   1. Contractor.
   2. Owner.
   3. Architect.
   4. Contractor's superintendent.
   5. Major subcontractors.

C. Agenda:

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

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

3.04 PROGRESS MEETINGS

A. General Contractor will make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.

B. Attendance Required:
1. Contractor.
2. Owner.
3. Architect.
4. Contractor's superintendent.
5. Major subcontractors.

C. Agenda:
1. Review minutes of previous meetings.
2. Review of work progress.
3. Field observations, problems, and decisions.
4. Identification of problems that impede, or will impede, planned progress.
5. Review of submittals schedule and status of submittals.
6. Review of RFIs log and status of responses.
7. Review of off-site fabrication and delivery schedules.
8. Maintenance of progress schedule.
9. Corrective measures to regain projected schedules.
10. Planned progress during succeeding work period.
11. Coordination of projected progress.
12. Maintenance of quality and work standards.
13. Effect of proposed changes on progress schedule and coordination.
14. Other business relating to work.

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

3.05 CONSTRUCTION PROGRESS SCHEDULE

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

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

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

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

E. Submit updated schedule with each Application for Payment.

3.06 COORDINATION DRAWINGS

A. Provide information required by Project Coordinator for preparation of coordination drawings.

B. Review drawings prior to submission to Architect.

3.07 SUBMITTAL SCHEDULE

A. Submit to Architect for review a schedule for submittals in tabular format.
   1. Submit at the same time as the preliminary schedule specified in Section - 01 3216 - Construction Progress Schedule.
   2. Account for time required for preparation, review, manufacturing, fabrication and delivery when establishing submittal delivery and review deadline dates.

3.08 SUBMITTALS FOR REVIEW

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

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

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

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

3.09 SUBMITTALS FOR INFORMATION

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

B. Submit for Architect's knowledge as contract administrator or for Owner.

3.10 SUBMITTALS FOR PROJECT CLOSEOUT

A. Submit Correction Punch List for Substantial Completion.

B. Submit Final Correction Punch List for Substantial Completion.

C. When the following are specified in individual sections, submit them at project closeout in conformance to requirements of Section 01 7800 - Closeout Submittals:
   1. Project record documents.
   2. Operation and maintenance data.
   3. Warranties.
   4. Bonds.
   5. Other types as indicated.

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

3.11 NUMBER OF COPIES OF SUBMITTALS

A. Electronic Documents: Submit one electronic copy in PDF format; an electronically-marked up file will be returned. Create PDFs at native size and right-side up; illegible files will be rejected.

B. Documents for Review:
   1. Small Size Sheets, Not Larger Than 8-1/2 by 11 inches: Submit the number of copies that Contractor requires, plus two copies that will be retained by Architect.
   2. Larger Sheets, Not Larger Than 36 by 48 inches: Submit one reproducible transparency and one opaque reproduction.

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

3.12 SUBMITTAL PROCEDURES

A. General Requirements:
   1. Use a single transmittal for related items.
   2. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction work, and coordination of information is in accordance with the requirements of the work and Contract Documents.
      a. Submittals from sources other than the Contractor, or without Contractor's stamp will not be acknowledged, reviewed, or returned.
   3. Deliver each submittal on date noted in submittal schedule, unless an earlier date has been agreed to by all affected parties, and is of the benefit to the project.
      a. Upload submittals in electronic form to Electronic Document Submittal Service website.
   4. Schedule submittals to expedite the Project, and coordinate submission of related items.
      a. For each submittal for review, allow 15 days excluding delivery time to and from the Contractor.
      b. For sequential reviews involving Architect's consultants, Owner, or another affected party, allow an additional 7 days.

B. Shop Drawing Procedures:
   1. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting the Contract Documents and coordinating related work.
   2. Generic, non-project-specific information submitted as shop drawings do not meet the requirements for shop drawings.

C. Samples Procedures:
   1. Transmit related items together as single package.
   2. Identify each item to allow review for applicability in relation to shop drawings showing installation locations.

D. Shop Drawing Procedures:
   1. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting the Contract Documents and coordinating related Work.
   2. Generic, non-project specific information submitted as shop drawings do not meet the requirements for shop drawings.

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

F. Transmit each submittal with approved form.

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

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

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

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

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

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

M. Provide space for Contractor and Architect review stamps.

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

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

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

3.13 SUBMITTAL REVIEW

A. Submittals for Review: Architect will review each submittal, and approve, or take other appropriate action.

B. Submittals for Information: Architect will acknowledge receipt and review. See below for actions to be taken.

C. Architect's actions will be reflected by marking each returned submittal using virtual stamp on electronic submittals.

D. Architect's and his consultants' actions on items submitted for review:
   1. Authorizing purchasing, fabrication, delivery, and installation:
      a. "Approved", or language with same legal meaning.
      b. "Approved as Noted, Resubmission not required", or language with same legal meaning.
         1) At Contractor's option, submit corrected item, with review notations acknowledged and incorporated.
      c. "Approved as Noted, Resubmit for Record", or language with same legal meaning.
   2. Not Authorizing fabrication, delivery, and installation:

E. Architect's and his consultants' actions on items submitted for information:
   1. Items for which no action was taken:
      a. "Received" - to notify the Contractor that the submittal has been received for record only.
   2. Items for which action was taken:
      a. "Reviewed" - no further action is required from Contractor.

END OF SECTION

SECTION 01 3100
PROJECT COORDINATION

SCOPE

1.01 RELATED REQUIREMENTS:

A. Conditions of the Contract.
   1. Section 011000 SUMMARY OF WORK.
   2. Section 014010 TESTING LABORATORY SERVICES.
   3. Section 00 7200 GENERAL CONDITIONS
      a. AIA Document A201 (2007) General Conditions to the Contract for Construction
   4. Section 00 800 SUPPLEMENTARY CONDITIONS

B. Utility Shut-Offs and Changeovers:
   1. Notify the Architect and Owner at least 72 hours in advance of utility connections or shutoff. Coordinate these operations with the Owner, through the Architect, and complete the work in the minimum amount of time.
   2. Utility services and building services shut-offs result in extremely critical curtailment of building services and operation. Shut-offs must be accomplished at the Owner's schedule, and overtime, round the clock, holiday or weekend work may be required at no additional cost to the Owner; or at the Contractors' option, by-pass service may be provided.

C. Progress of the Work: Keep Architect informed of the progress of the work.

D. Deliveries: If requested, provide verification of delivery dates required to conform to the then current project construction schedule.

E. Chases: Unless otherwise specified or indicated, all items such as piping, ductwork and conduit shall be concealed in walls or chases. Cutting or chasing required after walls are in place shall be performed by the proper trades or crafts at the expense of the trade or craft requiring the cutting or chasing.

F. Tests: Where the contract documents require any work to be tested, the Architect shall be notified sufficiently in advance so that he may observe such tests.

G. Each Sub-Contractor shall be responsible for coordination of their work with the entire scope of the project defined by the Construction Drawings and Specifications.

END OF SECTION

SECTION 01 3114
COORDINATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Services of a coordinator for facility services construction.

1.02 RELATED REQUIREMENTS

A. Section 01 1000 - Summary: Responsibilities of separate contractors.

B. Section 01 3000 - Administrative Requirements: Additional requirements for coordination.

C. Section 01 6000 - Product Requirements: Spare parts and maintenance materials.

D. Section 01 7000 - Execution and Closeout Requirements: Starting of Systems. Systems Demonstration.

E. Section 01 7800 - Closeout Submittals: Project record documents.

1.03 MECHANICAL AND ELECTRICAL COORDINATOR

A. Employ and pay for services of a person, technically qualified and administratively experienced in field coordination of the type of work required to be coordinated, for the duration of the Work.

1.04 SUBMITTALS

A. Submit name, address, and telephone number of coordinator and name of principal officer for review.

B. Submit coordination drawings and schedules prior to submitting shop drawings, product data, and samples.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 COORDINATION REQUIRED

A. Coordinate the work listed below:
   1. Fire Suppression: Division 21.
   2. Plumbing: Division 22.
   3. Heating, Ventilating, and Air Conditioning: Division 23.
   4. Integrated Automation: Division 25.
   5. Electrical: Division 26.
   6. Communications: Division 27.
   7. Electronic Safety and Security: Division 28.
   8. Site Utilities: Division 33.

B. Coordinate progress schedules, including dates for submittals and for delivery of products.

C. Conduct meetings among subcontractors and others concerned, to establish and maintain coordination and schedules, and to resolve coordination matters in dispute.

D. Participate in progress meetings. Report on progress of work to be adjusted under coordination requirements, and any required changes in schedules. Transmit minutes of meetings and reports to concerned parties.

3.02 COORDINATION DOCUMENTS

A. Prepare coordination drawings to organize installation of products for efficient use of available space, for proper sequence of installation, and to identify potential conflicts.

B. Prepare a master schedule identifying responsibilities for activities that directly relate to this work, including submittals and temporary utilities; organize by specification section.

C. Identify electrical power characteristics and control wiring required for each item of equipment.

D. Maintain documents for the duration of the work, recording changes due to site instructions, modifications or adjustments.

E. After Architect review of original and revised documents, reproduce and distribute copies to concerned parties.

3.03 COORDINATION OF SUBMITTALS

A. Review shop drawings, product data, and samples for compliance with Contract Documents and for coordination with related work. Transmit copies of reviewed documents to Architect.

B. Check field dimensions and clearances and relationship to available space and anchors.

C. Check compatibility with equipment and work of other sections, electrical characteristics, and operational control requirements.

D. Check motor voltages and control characteristics.

E. Coordinate controls, interlocks, wiring of switches, and relays.

F. Coordinate wiring and control diagrams.

G. When changes in the work are made, review their effect on other work.

H. Verify information and coordinate maintenance of record documents.

3.04 COORDINATION OF SUBSTITUTIONS AND MODIFICATIONS

A. Review proposals and requests for substitution prior to submission to Architect.

B. Verify compliance with Contract Documents and for compatibility with work of other sections.

C. Submit with recommendation for action.

3.05 OBSERVATION OF WORK

A. Observe work for compliance with Contract Documents.

B. Maintain a list of observed deficiencies and defects; promptly submit.

3.06 DOCUMENTATION

A. Observe and maintain a record of tests. Record:
   1. Specification section number and product name.
   2. Name of Contractor, subcontractor.
   3. Name of testing agency and name of inspector.
   4. Name of manufacturer's representative present.
   5. Date, time, and duration of tests.
   6. Type of test, and results.
   7. Retesting required.

B. Submit copies of documentation to Architect upon request.

3.07 EQUIPMENT START-UP

A. Verify utilities, connections, and controls are complete and equipment is in operable condition as required by Section 01 7000.

B. Observe start-up and adjustments, test run, record time and date of start-up, and results.

C. Observe equipment demonstrations made to Owner; record times and additional information required for operation and maintenance manuals.

3.08 INSPECTION AND ACCEPTANCE OF EQUIPMENT

A. Prior to inspection, verify that equipment is tested, operational, clean, and ready for operation.

B. Assist Architect with review. Prepare list of items to be completed and corrected.

END OF SECTION

SECTION 01 3216
CONSTRUCTION PROGRESS SCHEDULE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Preliminary schedule.

B. Construction progress schedule, bar chart type.

1.02 REFERENCE STANDARDS

A. AGC (CPSM) - Construction Planning and Scheduling Manual; 2004.

B. M-H (CPM) - CPM in Construction Management - Project Management with CPM; O'Brien; 2006.

1.03 SUBMITTALS

A. Within 10 days after date of Agreement, submit preliminary schedule.

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

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

D. Submit updated schedule with each Application for Payment.

1.04 QUALITY ASSURANCE

A. Scheduler: Contractor's personnel or specialist Consultant specializing in CPM scheduling with three (3) years minimum experience in scheduling construction work of a complexity comparable to this Project, and having use of computer facilities capable of delivering a detailed graphic printout within 48 hours of request.

1.05 SCHEDULE FORMAT

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

B. Diagram Sheet Size: Maximum 22 x 17 inches.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PRELIMINARY SCHEDULE

A. Prepare preliminary schedule in the form of a horizontal bar chart.

3.02 CONTENT

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

B. Identify each item by specification section number.

C. Identify work of separate stages and other logically grouped activities.

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

E. Provide separate schedule of submittal dates for shop drawings, product data, and samples, owner-furnished products, products identified under Allowances, and dates reviewed submittals will be required from Architect. Indicate decision dates for selection of finishes.

F. Provide legend for symbols and abbreviations used.

3.03 BAR CHARTS

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

B. Identify the first work day of each week.

3.04 NETWORK ANALYSIS

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

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

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

D. Analysis Program: Capable of compiling monetary value of completed and partially completed activities, accepting revised completion dates, and recomputation of all dates and float.

E. Required Reports: List activities in sorts or groups:
   1. By preceding work item or event number from lowest to highest.
   2. By amount of float, then in order of early start.

3.05 REVIEW AND EVALUATION OF SCHEDULE

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

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

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

3.06 UPDATING SCHEDULE

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

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

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

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

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

F. Submit reports required to support recommended changes.

3.07 DISTRIBUTION OF SCHEDULE

A. Distribute copies of updated schedules to Contractor's project site file, to subcontractors, suppliers, Architect, Owner, and other concerned parties.

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

END OF SECTION

SECTION 01 3300

SUBMITTAL PROCEDURES

SCOPE

1.01 THIS SECTION INCLUDES ADMINISTRATIVE AND PROCEDURAL REQUIREMENTS FOR SUBMITTALS REQUIRED FOR PERFORMANCE OF THE WORK, INCLUDING THE FOLLOWING:

A. Shop drawings.
   1. Product data.
   2. Samples.
   3. Quality Requirements

1.02 SUBMITTAL PROCEDURE

A. Contractors and Subcontractors that are required to submit information shall submit to the Architect the following:
   1. Shop Drawings: Minimum six (6) sets of drawings. Four (4) will be returned.
   2. Number of Copies: Architect and any associated outside consultant will retain one print each; remainder will be returned. Consequently, GC shall submit as many copies needed to meet foregoing requirement and their own distribution needs.
   3. the Contractors and Subcontractors submitting drawings and/or product information shall allow ten (10) working days processing time for the Architect to review and return such submittals. The Architect will not be held responsible for delays in construction resulting from the Contractor and Subcontractor being required to resubmit drawings and/or product information. Contractors and subcontractors shall correct and return to Architect submittals marked either “Note Markings”, “Resubmit”, “Rejected”, or “Not Reviewed” within ten (10) calendar days.
   4. The General Contractor shall review all shop drawings and other submittals received from all sub-contrcatrors and material men for conformance with drawings and specifications. If the General Contractor cannot verify required conformance with the Contract Documents, shop drawings and all other submittals shall be resubmitted by the General Contractor to the subcontractors and material suppliers for correction prior to the General Contractor's submittal to the Architect. Shop drawings or other submittals transmitted by the General Contractor to the Architect and/or to the Owner attest that a complete review for accuracy and application for the project has been completed to very conformance with the Contract Documents.
   5. Shop Drawings Contractors and Subcontractors submitting drawings and/or product information shall allow ten (10) working days processing time for the Architect to review and return such submittals. The Architect will not be held responsible for delays in construction resulting from the Contractor and Subcontractor being required to resubmit drawings and/or product information. Contractors and subcontractors shall correct and return to Architect submittals marked either “Note Markings”, “Resubmit”, “Rejected”, or “Not Reviewed” within ten (10) calendar days.

1.03 SHOP DRAWINGS

A. Submittals shall be made through the General Contractor. Submittals not received from the General Contractor shall be returned without review.

B. Shop drawings not requested by the Architect shall be returned without action

C. If items to be installed are in exact accordance with the contract documents, shop drawings submission is not required. Should alterations or substitutions be proposed for any given item, shop drawing submission is required.

D. The Contractor shall not perform any portion of the Work requiring submittal and review of shop drawings, product data, samples or similar submittals until the respective submittal has been approved by the Architect. Such Work shall be in accordance with approved submittals.

E. Submit newly prepared information drawn accurately to scale. Highlight, encircle, or otherwise indicate deviations from the Contract Documents. Do not reproduce Contract Documents or copy standard information as the bases of Shop Drawings. Standard information prepared without specific reference to the Project is not a Shop Drawing.
   1. AutoCAD Drawings: A CD copy of CAD Drawings may be available from the Architect. The Contractor requiring this service must contact the Architect to verify availability. Cost to obtain AutoCAD drawings will be $150.00 per Drawing Sheet. Request for CD copy should be addressed to the Project Architect.

F. Shop Drawings shall include the following information:
   1. Dimensions.
   2. Identification of products and materials included by sheet and detail number or by schedule identification number.
   3. Compliance with specified standards.
   4. Notation of coordination requirements.
   5. Notation of dimensions established by field measurements.

G. By approving and submitting shop drawings, the Contractor thereby represents that he has determined and verified field measurements, field construction criteria, materials, catalog numbers, and similar data, and that he has checked and coordinated each shop drawing with the requirements of the Work and of the Contract Documents prior to submitting to the Architect.

H. The Contractor shall make corrections required by the Architect and shall resubmit the required number of corrected copies of shop drawings until appropriately marked. The Contractor shall direct specific attention in writing or on resubmitted shop drawings to revisions other than the corrections requested by the Architect on previous submissions.

I. The Architect will review shop drawings only for conformance with the design concept of the Project and with the information given in the Contract Documents. The Architect's review of a separate item shall not indicate review of an assembly in which the item functions.
   1. Only shop drawings, product data, and samples marked "No Exceptions Taken" or "Note Markings/Confirm" shall be considered "final" and used in conjunction with the work of this Project.

J. The Architect's review of shop drawings shall not relieve the Contractor of responsibility for any deviation from the requirements of the Contract Documents unless the Contractor has informed the Architect in writing of such deviation at the time of submission and the Architect has given written approval to the specific deviation, nor shall the Architect's action relieve the Contractor from responsibility for errors or omissions in the shop drawings.
   1. The Architect's review of such submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and qualities, or for substantiating instructions or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents. Unless otherwise specifically stated by the Architect, the Architect's review shall not constitute approval of safety precautions or, of any construction means, methods, techniques, sequences, or procedures. The Architect's approval of a specific item shall not indicate approval of an assembly of which it is a component.

K. Notations and remarks added to shop drawings by the Architect are to insure compliance to Drawings and Specifications and do not imply a requested or approved change to contract cost.

L. Should deviations, discrepancies, or conflicts between shop and contract drawings and Specifications be discovered, either prior to or after review, Contract Documents shall control and be followed.

M. Shop drawings will be marked as follows: Contractor shall take the following action for each respective marking:

1. “NO EXCEPTIONS TAKEN” - Copies will be distributed as indicated under above schedule.
2. “NOTE MARKINGS/CONFIRM” - Final but Restricted Release; Contractor may proceed with fabrication, taking into account the necessary corrections on submittal and with Contract Documents.
3. “NOTE MARKINGS/RESUBMIT” - Contractor may proceed with fabrication, taking into account the necessary corrections. Corrected shop drawings shall be resubmitted before fabrication of this work is complete to obtain a different action marking. Do not allow drawings marked “Resubmit” to be used in connection with installation of the Work.
4. “REJECTED” - Contractor will be required to resubmit shop drawings in their entirety. No fabrication or installation shall be started until shop drawings so marked have been completely revised, resubmitted, and marked by Architect according to preceding Paragraphs a or b.

1.04 PRODUCT DATA

A. Collect Product Data into a single submittal for each element of construction or system. Product data includes printed information, such as manufacturer’s installation instructions, catalog cuts, standard color charts, rough-in diagrams and templates, standard wiring diagrams, and performance curves.
   1. Mark each copy to show applicable choices and options. Where printed Product Data includes information on several products that are not required, mark copies to indicate the applicable information. Include the following information:
      a. Manufacturer’s printed recommendations.
      b. Compliance with trade association standards.
      c. Compliance with recognized testing agency standards.
      d. Application of testing agency labels and seals.
      e. Notation of dimensions verified by field measurement.
      f. Notation of coordination requirements.
      g. Do not submit Product Data until compliance with requirements of the Contract Documents has been confirmed.
         1) Preliminary Submittal: Submit a preliminary single copy of Product Data where selection of options is required.
      h. Submittals: Submit copies in accordance with Section C, item 11 above. The Architect will retain two and will return the others marked with action taken and corrections or modifications required.
         1) Unless non-compliance with Contract Document provisions is observed, the submittal may serve as the final submittal.
      i. Distribution: Furnish copies of final submittal to installers, subcontractors, suppliers, manufacturers, fabricators, and others required for performance of construction activities. Show distribution on transmittal forms.
         1) Do not proceed with installation until a copy of Product Data is in the installer’s possession.
         2) Do not permit use of unmarked copies of Product Data in connection with construction.

B. In compliance with the OSHA Hazard Communication Standard (1910.1200, 08-24-1987), Contractors shall post at the site MSDS (Material Safety Data Sheets) for ALL products classified as hazardous that their firm has knowledge that they will be furnishing, using, or storing on the job site during the duration of this Project in accordance with OSHA standards. At the completion of the project, the Contractor shall turn their “MSDS” information directly over to the Owner with a receipt for the Owner to sign. A copy of the signed receipt only shall be submitted to the Architect.
   1. Material Safety Data Sheets (MSDS) shall not be submitted to the Architect for review. Material Safety Data Sheets submitted to Architect will be returned with no action taken.

1.05 SAMPLES

A. The Contractor shall submit to the Architect triplicate samples to illustrate materials or workmanship, colors, and textures, and establish standards by which the Work will be judged.
   1. Submit full size, fully fabricated samples cured and finished as specified and physically identical with the material or product proposed. Samples include partial sections of manufactured or fabricated components, cuts or containers of materials, color range sets, and swatches showing color, texture, and pattern. Where variation in color, pattern, texture, and other characteristic is inherent in the material or product represented, submit at least 3 multiple units that show approximate limits of the variations.

B. By approving and submitting samples, the Contractor thereby represents that he has determined and verified materials, catalog numbers, and similar data, and that he has checked and coordinated each sample with the requirements of the Work and of the Contract Documents prior to submitting to the Architect.

C. The Architect will review samples but only for conformance with the design concept of the Project and with the information given in the Contract Documents. The Architect's review of a separate item shall not indicate approval of an assembly in which the item functions.

D. The Architect's action shall not relieve the Contractor of responsibility for deviations from the requirements of the Contract Documents unless the Contractor has informed the Architect in writing of the deviation at the time of submission and the Architect has given written approval to the specific deviation, nor shall the Architect's action relieve the Contractor from responsibility for errors or omissions in the samples.

E. Materials shall not be ordered until final review is received in writing from the Architect. Materials shall be furnished, equal in every respect to reviewed samples. Where color or shade cannot be guaranteed, the maximum deviation shall be indicated by the manufacturer. Work shall be in accordance with the final reviewed samples.

1.06 QUALITY REQUIREMENTS

A. Delegated Design Submittal: In addition to Shop Drawings, Product Data, and other required submittals, submit a statement, signed and sealed by the responsible design professional, for each product and system specifically assigned to the Contractor to be designed or certified by a design professional, indicating that the products and systems are in compliance with performance and design criteria indicated. Include list of codes, loads, and other factors used in performing these services.

B. Mock-ups of certain exterior and interior finish products and assemblies will be required. Items to be mocked up will include brock and stone or other masonry veneers, windows, siding, trim, and color samples. Interior finishes may include assemblies of millwork, colors, flooring materials, etc. Refer to Section 01 4000 Quality Requirements.

END OF SECTION

SECTION 01 3515.01

LEED FOR HOMES REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Section includes general requirements and procedures for compliance with certain USGBC LEED prerequisites and credits needed for Project to obtain LEED certification based on LEED for Homes Rating System.

1.02 DEFINITIONS

A. Chain-of-Custody Certificates: Certificates signed by manufacturers certifying that wood used to make products was obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship." Certificates shall include evidence that manufacturer is certified for chain of custody by an FSC-accredited certification body.

B. LEED: Leadership in Energy & Environmental Design

C. USGBC: United States Green Building Council

D. First paragraph below is based on "Requirements" and "Potential Technologies & Strategies" paragraphs in LEED-NC and LEED-CI Credit MR-6. LEED requirements say "made from plants" but LEED includes wool as an example.

E. Rapidly Renewable Materials: Materials made from plants that are typically harvested within a 10-year or shorter cycle. Rapidly renewable materials include products made from bamboo, cotton, flax, jute, straw, sunflower seed hulls, vegetable oils, or wool.

F. First paragraph below applies to LEED-NC and LEED-CS.

G. Regional Materials: Materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles (800 km) of Project site. If only a fraction of a product or material is extracted/harvested/recovered and manufactured locally, then only that percentage (by weight) shall contribute to the regional value.

H. First two paragraphs below apply to LEED-CI.

I. Regionally Manufactured Materials: Materials that are manufactured within a radius of 500 miles (800 km) from Project site. Manufacturing refers to the final assembly of components into the building product that is installed at Project site.
   1. First paragraph below applies to LEED-NC and LEED-CS.

J. Note that LEED-NC, LEED-CI, and LEED-CS use the term "pre-consumer" rather than "post-industrial." Also note that when manufacturers and trade associations use the term "post-industrial" it often includes spills, scraps, and damaged and surplus materials that are fed back into the same manufacturing process and that these materials are not considered recycled content by the LEED rating systems.
   1. Recycled Content: The recycled content value of a material assembly shall be determined by weight.
      a. Recycled content is material that includes at least 25% postconsumer or 50% pre-consumer (pre-industrial) recycled material.
      b. "Post-consumer" material is defined as waste material generated by households or by commercial, industrial, and institutional facilities in their role as end users of the product, which can no longer be used for its intended purpose.
      c. "Pre-consumer" material is defined as material diverted from the waste stream during the manufacturing process. Excluded is reutilization of materials such as rework, regrind, or scrap generated in a process and capable of being reclaimed within the same process that generated it.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Each contractor shall be responsible for understanding the requirements of LEED credits attempted. A summary of credits being attempted and the LEED Certification level is attached to this section.

B. More detailed requirements and explanation of each Credit are contained in the LEED for Homes Reference Guide, 2009 Edition as published by USGBC.

C. Each contractor shall obtain a copy of the LEED for Homes Reference Guide, 2009 Edition.

D. The General Contractor shall keep a copy of the LEED for Homes Reference Guide, 2009 Edition on site in the job office at all times during construction.

1.04 SUBMITTALS

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

B. LEED Action Plans: Provide preliminary submittals within 60 days of date established for commencement of the Work [the Notice to Proceed] [the Notice of Award] indicating how the following requirements will be met:

1. Credit MR List of proposed materials with recycled content. Indicate cost, post-consumer recycled content, and pre-consumer recycled content for each product having recycled content.
2. Credit MR : List of proposed regional materials. Identify each regional material, including its source, cost, and the fraction by weight that is considered regional.

C. LEED Progress Reports: Concurrent with each Application for Payment, submit reports comparing actual construction and purchasing activities with LEED action plans.

1.05 LEED FOR HOMES CREDITS

PART 2 LEED FOR HOMES CREDITS

2.01 A COMPREHENSIVE LIST OF LEED FOR HOMES CREDITS IS DESCRIBED BELOW BUT NOT ALL APPLY TO THIS PROJECT. . SEE ATTACHED SPREADSHEET WHICH IDENTIFIES LEED CERTIFICATION LEVEL BEING ATTEMPTED AND ASSOCIATED REQUIRED CREDITS FOR THIS PROJECT.

2.02 ID 1: INTEGRATED PROJECT PLANNING

A. Prerequisite - Preliminary Rating. As ready as practical, conduct a preliminary LEED for Homes meeting, with the participation of the Provider and key members of the project team. As part of the meeting, create an action plan that identifies the following:

1. The targeted LEeD award level (Certified, Silver, GOld or Platinum).
2. The LEED for Homes credits that have been selected to meet the targeted award level.
3. The party accountable for meeting the LEED for Homes requirements for each selected credit.

B. Credits - Integrated Project Team (1 point). Assemble and involve a project team to meet the three criteria below.

1. Include team members, in addition tot he builder and Verification Team, whose capabilities include at least three of the following set skills.
   a. architecture or residential building design;
   b. mechanical or energy engineering;
   c. building science or performance testing;
   d. green building or sustainable design; and
   e. civil engineering, landscape architecture, habitat restoration, or land-use planning.
2. Actively involve all team members referenced above in at least three of the following phases of the home design and construction process:
   a. conceptual or schematic design;
   b. LEED planning;

c. preliminary design;
d. energy and envelope systems analysis or design;
e. design development;
f. final design, working drawings or specifications; and
g. construction.

3. Conduct meetings with the project team at least monthly to review project status, introduce new team members to project goals, discuss problems encountered, formulate solutions, review responsibilities and identify next steps.
4. Supporting Verification Materials, made available by the Project Team
   a. Present a list of project team members to the Verification Team.
   b. Present a list of meeting dates or plans for regularly scheduled meetings to the Verification Team.
5. Verification Team
   a. Participate in preliminary LEED for Homes rating, or verify participation by the LEED for Homes Provider.

C. Professional Credentialed with Respect te LEED for Homes (1 point). At least one principal member of the project team shall be a professorial who is credentialed with respect to LEED for Homes as determined by the US Green Building Council.
1. Supporting Verification Materials, made available by the Project Team.
   a. Identify the Professional Credentials with respect toe LEED for HOmes to the verification team.
2. Verification Team
   a. Visually verify the list of project team members and meeting dates.

D. Design Charrette (1 point). No later than the design development phase and preferably during schematic design, conduct at least one full-day Integrated design workshop with the project team defined in ID 1.2. Use the workshop to integrate green strategies across all aspects of the building design, drawing on the expertise of all participants.
1. Supporting Verification Materials, made available by the Project Team.
   a. Present information about the charrette (dates, participants, etc.) to the Verification Team.
2. Verification Team
   a. Visually verify te list of project team members and meeting dates.

E. Building Orientation for Solar Design (1 point). Design the home such that all the following requirements are met:
1. The glazing area on the north and south facing walls of the building is at least 50% greater than the sum of the glazing area on the east and west facing walls.
2. The east-west axis of the building is within 15 degrees of due east-west.
3. The roof has a minimum of 450 square feet of south-facing area that is oriented approximately for solar applications.
4. At least 90% of the glazing on the south-facing wall is completely shaded (using shading, overhangs, etc.) at noon on June 21 and unshaded at noon on December 21.

F. Synergies and Trade Offs: This credit is intended to promote an integrated, system-oriented approach to green project design and development. The selected green home-building strategies and technologies in the rating system should each be fully integrated into a home's design.

2.03 ID 2: DURABILITY MANAGEMENT PROCESS

A. Intent: Promote durability and high performance of the building enclosure and its components and systems through appropriate enclosure, materials selection, and construction practices.

B. enclosure - Durability Planning. Prior to construction, the project team shall do the following:
1. Complete the Durability risk Evaluation Form to identify all moderate and high-risk durability issues for the building enclosure.

2. Develop specific measures to respond to those issues.
3. Identify and incorporate all the applicable indoor moisture control measures listed in Table 1.
4. Incorporate the measures from 2.1(b) and (c) above, into project documents (drawings, specifications, and /or scope of work, as appropriate).
5. List all of the durability enclosure and indicate their locations in the project documents in a durability inspection checklist. Include the checklist in project documents for use in verification.
6. Supporting Verification Materials, enclosure available by the Project Team
   a. Complete and submit the Durability Evaluation Form to the Verification Team
   b. Include durability measures in project documents
   c. Develop and submit a completed durability inspection checklist.
7. Verification Team
   a. Verify completion of the Durability Evaluation Form and durability inspection checklist.

C. Durability Management. During construction, the builder shall have a quality management process in place to ensure installation of the durability measures. This prerequisite can be satisfied by having the builder inspect and check off each measure in the durability inspection checklist created for 2.1(e) above.
   1. Supporting Verification Materials, made available by the Project Team.
      a. Present documentation of quality management processes to the Verification Team or conduct an inspection of durability measures in the home and indicate the completion of the inspection on the durability inspection checklist.
      b. Ensure that all applicable measures in Table 1 were installed.
   2. Verification Team
      a. Visually verify documentation of quality management process or verify that the project team conducted on-site inspection of durability measures and indicated its completion on the durability inspection checklist.
      b. Visually verify that all applicable measures in Table 1 were installed.

Location or equipment	**Required moisture control measures**
Tub, showers, and spa areas	Use nonpaper-faced backer board on walls
Kitchen, bathroom, laundry rooms, and spa areas	Use water-resistant flooring; do not install carpet
Entryway (within 3 feet of exterior door)	Use water-resistant flooring, do not install carpet.
Tank water heater in or over living space	Install drain and drain pan.
Clothes washer in or over living space	Install drain and drain pan, or install accessible single-throw supply valve.
Conventional clothes dryer	Exhaust directly to outdoor.
Condensing clothes dryer	Install drain and drain pan.

D. Credits - third Party Durability management Certification (3 points). Have the Verification Team inspect and verify each measure listed in the durability inspection checklist created for 2.1(e) above.
   1. Verification Team
      a. Visually verify that strategies listed on the durability inspection checklist were incorporated into the home.
      b. Upon verification, check off and sign the durability inspection checklist.

E. Synergies and Trade-Offs. Many of the credits int he LEED for Homes Rating System can serve as durability strategies and may be used in the creation of a durability inspection checklist. If this is done, the home can still receive LEED points for those credits.

2.04 ID 3: INNOVATION OR REGIONAL DESIGN

A. Intent: Minimize the environmental impact of the home by incorporating additional green design and construction measures that have tangible and demonstrable benefits beyond those int he LEED for Homes Rating System.

B. Prerequisites - None

C. Credit - Innovation 1 (1 point). Prepare a written Innovative Design Request, to be submitted by the LEED for HOmes Provider to USGBC, explaining the merits of the proposed measure. This point cannot be counted until LEED for Homes has ruled ont he request. All written submittals must contain the following.
   1. The intent of the proposed measure.
   2. The proposed requirement for compliance/
   3. the proposed documentation to demonstrate compliance; and
   4. A description and an estimate of the benefit or impact provided by the proposed measure.

D. Innovation 2 (1 point)

E. Innovation 3 (1 point)

F. Innovation 4 (1 point).

G. Synergies and Trade-Offs: This credit rewards innovative or regional measures that are not addressed elsewhere in he Rating System. A project can also receive 1 LEED point for exceeding the performance requirements of existing credits.

H. Verification and Submittals
   1. Supporting Verification Materials, made available by the Project Team
      a. Notify the LEEd for Homes Provider as early as possible about the intent to submit a innovation request.
      b. Complete a formal innovative or regional design request.
      c. Sign an Accountability form to indicate that you met the requirements of the Innovation Credit.
   2. Verification Team.
      a. Review the innovative or regional design request and verify that all elements are installed in the home.
      b. Submit the request to USGBC for review.
      c. Provide feedback to the project team about the ruling.
      d. For each Innovation credit, verify that the Accountability Form has been signed by the responsible party.

2.05 LL 1 : LEED FOR NEIGHBORHOOD DEVELOPMENT

A. Intent: Minimize the environmental impact of land development practices by building Homes in LEED for Neighborhood Development certified developments.

B. Prerequisites: None

C. Credits:
   1. LEED for Neighborhood Development (10 points). Complete the requirements of the LEED for Neighborhood Development (LEED-ND) certification program.

D. Synergies and Trade Offs - A project receiving for LL 1 is not eligible for points under LL 2-6 and vise versa.

E. Verification and Submittals
   1. Demonstrate LEED for Neighborhood Development certification or that requirements for Stage 2 have been met.

F. Verification Team
   1. Verify LeeD for Neighborhood Development certification or that requirements for Stage 2 have been met.

2.06 LL2: SITE SELECTION

A. Intent: Avoid development on environmentally sensitive sites.

B. Prerequisites: None

C. Credits:

1. Site Selection (2 points). Do not develop buildings, build structures, roads or parking area on portions of sites that meet any of the following criteria:
    a. Land whose elevation is at or below the 100-year floor plain as defined by FEMA.
    b. Land that is specifically identified as habitat for any species on federal or state threatened or endangered lists.
    c. Land within 100 feet of any water, including wetlands as defined by US COde of Federal Regulations 40 CFR, Parts 230-233 and Part 22, and isolated wetlands or areas of special concern identified by state or local rule, or land within distances given in applicable state or local regulations, whichever is more stringent. New wetlands constructed as part of stormwater mitigation or other site restoration efforts are exempt from this part of the requirement.
    d. Land that prior to acquisition for the project was public parkland, unless land of equal or greater value as parkland is accepted in trade by the public landowner (park authority projects are exempt).
    e. Land that contains "prime soil", "unique soils", or "soils of state significance", as identified in state Natural Resources Conservation Service soil surveys. Verification of soil types should be conducted by the project civil engineer, wetlands engineer, or biologist. If no p project team member is qualified to verify this requirement, follow the steps lid out in the LEED for Homes reference Guide. Sites that are previously developed are exempt from this requirement.

D. Synergies and Trade offs: A project receiving points for LL1 is not eligible for points under LL 2-6 and vice versa.

E. Calculations: At least 95% of the site must meet the criteria listed above.

F. Supporting Verification Materials, made available by the Project Team:

1. Provide all necessary soil and site data to Verification Team.
2. Sign an accountability Form averring that the site meets all the stipulations of the credit.

G. Verification Team:

1. Verify site data, floodplain maps, soil data maps, or other supporting verification materials.
2. Verify that the Accountability Form has been signed by the responsible party.

2.07 LL 4: INFRASTRUCTURE

A. Intent: Encourage the building of LEED homes in developments that are served by or are near existing infrastructure (i.e. sewers and water supply).

B. Prerequisites: None

C. Credits.

1. Existing Infrastructure (1 point): Select a lot that is within 1/2 mile of existing water service lines and sewer service lines. In the case of a multi home new development, each home in the development is awarded this point if the center of the development site is within 1/2 mile of existing water service lines and sewer service lines.

D. Synergies and Trade Offs: A project receiving points for LL 1 is not eligible for points under LL 2-6 and vice versa.

E. Calculations: Calculate the distance from he home to the nearest existing water and sewer hookup.

F. Supporting Verification Materials, made available by the Project Team

1. If necessary, present local maps and documents tot he Verification Team demonstrating the proximity of the home to existing water and sewer infrastructure.

G. Verification Team:
   1. Visually verify (using maps, documents, or on-site observation) that the home is within 1/2 mile of existing water and sewer infrastructure.

2.08 LL 5: COMMUNITY RESOURCES/TRANSIT

A. Intent: Encourage the building of LEED homes in development patterns that allow for walking, biking, or public transit (thereby minimizing dependency on personal automobiles and their associated environmental impacts).

B. Prerequisites: None

C. Credits (Note: for new multi home developments, the distance below can be measured from the center of the community as long as the distance from the enter of the community to the farthest home does not exceed 1/4 mile. Using this approach, whole communities can qualify for this credit. For any homes farther than 1/4 mile from the center of the community, distances must be recalculated from each home).
   1. Basic Community Resources/Transit (1 point). Select a site that meets one of the following criteria:
      a. Located within 1/4mile of four basis community resources (Table 1)
      b. Located within 1/2 mile of seven basic community resources (Table 1).
      c. Located within 1/2 mile of transit services that offer 30 or more transit rides per weekday (combined bus, rail, and ferry). OR
   2. Extensive Community Resources/Transit (2 points). Select a site that meets one of the following criteria:
      a. Located within 1/4 mile of seven basic community resources (Table 1).
      b. Located within 1/2 mile of 11 basic community resources (Table 1)
      c. Located within 1/2 mile of transit services that offer 60 or more transit rides per weekday (combined bus, rail, and ferry). OR
   3. Outstanding Community Resources/Transit (3 points) Select a site that meets one of the following criteria:
      a. Located within 1/4 mile of 11 basic community resources (Table 1).
      b. Located within 1/2 mile of 14 basic community resources (Table 1).
      c. Located within 1/2 mile of transit services that offer 125 or more transit rides per weekday (combined bus, rail and ferry).
   4. Transit rides per weekday are calculated as follows: (1) within a 1/2 mile radius, count all the transit stops; (2) multiply each transit stop by the number of buses, trains, and ferries that pass through that stop per day; (3) add the total number of rides available at each stop within 1/2 mile together. Example: If there are four bus stops, and at each bus stop the services frequency is half-hourly (40 times per day), the total transmit rides per day is 192.

D. Synergies and Trade-Offs: A project receiving points for LL1 is not eligible for points under LL 2-6 and vice versa.

E. Calculations: The distance requirements mus be calculated based on possible walking distances, not "as the crow flies". For example, if a resource is within 1/2 mile on a map, but requires <1/2 mile of walking because of highways or other obstructions, the resource should not be counted. Count the total number of community resources that ar within 1/4 mile and 1/2 mile. Up to two of each type of community resources may be counted. For example, in LL 5.1, two restaurants can count for two of the four community resources within 1/4 mile. A project that wants to count a community resource that is not listed must submit a Credit interpretation Request to USGBC. Developers of larger communities can measure the distance to the community resource from the center of the community, as long as the distance from the center to the farthest home does not exceed 1/4 mile. Using this approach, whole communities can be

qualified for this credit. For any homes farther than 1/4 mile from the center of the community, distance must be recalculated for each home. Calculate transit rides per weekday as follows:

1. Count all transit stops that are within 1/2 mile of the home. Multiple transit sops can only be counted if they are for different transit lines. For example, a single bus that stops just north of the home, in front of the home, or just south of the home, should only be counted as one stop. Stops for the same line that travel in different directions (e.g. an inbound bus and an outbound bus) count s different stops. In the case of large developments, count the distance from the center of the development;
2. For each transit stop, count the number of times a bus, train, or ferry stops per day. If the number of rides varies over the year (e.g the project is in an academic campus or a seasonal resort), the average rides per weekday should be used;
3. Sum the total number of rides per day for each stop within 1/2 mile.

F. Supporting Verification Materials, made available by the Project Team:
   1. Present maps and/or a list of community resources or transit modes to the Verification Team.
   2. If applicable, present calculations for transit rides to the Verification Team.

G. Verification Team:
   1. Visually verify (using maps, lists provided by the project team, and/or on-site observation) the presence of community resources or transit rides, as per the credit requirements.
   2. If applicable, visually verify calculations for transit rides.

H. Table 1 - Types of Basic Community Resources

ARTS AND ENTERTAINMENT CENTER
BANK
COMMUNITY OR CIVIC CENTER
CONVENIENCE STORE
DAYCARE CENTER
FIRE STATION
FITNESS CENTER OR GYM
LAUNDRY OR DRY CLEANER
LIBRARY
MEDICAL OR DENTAL OFFICE
MUSEUM
PHARMACY
POLICE STATION
POST OFFICE
PLACE F WORSHIP
RESTAURANT
SCHOOL
SUPERMARKET
OTHER NEIGHBORHOOD-SERVING RETAIL
OTHER OFFICE BUILDING OR MAJOR EMPLOYMENT CENTER
NOTE: UP TO TWO OF EACH TYPE OF COMMUNITY RESOURCE MAY BE COUNTED. FOR EXAMPLE, TWO RESTAURANTS WITHIN 1/4 MILE MAY BE COUNTED AS TWO COMMUNITY RESOURCES; FOUR RESTAURANTS ALSO COUNT AS TWO.

2.09 SS1: SITE STEWARDSHIP

A. Intent: Minimize long-term environmental damage to the building lot during the construction process.

B. Prerequisites:

1. Erosion Controls During Construction. Prior to construction, design and plan appropriate erosion control measures. During construction, implement these measures. erosion control measures must include all of the following:
    a. Stockpile and protect disturbed topsoil from erosion (for reuse).
    b. Control the path and velocity of runoff with silt fencing or comparable measures.
    c. Protect on-site storm sewer inlets, streams, and lakes with straw bales, silt fencing, silt sacks, rock filters, or comparable measures.
    d. Provide swales to divert surface water from hillside.
    e. If soils in a sloped area (i.e. 25$ or 4:1 slope) are distributed during construction, use tiers, erosion blankets, compost blankets, filter socks and berms, or some comparable approach to keep soil stabilized.

C. Credits
1. Minimize Disturbed Area of Site (1 point). Minimize disturbance tot he site by meeting the following:
    a. Where the site is not previously developed:
        1) Develop a tree or plant preservation plan with "no disturbance" zones clearly delineated on drawings and on the lot (see Note 1 below).
        2) Leave at least 40% of the buildable lot area undisturbed, not including area under roof. Only softscape can be counted toward this credit; projects cannot receive credit for preserving preexisting hardscape, such as driveways.
    b. Where the site is previously developed:
        1) Develop a tree or plant preservation plan with "no-disturbance" zones clearly delineated on drawings and on the lot (see Note 1 below), and rehabilitate the lot by undoing any previous soil compaction; removing existing invasive plants, and meeting the requirements of SS2.2 (see Note 2 below). OR
        2) Building on site with a lot area of less than 1/7 acres, or with housing density for the project that is equal to or greater than 7 units per acre. For multi family buildings, the average lot size shall be calculated as the total lot size divided by the number of units.
    c. Notes:
        1) Any '"no-disturbance" zones must also be protected from parke construction vehicles and building material storage. Soils compacted by vehicles or stored materials can cause major difficulties in establishing any new landscaping.
        2) HOmes on previously developed lots that disturb the entire lot during construction an earn t his credit by meeting the requirements in part (c) above.

D. Synergies and Trade Offs: SS 4.2 rewards homes for the installation of permanent erosion controls. IF the project does not include full landscaping, homeowners associations or other rules mst require homeowners to have the ste fully landscaped within one year; see SS2. Erosion controls and soil stabilization measures must be robust enough to function until landscaping is in place (i.e. up to one year).

E. Supporting Verification Materials,made available by the Project Team.
1. Ensure that required erosion control measures have been installed.

F. Verification Team:
1. Visually verify that the required erosion control measures have been installed.

2.10 SS2 : LANDSCAPING

A. Intent: Design landscape features to avoid invasive species and minimize demand for area and synthetic chemicals.

B. Prerequisites:
1. No invasive Plants. Introduce no invasive plant species into the landscape. *Note: Invasive plant species vary by regions Consult the local Cooperative Extension Service or state agencies. A list of regional resources is available from the US Department of*

Agriculture, at www.invasivespeciesinfo.gove/unitedstates/state.shtml. Not all nonnative species are considered invasive.

C. Credits: *Points shown below are for homes that are fully landscaped. A project that has not completed the designed landscaping may earn up to 50% of the prints for each credit as lng as 50% or more of the designed landscaping is completed upon certification. In this case, 100% completion of the landscaping must be required by homeowner association or other rules within a specific tim period not to exceed one year after occupancy. Erosion controls and soil stabilization measures must be robust enough to be effective for one year. The builder or project team must also develop a landscaping plan that meets the requirements in SS2 and provide it to the homeowner.*

1. Basic Landscape Design (2 points). Meet ll of the following requirements for all designed landscape softscape:
   a. Any turf must be drought-tolerant.
   b. Do not use turf in densely shaded areas.
   c. Do not use turf in areas with a slope of 25% (i.e. 4:1 slope).
   d. dd mulch or soils amendments as appropriate. Mulch is defined as a covering placed around plants to reduce erosion and water loss and to help regulate soil temperature. In addition, upon decomposition, organic mulches serve as soil amendments. The type of mulch selected can affect soil pH.
   e. All compacted soil (e.g. from construction vehicles) must be tilled to at last 6 inches.
2. Limited Conventional Turf (maximum 3 points, as specified in Table 1). Limit the use of conventional turf int he designed landscape softscape.
3. Drought Tolerant Plants (maximum 2 points as specified in Table 2). Install drought-tolerant plants.
4. Table 1. Limited Conventional Turf. Percentage of designed landscape softscape are that is conventional turf.

41-60%	1
21-40%	2
20% or less	3

5. Table 2. Drought-Tolerant Plants. Percentage of installed plants that are drought-tolerant.

45-89%	1
90% or more	2

6. Reduce Overall Irrigation Demand by at least 20% (maximum 6 points, as specified in Table 3). Design the landscape and irrigation system to reduce overall irrigation water usage. The estimates must be calculated and prepared by a landscape professional, biologist, or other qualified professional using the methods outlined below.
7. Table 3. Reduction in Water Demand.

reduction in estimated irrigation water usage	SS 2.5 points	WE 2.3 points	Total Points
20-24%	2	0	2
25-29%	3	0	3
30-34%	4	0	4
35-39%	5	0	5
40-44%	6	0	6
45-49%	6	1	7
50-54%	6	2	8

55-59%	6	3	9
60% or more	6	5	10

8. Method for calculating reduction in irrigation demand
   a. Step 1. Calculate the baseline irrigation water usage. Baseline Usage = Landscaped Area m*ET*0.62 where ET = Baseline Evapotranspiration Rate (available from local and state Department of Agriculture).
   b. Step 2. Calculate the design case irrigation water usage: Design Case Usage = (Landscape Area *ET + IE) *CF *0.62 where ET = ET *K and K = K *K. Refer to Tables 4 and 5 for values for K and KK and to Table 6 for values for IE. For CFm use estimated value based on manufacturers specifications for percentage water savings
   c. Step 3. Calculate the percentage reduction in irrigation water usage. Percentage Reduction = (1- Design Case Usage / Baseline Usage) *100
   d. Step 4: Refer to Table 3, above to determine points earned.
9. Table 4 Species Factor

Vegetation Type	Species factor (k)		
	Low	Average	High
Trees	0.2	0.5	0.9
Shrubs	0.2	0.5	0.7
Groundcover	0.2	0.5	0.7
Turf	0.6	0.7	0.8

10. Table 5 Microclimate Factor

Example microclimate impacts	Microclimate Factor	(K)	
Shading	0.5	0.8	1.0
High sun exposure	1.0	1.2	1.5
Protection from wind	0.8	0.9	1.0
Windy Area	1.0	1.0	1.5

11. Table 6 Irrigation Efficiency

Irrigation type	Irrigation efficiency (IE)	
Fixed spray	0.4	0.6
Impact and microspray	0.5	0.7
Rotors	0.6	0.8
Multistream rotators	0.6	0.8
Low volume and point source (e.g. drip)	0.7	0.9

D. Synergies and Trade Offs. A project receiving points in SS 2.5 should also refer to WE 2.3. Any measures chosen in SS2 should be integrated with irrigation system design, which is addressed in WE 2. Rainwater and graywater reuse system (WE 1) should also be include din landscaping design.

2.11 SS3: LOCAL HEAT ISLAND EFFECT

A. Intent: Design landscape features to reduce local heat island effect.

B. Prerequisites: None

C. Credits:
   1. Revise Local Heat Island Effects (1 point). Do one of the following:
      a. Locate trees or other plants or provide shading for at least 50% of side-walks, patios, and driveways within 50 feet of the home. Shading should be calculated for noon on June 21, when the sun is directly overhead, based on five years' growth.
      b. Install light colors, high albedo materials or vegetation for at least 50% of sidewalks, patios, and driveways within 50 feet of the home. Acceptable strategies include the following
         1) white concrete;
         2) gray concrete;
         3) open pavers (counting only vegetation, not the pavers); and
         4) any material with a solar reflectance index (SRI) of at least 29.

D. Synergies and Trade Offs. Shading landscapes around the home can reduce irrigation needs as well as temper the home's outdoor environment and reduce cooling load. Providing shade is addressed in two other credits (EA1.2 (Exceptions Energy Performance) and SS4.2(b) and (c) (Vegetated Roof). Locating fences, trees, shrubs, or other plantings appropriately can capture deflect seasonal breezes.

E. Calculations: At least 50% of the sidewalks, patios, and driveways must be shaded or compromised of materials that meet the requirements of part (b). For multi-home developments, common roads should not be included in this calculation. Use one of the following calculations.
   1. Percentage of Non roof Shaded Hardscape = Shaded Area of Hardscape / Total Area of Hardscape. Where shaded Area is the area in shade at noon on June 21 at five year's growth. Assume that the sum is directly overhead. S estimating may be necessary to terminate the coverage expected by the vegetation of five years' growth. Additional methods for meeting the requirements include: Parking that is beneath the home or under a vegetated deck, or lower levels of a multi-level garage.
   2. Percentage of Non roof Light-Colored Hardscape = Light-Colored Hardscape / Total Area o Hardscape where light-colored materials include white concrete, vegetation between pavers, or any material with an SRI of 29 or more.

F. Supporting Verification Materials made available by the Project Team:
   1. Present calculations to the Verification Team demonstrating the percentage of the sidewalks, patios, and driveways that is shaded, high albedo, and/or vegetated.
   2. For part (b) present specifications or test results demonstrating the SRI Value.
   3. Sign an Accountability Form to indicate that any shading designs or materials Choices meet the requirements of the credit.

G. Verification Team
   1. Visually verify that the calculations are completed.
   2. Conduct on-site verification of trees and plantings installed to provide shade, and high-albedo products, as per the calculations provided.Verify that an Accountability Form has been signed by the responsible party.

2.12 SS4: SURFACE WATER MANAGEMENT

A. Intent: Design site features to minimize erosion and runoff from the home site.

B. Prerequisite: None

C. Credits *(None: Certain surface water management strategies may be regulated, restricted, or even prohibited by local water authorities or code requirements).*
   1. Permeable Lt (maximum 4 points, as specified in Table 1). Design the lot such that at least 70% of the buildable land, not including area under roof, is permeable or designed to

capture water runoff for infiltration on site. Area that can be counted toward the minimum includes the following:

a. Vegetative landscaping (e.g. grass, trees, shrubs).
b. Permeable paving, installed by an experienced professional. Permeable paving must include porous above ground materials (e.g. open pavers, engineered products) and a 6-inch porous subbase, and the base layer must be designed to ensure proper drainage away from the home.
c. Impermeable surfaces that are designed to direct all runoff toward an appropriate permanent infiltration feature (e.g. vegetated swale, on-site rain garden, or rainwater cistern).

2. Permanent Erosion Controls (1 point Design and install one of the following permanent erosion control measures:
   a. If portions of the lot are located on a steep slope, reduce long-term runoff effects through use of terracing and retaining walls. OR
   b. Plant one tree, four 5 gallon shrubs, or 50 square feet of native groundcover per 500 square feet of disturbed lot area (including area under roof).
3. Management of Runoff from Roof (maximum 2 points) Design and install one or more of the following runoff control measures:
   a. Install permanent stormwater controls (e.g. vegetated swales, on-site rain garden, dry well, or rainwater Cistern) designed to manage runoff from the home (1 point).
   b. Install vegetated roof to cover 50% of the roof area (0.5 points) OR
   c. Install vegetated roof to cover 100% of the roof area (1 point).
   d. Have the site designed by a licensed or certified landscape design or engineering professional such that all water runoff from the home is managed through an on-site design element (2 points).
4. Table 1 Permeable Area

Percentage of buildable land (excluding area under roof) that is permeable	Points
70-79	1
80-89	2
90-99	3
100	4

D. Synergies and Trade Offs. SS1.1 addresses erosion control during construction. Trees, shrubs, or groundcovers installed for erosion control can be designed as drought-tolerant or other preferable; see SS2 for more information on landscaping. Conventional turf is less permeable that other plantings and consequently less effective at managing runoff.

E. Calculations:
   1. SS4.1 Permeable Lot. Use the following steps:
      a. Step 1. Calculate the total buildable land area, not including the area under roof. The total buildable land includes the entire lot except areas that are unbuildable because of public right-of-way, etc.
      b. Step 2: Estimate the percentage of the area calculate dinS 1 that is vegetated, covered with permeable paving, and/or designed with runoff features, as per the credit requirement
      c. Step 3: Refer to table 3, above to determine points earned.
   2. Permanent Erosion Controls. No calculations are required for SS4.2(a). For SS4(b), calculate the number of trees, shrubs, or groundcovers plants as follows:
      a. Trees required = total disturbed lot area / 500 feet. OR
      b. Shrubs required = (total disturbed lot area /500 feet) x 4 OR
      c. Native groundcover plants required = 10% * total disturbed lot area. A combination of trees, shrubs, and groundcover can be used to meet the credit requirements. For

example, for a project with 4,000 square feet of disturbed land, the installation of two trees, eight 5 gallon shrubs, and 200 square feet of groundcover would earn 1 point. Trees installed should be mature enough to have a caliper (trunk thickness) of at least 1.5 includes. Also it is acceptable to use ten 2-gallon shrubs rater than four 5-gallon shrubs per 500 square feet.

F. Supporting Verification Materials, made available by the Project Team.
   1. Present calculations to the Verification team demonstrating the percentage of the built area that is permeable or designed with infiltration features.
   2. Sign an Accountability Form to include that the landscape features that have been installed match that in the design.

G. Verification Team:
   1. Visually verify that the calculations are completed.
   2. t on-site verification of permeable elements, as per the calculations provided.
   3. Verify that an Accountability Form has been signed by the responsible party.

2.13 SS 5: NONTOXIC PEST CONTROL

A. Intent: Design home features to minimize the ned for poisons for control of insects, rodents and other other pests.

B. Prerequisite: None

C. Credits:
   1. Pest Control Alternatives (1/2 point each, maximum 2 points). Implement one or more of the measures below. All physical actions (for pest management practices) must be noted on construction plans.
      a. Keep all wood (i.e. siding, trim, structure) at least 12 inches above soil (code typically requires 8 inches).
      b. Seal all external cracks, joints, penetrations, edges, and entry points with caulking. Where openings cannot be caulked or sealed, install rodent-and corrosion-proof screens (e.g. copper or stainless steel mesh). Protect exposed foundation insulation with moisture resistant, pest-roof cover (e.g. fiber cement board, galvanized insect screen).
      c. Include no wood-to-concrete connections or separate any exterior wood-to-concrete connections (e.g. at posts, deck supports, stair stringers) with metal or plastic fasteners or dividers.
      d. Install landscaping such that all parts of mature plants will be at least 24 inches from the home.
      e. In the area marked "moderate to heavy" through "very heavy" on the termite infestation probability map (Figure 1), implement one or more of the following measures (1/2 point each):
         1) Treat all cellulosic material (e.g. wood framing) with a borate product to a minimum of 3 feet above the foundation.
         2) Install a sand or diatomaceous earth barrier.
         3) Install a steel mesh barrier terminate control system.
         4) Install nontoxic terminate bait system.
         5) Use noncellulosic (i.e. not wood or straw) wall structures.
         6) Use solid concrete foundation walls or masonry wall with top course of solid block bond beam or concrete-filled block.

D. Synergies and Trade-offs: Limiting conventional turf and install native plants (SS2) can help reduce the need for fertilizers and pesticides that contain toxic chemicals. Keeping plants way from the home makes ir unnecessary to irrigate close tot he home and risk leaking moisture into the homes foundation. The thermal bypass inspection, required in the EA credit category, addressed cracks, joints, and penetrations in the building envelope. Toxic chemicals, frequently used to control pets in homes, expose occupants to harmful or hazardous chemicals and

practices. However, alternatives are available, Proper placement and installation of physical barriers can help protect homes from termites, ants, mice and other pests. This credit rewards homes that use one or more of the listed pest control alternatives to minimize the need for poisons.

E. Approach and Implementation: The first step in controlling pests is to access the risks associated with different pests. Identify the types of local pests and determine whether the project is in an area where termites are a problem. This assessment should be done as part of durability planning. Select from the following nontoxic pest control strategies during the design phase, since they may require an alternative construction approach. (1) Use solid concrete foundation walls or concrete filled blocks; (2) use noncellulosic wall structures.

2.14 SS6 COMPACT DEVELOPMENT

A. Intent: Make use of compact development patterns to conserve land and promote community livability, transportation efficiency, and workability.

B. Prerequisite: None

C. Credits:
   1. Moderate Density: (2 points). Build homes with an average housing density of 7 or more dwelling units per acre of buildable land. A single home on 1/7 acre buildable lot qualified OR
   2. High Density (3 points). Build homes with an average housing density of 10 or more dwelling units per acre of buildable land. A single home on 1/10 acre buildable lot qualified. OR
   3. Very High Density (4 points); Build homes with an average housing density of 20 or more dwelling units per area of buildable land. A single home on 1/20 acre buildable lot qualifies. *Note: Buildable Land Area if calculated as follows: (1) Exclude pubic streets or public right-of-way, land occupied by nonresidential structures, public parks, and land excluded from residential development by law; (2) For multiple-lot-developments, include only the sum of the lot areas for homes being built for LEED for Homes; (3) the numerator is the number f housing units in the project, and the denominator is the buildable and area included in the project (subject to the above exclusions). Both relate to the project only,not the surrounding area.*

D. Synergies and Trade Offs. SS1.2 is automatically granted to moderate, high, or very high-density homes because of the reduced impact of compact development.

E. Calculations: Calculate average housing density as follows, whether the project is a single home or a large development. Average Density = housing units / acres of buildable land. Note that buildable land includes subdivision covenant setbacks, unless they meet the exclusion requirements described in the Note for calculating buildable area.

F. Supporting Verification Materials, made available to the Project Team:
   1. Present calculations to the Verification Team demonstrating the average housing density of the project.

G. Verification Team:
   1. Visually verify the housing density calculations.

2.15 WE 1: WATER RESCUE

A. Intent: Use municipal recycled water or offset central water supply through the capture and controlled reuse of rainwater and/or gray water

B. Prerequisite: None

C. Credits: *(Note: Rainwater and graywater capture systems are subject to local codes and may require special permits. Note that the water quality should meet local standards, and consult manufacturers' recommendations to determine the compatibility of plumbing fixtures with*

graywater. Man states regulatory agencies require that water going into a toilet or sink meet possible water standards; builders should comply with local codes.

1. Rainwater Harvesting System (maximum 4 points, as specified in Table 1 below). Design and install a rainwater harvesting and storage system (including surface run-off and.or roof runoff) for landscape irrigation use or indoor water use. The storage system must be sized to hold all the water from a 1-inch rainfall event (equivalent to 0.62 gallons per square foot of a roof area used for capture), taking into consideration the size f the harvest system (ie. 50% or 75% of total roof area, depending on the measure chosen from Table 1 below). AND/OR
2. Graywater Reuse System (1 point). Design and install a graywater reuse system for landscape irrigation use (i.e., not s septic system) or indoor water use. The system must include a tank or dosing basin that can be used as part of the irrigation system. Graywater must be collected from at least one of the following:
   a. clothes washer;
   b. showers;
   c. some combination of faucets and other sources estimated to exceed 5,000 gallons per year OR
3. Use of Municipal Recycled Water System (3points). Design the plumbing such that irrigation system water demand is supplied by municipal recycled water. This is applicable only in Communities with a municipal recycled water program *(Note: A home using a municipal recycled water system cannot receive points under WE C.2 (Graywater Reuse System) or WE C.1 (rainwater Harvesting System) for outdoor applications.*
4. Table 1. Rainwater Harvesting

System Size	Application	Points
>/- 50% of roof area	indoor only	2
>/- 50% of roof area	outdoor only	3
>/- 75% of roof area	both indoor and outdoor	4

D. Synergies and Trade Offs: A project receiving for WE C.3 must skip WE C.1 and WE C.2, Rainwater harvesting and graywater reuse irrigation systems should be irrigated with resource-efficient landscape (SS2) and irrigation system design (WE2).

E. Calculations:
   1. Step 1: Determine the rainwater harvest system size as a percentage of the total area of the roof (including and porches and attached garage), using the following equation and referring to Table 1, above: System Size (%) = Harvest area / Total Roof Area For example, if the total roof area is 12,200 square feet and the system harvest water for 800 square feet, then the system is sized for 67% of the roof area and can earn either 2 or 3 points, depending on whether the water is used for indoor or outdoor applications.
   2. Step 2: Determine the minimum storage capacity requirement as follows: Storage Capacity = 0.62 GAl/Ft x Harvest Area. Where the rooftop harvest area is even in square feet. For example, if the rooftop harvest area is 800 square feet, the storage tank must be at least 496 gallons (0.62 Gal/ft x 800 ft).

F. Supporting Verification Materials, made available by the Project Team:
   1. Present calculations for the rainwater harvesting system size and storage capacity to the Verification Team.
   2. Include any rainwater harvesting system equipment literature in the occupant's operation and maintenance manual.

G. Verification Team:
   1. Visually verify that all calculations recalculated tot his credit are completed.
   2. Visually verify that the rainwater harvesting system has been installed.

2.16 WE 2: IRRIGATION SYSTEM

A. Intent: Minimize outdoor demand for water through water-efficient irrigation.

B. Prerequisite: None

C. Credits *(Note: Points shown below are for irrigation systems installed throughout te designed landscape. If only 50% of the designed landscape includes these measures, then only 50% of the points are available. Even if part of the yard is not landscaped, the irrigation system must be stubbed to that part of the yard, as appropriate.*

1. High Efficiency Irrigation System (1 point each, maximum 3 points). Design and install a high-efficiency irrigation system (based on overall landscaping plans, including measures adopted in SS2) such that any of the following are met:
   a. Install an irrigation system designed by the EPA WaterSense certified professional.
   b. Design and install an irrigation system with head-to-head coverage.
   c. Install a central shut-off valve.
   d. Install a submeter for the irrigation system.
   e. Use drip irrigation for at least 50% of landscape planting beds to minimize evaporation.
   f. Create separate zones for each type of bedding area based on watering needs.
   g. Install a timer or controller that activated the valves for each watering zone at the best time of day to minimize evaporative losses while maintaining healthy plants and obeying local regulations and water use guide.
   h. Install pressure-regulating devices to maintain optimal pressure and prevent misting.
   i. Utilize high-efficiency nozzles with an average distribution uniformity (DU) of at least 0.70. This may include conventional rotors, multistream rotors, or high-efficiency spray heads, but the DU must be verified by manufacturer documentation or third-party tests. A point source (drip) irrigation system should be counted as having a DU of 0.80.
   j. Check valves in head.
   k. Install a moisture sensor controller or rain delay controller. For example, "smart" evapotranspiration controllers receive radio, pager, or Internet signals to direct the irrigation system to replace only the moisture that the landscape has lost because of heat, wind, etc. AND/OR
2. Third Party Inspection (1point). Perform a third-party inspection of the irrigation system in operation, including observation of all of the following:
   a. All spray heads are operating and delivering water only to intended zones.
   b. Any switches or shut off valves are working properly.
   c. Any timers or controllers are set properly.
   d. Any irrigation systems are located at least 2 feet from the home.
   e. Irrigation spray does not hit the home. OR
3. Reduce OVerall Irrigation Demand by at Least 45% (maximum 4 points, as specified in Table 1). Design the landscape and irrigation system to reduce the overall irrigation demand water budget. The estimates must be calculated and prepared by a landscape professional, biologist, or other qualified professional using the methods outlined below. *Note: A project must earn full points in SS 2.5 before receiving points for this credit.*
4. Table . Reduction in Water Demand

Reduction in estimated irrigation water usage	WE C.3 points	SS 2.5 points	Total points
45-49%	1	6	7
50-54%	2	6	8
55-59%	3	6	9
60% or more	4	6	10

D. Methods for calculating reduction in irrigation demand.
   1. Step 1: Calculate the baseline irrigation water usage: Baseline Usage = Landscaped Area *ET *0.62 where ET - Baseline Evapotranspiration Rate (available from local and state departments of agriculture).
   2. Step 2: Calculate the design case irrigation water usage: Design Case Usage - (Landscaped Area *ET / IE0 *CF *0.62 where ET = ET * K and K = K *K. Refer to Tables 2 and 3 for values for K and K and to table 4 for values for IS. For CF, use estimated value based on manufacturer's specifications for percentage water savings.
   3. Step 3: Calculate the percentage reduction in irrigation water usage: Percentage Reduction = (1-Design Case USage / Baseline Usage) * 100
   4. Step 4: Refer to Table 1, above, to determine points earned.
   5. Table 2. Species Factor

	Species Factor (K)		
Vegetation Type	Low	Average	High
Trees	0.2	0.5	0.9
Shrubs	0.2	0.5	0.7
Groundcover	0.2	0.5	0.7
Turf	0.6	0.7	0.8

   6. Table 3. Microclimate Factor

	Microclimate Factor (K)		
Example microclimate impacts	Low	Average	High
Shading	0.5	0.8	1.0
High sun exposure	1.0	1.0	1.5
Protection from wind	0.8	0.9	1.0
Windy Area	1.0	1.2	1.5

   7. Table 4. Irrigation Efficiency

	Irrigation Efficiency (IE)	
Irrigation Type	Low	High
Fixed Spray	0.4	0.6
Impact and microspray	0.5	0.7
Rotors	.6	0.8
Multistream rotators	0.6	0.8
Low volume and point source (e.g. drip)	0.7	0.9

E. Synergies and Trade offs: A project receiving points for WE C.3 must skip WE C.1 and C.2. A project receiving points for WE C.3 must achieve full points in SS 2.5. This irrigation system design must address all aspects of the landscape design, including any features from SS2, as well as any rainwater harvesting or graywater reuse system (WE 1).

F. Supporting Verification Materials,made available by the Project Team:
   1. Present any system equipment information and design plans to the Verification Team.
   2. Include any system equipment information in the occupants operations and maintenance manual.
   3. Sign an Accountability form to indicate that the installed system meets the requirements of the credit.

G. Verification Team:
   1. Where appropriate, visually verify that all applicable elements of the irrigation system (e.g. controls, sensors, meters) are installed.
   2. Verify that an Accountability Form has been signed by responsible party.
   3. Conduct an on-site verification that the irrigation system is operating.
   4. If performed by someone other than the Verification Team, verify that an Accountability Form has been signed by the responsible party.

2.17 WE 3: INDOOR WATER USE

A. Intent: Minimize demand for water through water-efficient fixtures and fittings.

B. Prerequisites: None

C. Credits: *Note: Compensating shower valves and conventional,non-compensating shower valves may not work property when low-flow shower heads (restricting water flow below 2.5 gpm) are installed. Installing low-flow showerhead where compensating valves or conventional, non-compensating valves are installed can increase the risk of scalding (or other type of injuries,such as slips and falls due to thermal shock) when the plumbing system experiences pressure changes. Make sure any low-flow showerhead is installed with a valve that has been designed, tested,and verified to function safely at the reduced flow rate. If in doubt, consult the manufacturer of the value before installing a low-flow showerhead.*
   1. High-Efficiency Fixtures and Fittings (1 point each, maximum 3 points). Meet one r more of the following requirements by installing high-efficiency (lo-flow) fixtures or fittings. A project cannot earn points in both WE C.1 and WE C.2 for the same fixture type (e.g faucets, shower or toilet).
      a. The average flow rate for all lavatory faucets must be </- 2.00 gpm
      b. The average flow rate for all showers must be </- 2.00 gpm per stall.
      c. The average flow rate fr toilers must be </- 1.30 gpf. OR toilets must be dual-flush and meet the requirements of ASME A112.19.14 OR toilets must meet the U.S. EpA WaterSense specification and be certified and labeled accordingly.
   2. Very High Efficiency Fixture and Fittings (2 points each, maximum 6 points). Meet one or more of the following requirements by installing very high efficiency fixtures or fittings. A project cannot earn points in both we C.1 and WE C.2 for the same fixture type (e.g. faucets, shower or toilet).
      a. The average flow rate for all lavatory faucets must be </- 1.50 gpm OR lavatory faucets must meet the US EPA WaterSense specification and be certified and labeled accordingly.
      b. The average flow rate for all showers must be </- 1.75 gpm per stall.
      c. The average floor rate for all toilets must be </- 1.10 gpf.

D. Synergies and Trade Offs. Indoor water savings also can be achieved with more efficient water distribution systems and appliances. Points for indoor water distribution-related savings are available under EA 7.1, and points for appliance-related waste savings are available under EA9. Low flow shower heads and faucets will reduce demand for hot water and resulting energy use for water heading, Credits in EA 7 address water heating efficiency.

E. Calculations: If a project waste multiple fixtures and fittings with different efficiencies use a straight-line average to determine the overall average efficiency of each fixture type. For example, if two lavatory faucets have flow rates of 1.5 gpm and a third if rated for 2.1 gpm, the average overall flow rate is equal to (1.5+1.5+2.10/3, or 1.7 gallons per minute. For the purpose of this calculation, the flow rate of dual-flush toilets an be calculated using the flowing formula (high and low volumes mus be verified): Avg. volume = {(high volume flush) + 2*(low volume flush)}/3. Using this approach, dual-flush toilets can be used to meet WE C.2 if the average floor rate for all toilets in the home if </- 1.10 gpf. If the high and low volume cannot be verified, a value of 1.25 gallons per flush must be used. Average flow rates must be calculated to the

hundredth place. For example, if the average flow rate is 1.13, this cannot be rounded down to 1.10.

F. Supporting Verification Materials,made available by the project team:
   1. Include any equipment literature in the occupant's operations and maintenance manual.

G. Verification Team:
   1. Visually verify that all fixtures and fittings meet the appropriate requirements.

2.18 EA 1: OPTIMIZE ENERGY PERFORMANCE

A. Intent: Improve the overall energy performance of a home by meeting or exceeding the performance of an ENERY STAR labeled home.

B. Prerequisite: Performance of ENERGY STAR for Home. Meet the performance requirements of ENERGY STAR for Homes, including third-party inspections.

C. Credits:
   1. Exceptional Energy Performance (maximum 34 points). Exceed the performance of ENERGY StAR for Homes. Use the equations below relating the Home Energy Standards (HERS) Index to the appropriate number of LEEd points.
      a. South LEED pts = {[Log (100 - HERS Index)]/0/024} - 48.3
      b. North- LEED pts = {[Log (100 -HERS Index)]/0.021} - 60.8
   2. Table 1. HERS Index and LEED Points:

HERS Index	IECC Climate Zones 1-5 Percent Above IECC 2004	LEED For Homes Points	HERS Index	IECC Climate Zones 6-8 Percent Above IECC 2004	LEED for Homes Points
100	0		100	0	
95	5		95	5	
90	10		90	10	
85	15		85	15	
84	16	2.0	84	16	
83	17	3.0	83	17	
82	18	4.0	82	18	
81	19	5.0	81	19	
80	20	6.0	80	20	
79	21	7.0	79	21	2.0
78	22	7.5	78	22	3.0
77	23	8.5	77	23	4.0
76	24	9.0	76	24	5.0
75	25	10.0	75	25	6.0
74	26	10.5	74	26	6.5
73	27	11.6	73	27	7.5
72	28	12.0	72	28	8.0
71	29	12.5	74	29	9.0
70	30	13.0	70	30	9.5
69	31	14.0	69	31	10.0
68	32	14.5	68	32	11.0
67	33	15.0	67	33	11.5
66	34	15.5	66	34	12.0
65	35	16.0	65	35	12.5
64	36	16.5	64	35	13.5
63	37	17.0	63	37	14.0

62	38	17.5	62	38	14.5
61	39	18.0	61	39	15.0
60	10	18.5	60	40	15.5
55	45	20.5	55	45	18.0
50	50	22.5	50	50	20.0
45	55	24.2	45	55	22.0
40	60	26.0	40	60	24.0
35	65	27.0	35	65	25.5
30	70	28.5	30	70	27.0
25	75	30.0	25	75	28.5
20	80	31.0	20	80	30.0
15	85	32.0	15	85	31.0
10	90	33.0	10	90	32.0
5	95	33.5	5	95	33.0
0	100	34.0	0	100	34.0

D. Synergies and Trade Offs: A project receiving points for this credit must skip credits EA2-6, 7.3 and 8-10. Passive solar designs mus be modeled and can take credit using the approach load out in EA 1. Shading and the reduction of local heat island effects (SS 3) can reduce energy demands for space cooling. Similarly vegetated roofs (SS4.3) can reduce both space heating and cooling loads. HIgh efficiency appliance and fixtures (WE 3) can reduce hot water demand. Reduced framing (MR 1) can allow for more insulation and fewer thermal breaks. Proper design and verification of space heating and cooling distribution systems (EQ6) can help provide thermal comfort with minimized waste. In hot and humid climates, effective dehumidification (EQ3) can significantly reduce cooling loads.

E. Supporting Verification Material, made available by the project team:
   1. Present any equipment or product literature (e.g. user manuals brochures, specifications) related to the energy-consuming systems and energy-saving components (e.g. HVAC equipment, windows, insulation, appliances) to the Verification Team.
   2. Include all equipment literature in the occupant's operations and maintenance manual.

F. Verification Team:
   1. Complete the verification requirements for an ENERGY STAR home, including thermal bypass (insulation) inspection, envelope air leakage testing with a blower door, and duct leakage testing with a duct pressurization fan.
   2. Visually verify all energy-consuming systems and energy-savings components (e.g. HVAC equipment, windows, insulation, appliances) at the home site. Document the relevant metrics (e.g., efficiencies, R-values, percentage fluorescent lights) and provide them to the qualified qualified energy rater for modeling.
   3. Conduct the necessary modeling to produce a HERS index, or have a qualified energy rater conduct the necessary modeling. Verify that the HERS index for the home meets or exceeds the prerequisite.
   4. Include a coy of the HERS rating report in the project documentation file and the occupant's operation and maintenance manual.

2.19 EA 2: INSULATION

A. Intent: Design and install insulation to minimize heat transfers and thermal bridging.

B. Prerequisites:
   1. Basic Insulation. Meet all the following requirements:
      a. Install insulation that meets or exceeds the R-value requirements listed in Chapter 4 of the 2004 International Energy Conservation Code. Alternative wall and insulation systems, such as structural insulated panels (SIPs) and insulated concrete forms (ICFs), must demonstrate a comparable R-value, but thermal mas or infiltration effects cannot be included in the R-value calculation.

b. Install insulation to meet the Glade II specifications set by the National Home Energy Rating Standards (table 1). Installation must be verified by an qualified energy rater or verification team conducting a predrywall thermal bypass inspection, as summarized in Figure 1. *Note: For any portion of the home constructed with SIP's or ICF's, the rater must conduct a modified visual inspection using the ENERGY STAR Structural Insulated Panel Visual Inspection Form.*

C. Credits:
1. Enhanced Insulation (2 points). Meet the following requirements:
a. Install insulation that exceeds the r-value requirements listed in Chapter 4 of the 2004 International Energy Conservation Code by at least 55. Alternative wall and insulation systems, such as structural insulated panels (SIPs) and insulated concrete forms (ICFs), must demonstrate a comparable R-value,but thermal mass or infiltration effects cannot be included in the R-Value calculation.
b. Install insulation to meet the Grade I specifications set by the National Home Energy Rating Standards (Table 1) Installation must be verified by an qualified energy rater or Verification Team conducting a predrywall thermal bypass inspection as summarized in Figure 1. *NOTE: For any portion of the home constructed with SIPs or ICFs, the rater must conduct a modified visual inspection, using the ENERGY StAR Structural Insulated Panel Visual Inspection Form.*

D. Synergies and Trade Offs: A project receiving points for EA 1 is not eligible for this credit, and vice versa. A project pursuing this credit must following the prescriptive pathway and all of the associated prerequisites in EA 2-10. prerequisites for EA 1.1 should be skipped. See the pathway schematic at the beginning of the EA section. MR1.2-1.5 address framing efficiency. efficient framing can create additional spacing in wall cavities, reducing thermal breaks and insulation compaction. Environmentally preferable insulation is awarded in MR 2.2.

E. Table 1. Summary of HERS Installation Grades

Grade	Description
I	Meet the requirements of Grade II (below), but allow only very small gaps, and compression incomplete fill amounts to 2% or less.
II	Moderate to frequent installation defects, gaps around wiring, electric outlets, etc. and incomplete fill amount to 10% or less. Gaps running clear through the insulation amount to no more than 2% of the total surface area covered by the insulation. Wall insulation is enclosed on ll six sides and in substantial contact with the sheathing material on at least one side (interior or exterior) of the cavity.

F. Figure 1. ENERGY STAR Thermal Bypass Inspection Checklist.

G. Calculations: No calculations are needs for this credit unless the insulation values are averaged. In this case, an overall thermal conductance can be calculated by hand or demonstrated using the RESCHECK software.

H. Supporting Verification Materials,made available by the project team:
1. If using RESCHECK to demonstrate overall performance, provide calculations to the Verification Team.

I. Verification Team:
1. Visually inspect the installation of insulation, per the thermal bypass insulation checklist, to confirm that the requirements have been met.
2. If manual calculations or the RESCHECK software is used to demonstrate overall performance, visually verify the calculations.

2.20 EA 3: AIR INFILTRATION

A. Intent: Minimize energy consumption caused by uncontrolled air leakage into and out of conditioned spaces.

B. Prerequisites:
   1. Reduced Envelope Leakage. Meet the air leakage requirements shown in Table 1. The air leakage rate must be tested and verified by an qualified energy rater.

C. Credits:
   1. Greatly Reduced Envelope Leakage (2 points). Meet the air leakage requirements shown in Table 1. The air leakage rate must be tested and verified by an qualified energy rater. OR
   2. Minimal Envelope Leakage (3 points). Meet the air leakage requirements shown in Table 1. The air leakage rae must be tested and verified by an qualified energy rater.

		Performance requirements (in ACH 50)		
LEED Criteria	ICC Climate Zones 1-2	ICC Climate Zones 3-4	ICC Climate ZOnes 5-7	ICC Climate Zones 8
EA 3.1 reduced Envelope Leakage (mandatory)	7.0	6.0	5.0	4.0
EA 3.2 Greatly Reduced Envelope Leakage (optional)	5.0	4.25	3.5	2.75
EA 3.3 Minimal Envelope Leakage (optional)	3.0	2.5	2.0	1.5

D. Synergies and Trade Offs: A project receiving points for EA 1 is not eligible for this credit, and vice versa. A project pursing this credit must following the prescriptive pathway and meet all the prerequisites in EA 2-10. Prerequisite EA 1.1 should be skipped. See the pathway schematic at the beginning of the EA section. Natural air leakage through the envelope contributes to the overall ventilation ate of the home. From a health perspective, it is important to not under ventilate a home. From an energy perspective, it is also important not to over ventilate. EQ 4 addressed the balance between mechanical and natural ventilation.

E. Calculations: No calculations are needed for this credit if the blower door test produced a result in ACH 50. The ACH50 value can be calculated using the following formula: ACH 50-CFM 50x60 mins/hr /volume where the volume is measured in cubic feet.

2.21 EA 4 : WINDOWS

A. Intent: Maximize the energy performance of windows.

B. Prerequisites:
   1. Good Windows: Meet all of the following requirements:
      a. Design and install window and glass doors that have NFrC ratings that meet or exceed the window requirements of the ENERGY STAR for HOmes national Builder Option Package (Table 1).
      b. The ratio of skylight glazing to conditioned floor area may not exceed 3%. All skylights must meet the ENERGY STAR performance requirements for the skylights, but are exempt from the requirements of Table 1.
      c. HOmes in the Northern or North/Central climate zones that have a total window-to-floor area ratio (WFA) of 18% or more must meet a more stringent U-factor requirement (also applicable to EA 4.2 and 4.3): U-factor = [0.18/WFA]*[u-factory frm

Table 1]. *Note: Up to 0.755 of the window-to-floor area may be used for decorative glass or skylight area that does not meet the U-factor and SHGC requirements above.*

C. Credits:
   1. Enhanced Windows (2 points). Design and install windows and glass doors that have NFRC ratings that exceed the window requirements in the ENERGY STAR for Homes national Builder Option Package (Table 1). OR
   2. Exceptional Windows (3 points). Design and install windows and glass doors that have NFRC ratings that substantially exceed the window requirements in the ENERGY STAR for Homes national Builder Option Package (Table 1).

D. Synergies and Trade Offs: A project receiving points for EA 1 is not eligible for this credit, and vice versa. A project pursuing this credit must follow the prescriptive pathway and meet all of the prerequisites in EA 2-10. Prerequisite EA 1.1 should be skipped. See pathways schematic at the beginning of EA sections. Improving the window performance may also reduce heating and/or cooling loads and the energy associated with operating heating and cooling equipment.

		Energy Star Zone			
	Metric	Northern	North Central	South Central	Southern
EA 4.B.1 Good	U Factor	</- .35 any	>/-0.40	</- 0.40	</- 0.55
Window	SHGC		>/- 0.45	</- 0.40	</- 0.35

EA 4.B.2.	U-Factor	,/-0.31 any	</- 0.35	</-0.35	</-0.55
Enhanced	SHGC		</- 0.40	</-0.35	</-0.33
EA 4.B.2.	U-Factor	</-0.28 any	</-0.32	</-0.32	</-0.55
Exceptional	SHGC		</-0.40	</-0.30	</-0.30

E. Calculations:
   1. Calculations for this credit under the following circumstances:
      a. If the window-to-floor area ratio (WFA) exceeds 0.18, calculate the WFA using the following equation: WFA = Total Glazing Area (ft) / Total Conditioned Floor Area (ft).
      b. If the WFA exceeds 0.18, the requirements for the prerequisite and each credit change in the following ways. In the north and north central zones, meet the following requirements; U-factor (0.18/WFA)*(U-factor in table 1). In the Southern and South Central zone, meet the following requirement: SHGC = (0.18*WFA)/SHGC in table).
      c. If a solar screen is used to meter the SHGC requirements, the overall SHGC for a window unit with solar screen is determined by the following equation: SHGC (overall) = [(window SHGC) x (Solar Screen SHGC) x (percentage of area covered)] + (window SHGC x percentage of area not covered). For example, a window with an SHGC of 0.5 using a solar screen that provides 70% shading (the equivalent of 0.3 solar heat gain coefficient) and covers 60% of the window has an overall solar heat gain coefficient of SHGC(overall) = (0.5x0.3x0.6) + (0.5x0.4) = 0.09 + 0.20 = 0.29

F. Supporting Verification Materials, made available by the project team:
   1. Present any equipment literature (e.g. brochures, specifications) to the verification team.
   2. Present any calculations related to excess window area, solar screens, or U-value and SHGC averaging to the verification team.
   3. U-value and SHGC averaging to the verification team.

G. Verification Team:
   1. Verify that installed skylight area does not exceed 3% of conditioned floor area.
   2. Verify that installed skylights are ENErGY STAR labeled.
   3. Verify calculation for the window-to-floor area ratio.
   4. Verify that installed windows meet the U-value and SHGC specifications in the prerequisite and/or credits.
   5. Conduct on-site verification to confirm that installed product's match above plans, calculations and product literature.

2.22 EA 5: HEATING AND COOLING DISTRIBUTION SYSTEM

A. Intent: Minimize energy consumption due to thermal bridges and/or leaks in the heating and cooling distribution system.

B. Forced Air Systems: Prerequisites:
   1. reduced Distribution Losses. Meet the following requirements:
      a. Limit duct air leakage rate to outside the conditioned envelope. The tests duct leakage rate must be </-4.0 cfm at 25 Pascals per 100 square feet of conditioned floor area (for each installed system), verified by the qualified energy rater. Testing is waived if the home meets EA 5.C.1 (b) or (c).
      b. Do not install ducts in exterior walls unless extra insulation is added to maintain the overall UA for an exterior wall without ducts. Ducts may be run inside interior wall cavities but must be fully ducted (i.e., do not use the wall cavity as the duct).
      c. Use at least R-6 insulation around ducts in unconditioned spaces.

C. Credits:
   1. Greatly reduced Distribution Losses (2 points). Limit duct air leakage to outside the conditioned envelope. The tested duct leakage rate must be </- 3.0 cfm at 25 Pascals per

100 square feet of conditioned floor area (for each installed system), verified by the qualified energy rater. OR

2. Minimal Distribution Losses (3 points). Meet one of the following requirements:
   a. .Limit duct air leakage to outside the conditioned envelope. The tested duct leakage rate mus be ,/- 1.0 cfm at 25 Pascals per 100 square et of conditioned floor area, verified by the qualified energy rater.
   b. Locate the air-handler unit and all ductwork visibly within conditioned spaces (i.e. no ductwork hidden in walls, chases, floors, or ceilings).

D. Nonducted HVAC Systems (e.g. Hydronic Systems) Prerequisites:
   1. Reduced Distribution Losses. Use at least R-3 insulation around distribution pipes in unconditioned spaces.

E. Credits:
   1. Greatly Reduced Distribution Losses (2 points). Keep the system (including boiler and distribution pipes) entirely within the conditioned envelope.
   2. Minimal Distribution Losses (1point). Install outdoor rest control (i.e. controls that modulate distribution water temperature based on outdoor air temperature).

F. Synergies and Trade Offs. A project receiving points for EA 1.2 is not eligible for this credit, and vice versa. A project pursuing this credit must follow the prescriptive pathway and meet all of the prerequisites in EA 2-10. Prerequisite EA 1.1 should be skipped. S ee the pathway schematic at the beginning of the EA section. Eq6 required prior duct design to ensure adequate air flow and Includes credit for testing air flow into each room. MR 1.2-1.5 address framing efficiency. HVAC and framing efficiency are closely linked; floor, ceiling, and roof framing layouts should be designed to use framing material efficiently and at the same time accommodate duct runs as efficiently as possible. Addressing both simultaneously provides an opportunity to achieve multiple resource efficient through one design exercise. Prerequisite 10 prohibits the placement of ductwork in the garage.

2.23 EA 6: SPACE HEATING AND COOLING EQUIPMENT

A. Intent: Reduce energy consumption associated with the heating and cooling system.

B. Prerequisites: Good HVAC Design and Installation. Meet each of the following requirements:
   1. Design and size HVAC equipment properly using ACCA Manual J, the ASHrAE 2001 and book of Fundamentals, or an equivalent computation procedure.
   2. Install HVAC equipment that meets the requirements of the ENERGY SAR for Homes national Builder Option Package (Table 1).
   3. Install programmable thermostat (except heat pumps and hydronic systems).

C. Credits:
   1. High Efficiency HVAC (2 points) Design and install HAVC equipment that is better than the equipment required by the ENERGY STAR Builder Option Package (Table 1). OR
   2. Very High Efficiency HVAC (maximum 4 points). Design and install HVAC equipment that is substantially better than the equipment required by the ENERGY STAR Builder Option Package (Table 1). Any piping designed as part of the heat pump system to carry water that is well above (or below) the thermostatic temperature settings in the home must have R-4 insulation or greater. *Note: The maximum of 4 points is available only if a heat pump is installed. Furnace and boiler systems can earn a maximum of points.*

D. Synergies and Trade Offs: A project receiving points for eA 1 is not eligible for this credit, and vise versa. A project pursing this credit must follow the prescriptive pathway and meet all of the prerequisites in EA 2-10. Prerequisite EA 1.1 should be skipped. See the pathways schematic at the beginning of the EA section. Substantial energy savings can be achieved by using heat recovery equipment. Heat or energy recovery systems are rewarded in EQ 4.2.EQ 10 prohibits the placement of the air handler unit in the garage. EA11 requires a refrigerant charge test and encourages the selection of preferred refrigerants.

2.24 EA 7: WATER HEATING

A. Intent: Reduce energy consumption associated with the domestic hotwater system, including improving the efficiency of both the hot water systems sign and the layout of the fixtures in the home.

B. Prerequisites: None

C. Credits:

1. Efficient Hot Water Distribution (2 points). D Design and install an energy-efficient hot was distribution system (See figure 1). None of the branch length requirements below apply to cold water demand loads (e.g. toilets), washing machines or tubs without shower heads. Select on the following designs:
   a. Structured plumbing system. The system must meet all of the following:
      1) The system must have a demand-controlled circulation loop that is insulated to at least R-4.
      2) The total length of the circulation loop must be less than 4 linear feet of plumbing in one story homes. Add 2x the ceiling height for two story homes,and add 4x the ceiling height for three or for story homes.
      3) Branch lines from the loop to each fixture must be </- 10 feet long and a maximum of 1/2 inch nominal diameter.
      4) The system must be designed with a push button control in each full bathroom and the kitchen and an automatic pump shut-off.
   b. Central manifold distribution system. The system must meet all of the following:
      1) The central manifold trunk must be no more than 6 feet in length.
      2) The central manifold trunk must be insulated to at least R-4.
      3) No branch line from the central manifold to any fixtures may exceed 20 feet in one story homes. Add 1x the ceiling height for two story homes,and add 2x the ceiling height for three or four story homes.
      4) Branch lines from the manifold must be a maximum of 12/2 inch nominal diameter.
   c. Compact design of conventional system. The system must meet all of the following:
      1) No branch line form the water heater to any fixtures may exceed 20 feet in one-story homes. Add 1x the ceiling height for two story homes, and add 2x the ceiling height for three and four story homes.
      2) Branch lines from the central header to each fixture must be a maximum of 1/2inch nominal diameter.
2. Pipe Insulation (1 point). All domestic hot water piping shall have R-4 insulation. Insulation shall be properly installed on all piping elbows to adequately insulate the 90 degree bend.
3. Efficient Domestic Hot Water Equipment (maximum 3 pints). Design and install energy-efficient water heating equipment. S elect one measure from Table 1 below.

D. Calculations:

1. For EA C.1 determine the ceiling height by measuring the floor-to-floor distance. For EA C.1 part (a1), calculate the allowable length for the circulation loop based on the number of stories in the home. Calculate the length of pipe in the installed circulation loop.
2. For EA C.1, Parts (a3), (b3) and (c1), calculate the length of installed pipe from the circulation loop, manifold, or water heater to the furthest fixture Any 3/8" diameter piping should be counted at half the length of 1/2" diameter pipe when calculating maximum branch length; check local code for compliance.
3. For EA C.1 (c1) in a multi story home, the maximum allowable branch length differs for each story. Branches to 1st floor fixtures may not exceed 20 feet; branches to 2nd story fixtures may not exceed 20 feet + 1xthe story height; branches to 3rd story fixtures may not exceed 20 feet + 2x the story height, etc.

4. For EA C.3, if a solar water heater is installed, have the installer estimate the percentage of the total annual hot water load that will be met by the solar water heater, taking into consideration system design, climate and estimated consumption patterns.

E. Supporting Verification Materials, made available by the project team:
   1. EA C.1 Efficient Distribution System - Sign an Accountability Form to indicate that the hot water distribution system is installed according to the credit requirements.
   2. EA C.3 Efficient Domestic Hot Water Equipment
      a. Present any equipment literature related t the hot water distribution system (e.g. user manuals, brochures, Specifications) to the verification team.
      b. Include equipment literature in the operations and maintenance occupants manual.
      c. For a solar hot water heater, present calculations to the verification team demonstrating the percentage of the annual domestic hot water load being met.

F. Verification Team:
   1. EA C.3 Efficient Distribution System
      a. Visually verify the design of the hot water distribution system.
      b. Verify that an Accountability Form has been signed by the responsible party.
   2. EA C.2 Pipe Insulation
      a. Visually verify that pipes are insulated according to the credit requirements.
   3. EA C.3 Efficient Domestic Hot Water Equipment
      a. Visually verify (using equipment literature,labels, etc. the type of equipment installed and its efficiency.
      b. For a solar hot water heater, visually verify that the calculations meet the requirements.

2.25 EA 8: LIGHTING

A. Intent: Reduce energy consumption associated with interior and exterior lighting.

B. Prerequisite: ENERGY STAR Lights. Install at least four ENERGY STAR labeled light fixtures or ENERGY STAR labeled compact fluorescent light bulbs (CLFs) in high use rooms (kitchen, dining room,living room, family room, hallways).

C. Credits:
   1. Improving Lighting (1.5 maximum points). Select and install one or both of the following measures:
      a. Indoor lighting (0.5 points). Install three additional ENERGY STAR labeled light fixtures or ENERGY STAR labeled compact fluorescent light bulbs (CFLs) in high use rooms. These are in addition to the four ENErGY STAR lights required by EA 8.B.
      b. Exterior lighting (1 point). All exterior lighting must have either motion sensor controls or integrated photovoltaic cells. The following lighting is exempt: emergency lighting; lighting required by code for health and safety purposes; and lighting used for eye adaptation near covered vehicle entrances or exists. OR
   2. Advanced Lighting Package (3 points). Install ENERGY STAR Advanced Lighting Package using only ENERGY STAR labeled fixtures. The Advanced Lighting Package consists of a minimum of 60% ENErGY STAR qualified hard-wired fixtures and 100% ENERGY STAR qualified ceiling fans (if any) OR Install EnerGY STAR Labeled lamps in 80% of the fixture throughout the home. ENERGY STAR labeled CFLs are acceptable. All ceiling fans must be ENERGY STAR labeled.

D. Synergies and Trade offs: A project receiving points for EA 1 is not eligible for this Credit, and vice versa. A project pursuing this credit ,ust follow th prescriptive pathway and meet all the associated prerequisites in EA 2-10. prerequisite eA 1.1 should be skipped. See the pathway schematic a the beginning of the EA section. Improving the lighting efficiency may also reduce cooling loads and the energy consumption associated with air-conditioning.

E. Calculations; For EA 8.c, calculate the percentage of the home's light fixtures that are ENERGY STAR labeled OR calculate the percentage of the home's lamps (i.e. light bulbs) that are ENERGY STAR labeled.

2.26 EA 9: APPLIANCES

A. Intent: Reduce appliance energy consumption.

B. Prerequisite: None

C. Credits:
   1. High Efficiency Appliances (maximum 2 points). Install appliances from the list below. To receive points for one type (e.g. refrigerator), every appliance of that type must meet the applicable requirements below.
      a. ENERGY STAR labeled refrigerators (1 point)
      b. ENERGY STAR labeled ceiling fans (at least one in living or family room and one per bedroom) (0.5 points).
      c. ENERGY STAR labeled dishwasher(s) that uses 6.0 gallons or less per cycle (0.5 points).
      d. ENERGY STAR labeled clothes washer(s) (0.5 points).
   2. Water Efficient Clothes Washer (1 point). Install clothes washer with modified energy factor (MEF) <2.0 and water factor (WF) <5.5. A clothes washer that meets these requirements and the requirement of EA 9.C1 can be counted for both.

D. Synergies and Trade Offs: A project receiving points for EA 1 is not eligible for this credit, and vice versa. Ap project pursuing this credit must follow the prescriptive pathway and meet all the prerequisites in EA 2-10. Prerequisite EA 1.1 should be skipped. See the pathway schematic at the beginning of the EA section.

E. Supporting Verification Materials, made available by the project team:
   1. Present any equipment literature related to the appliances (e.g. use manuals, brochures, specifications) to the verification team.
   2. Include appliance literature in the occupant's operations and maintenance manual.

F. Verification Team
   1. Visually verify (using equipment literature, labels, etc.) the type of equipment installed and its efficiency.

2.27 EA 10: RENEWABLE ENERGY

A. Intent: Reduce consumption of nonrenewable energy sources by encouraging the installation and operation of renewable electric generation system.

B. Prerequisite: None

C. Credits:
   1. Renewable Energy System (maximum 10 points). Design and install a renewable electricity generation system. Use energy modeling to estimate both the energy supplied by the renewable energy system and the annual reference electrical load. Receive 1 point for every 3% of the annual referenced electrical load met by the system. Annual reference electric load is defined as the amount of electricity that a typical home (e.g. the HERS Reference Home) would consume in a typical year. the annual reference electric load must be determined using the procedures specified in the 2006 Mortgage Industry National Home Energy Rating Standards (HERS) Guidelines. For example: Annual reference electric load = 10,000 KWh; Annual electricity consumption in LEeD home = 7,000 KWh; Annual electricity supplied by renewable energy system = 1,800 KWh; Percentage of annual reference electric load supplied by renewable energy system = 1,800/0,000 = 18.0%; LEED points under EA 10 = 18.0 /3 = 6.0 points.

D. Synergies and Trade offs: A project receiving points for EA 1 is not eligible for this credit, and vice versa. A project pursuing this credit ust follow the prescriptive pathway and meet all of the

prerequisites in EA 2-10. Prerequisite EA 1.1 should be skipped. See the pathway schematic at the beginning of the EA section. Passive solar designs must be modeled and can take credit using the approach laid out in EA 1. Solar hot water heating systems are rewarded in EA 7.C.

E. Calculations: The number of points earned is not based on a traditional calculation of percentage of energy demand met by he system. Instead for the sake of consistency with the performance pathway and the HERS methodology, points are earned by comparing the renewable energy out-put (kWh) with the energy demand in a hypothetical reference home. This calculation requires four steps:
   1. Step 1: Have the renewable energy contractor estimate the annual electricity output of the system.
   2. Step 2: Have the qualified energy rater or Verification Team model the annual electricity demand of a HERS reference home.
   3. Step 3: Calculate the percentage of the annual reference electric load that is met by the renewable energy system.
   4. Step 4: Calculate the number of LEED points earned, where 1 point is awarded for every 3% of the total annual reference electric load that is met by the renewable energy system.

F. Supporting Verification Materials made available by the project team:
   1. Present any equipment literature related to the renewable energy system (e.g., user manuals, brochures, specifications) to the Verification Team.
   2. Present calculations and/or modeling results to the Verification Team demonstrating the percentage of annual reference electric load being met by the renewable energy system.
   3. Include equipment literature in the occupant's operations and maintenance manual.

G. Verification Team:
   1. Visually verify the renewable energy system on-site.
   2. Visually verify that the calculations meet the requirements.
   3. Verify that an Accountability Form has been signed by the responsible party.

2.28 EA 11: RESIDENTIAL REFRIGERANT MANAGEMENT

A. Intent: Select and test air-conditioning refrigerant to ensure performance and minimize contributions to ozone depletion and global warming.

B. Prerequisites:
   1. Refrigerant Charge Test. Provide proof of proper refrigerant charge of the air-conditioning system (unless home has no mechanical cooling system).

C. Credits:
   1. Appropriate HVAC Refrigerant (1 point). Do one of the following:
      a. Do not use refrigerant.
      b. Install an HVAC system with non-HCFC refrigerant (e.g. R-410a).
      c. Install an HVAC system with a refrigerant that complies with the following equation (see table 1 for examples of the equation applied to R410a used in different system sizes). LCGWP+LCODPx10^5<160 where LCODP=[ODPrx(Lr*Life+Mr)xRc]/Life; LCGWP=[GWPr*(Lr*Life+Mr)*Rc]/Life; LCODP=Lifecycle Ozone Depletion Potential (lb CFC11/ton-year); LCOwP= Lifecycle Direct Global Warming Potential (lb CO/ton-year); GWPr=Global Warming Potential of Refrigerant (0-12,000 lb CO/lbr); ODPr= Ozone Depletion Potential of Refrigerant (0-0.2 lb CFC11/lbr); Lr = Refrigerant Leakage Rate (0.5-2.0%; default of 2% unless otherwise demonstrated); Mr=End-of-life Refrigerant Loss (2.0-10%; default of 10% unless otherwise demonstrated); Rc=Refrigerant Charge (0.50-5.0 lbs of refrigerant per ton of cooling capacity); Life - Equipment Life (10-35 years; default based on equipment type,unless otherwise demonstrated).

D. Synergies and Trade offs: Efficient air-conditioning systems are covered under EA 6. This credit is available to every project, whether the performance approach (EA1) or the prescriptive approach (EA 2-10) is used.

E. Table 1. Examples of Residential Refrigerants Eligible for EA 11.2.

refrigerant	combined LCGWP+LC ODP score	system size	refrigerant charge	leakage rate	equip life
R401a	152	2 ton	3.7 lb/ton	1.5%	15 years
R410a	151	3ton	3.0 lb/ton	2.0%	15 years
R410a	151	4 tons	3.0 lb/ton	2.0%	15 years
R410a	121	5 tons	3.0 lb/ton	2.0%	15 years

F. Calculations: No calculations are needed for this credit if R410a is used. Otherwise, use the equation to determine whether the selected HVAC refrigerant qualified.

G. Supporting Verification Materials, made available by the project team:
   1. EA 11.C.1 Refrigerant Charge Test: Present the refrigerant charge test results tot he verification team.
   2. EA 11.C.2 Appropriate HVAC Refrigerants: Present information elated to the type of refrigerant (e.g. cooling system user manuals, brochures, specifications) to the verification team.

2.29 WR 1 : MATERIAL EFFICIENT FRAMING:

A. Intent: Optimize the use of framing materials.

B. Prerequisites:
   1. Framing Order Waste Factor Limit: Limit the overall estimated water factor to 10% or less. If the water factor on any portion of the framing order exceeds 10%, calculate the overall waste factor shown in Table 1. Waste factor is defined as the percentage of framing material ordered in excess of the estimated material needed for construction.

Framing component	total cost	waste factor	waste cost
random lengths	$1,000	15%	$150
studs	$2,000	5%	$100
beams and headers	$500	20%	$100
roof deck	$2,000	0%	$0
wall sheathing	$0	0%	$0
rafters	$2,000	0%	$0
ceiling joists	$1,500	10%	$150
Cornice work	$3,000	10%	$300
Total	$12,000		$1,000
Overall waste factor	waste $/cost $		8.35

C. Credits:
   1. Detailed Framing Documents (1 point). Prior to construction, create detailed framing plans or scopes of work and accompanying architectural details for use on the job site. Indicate the specific locations, spacing, and sizes of all framing members in the floors, walls, roof, and ceiling (if different from the roof).
   2. Detailed Cut List and Lumber Order (1 point). The requirements in MR 1.2 mus be met to earn this credit. Prior to construction, create a detailed cut list and number order that corresponds directly to the framing plans and/or scope of work AND/OR
   3. Framing Efficiencies (maximum 3 points). Implement measures from table 2. OR
   4. Off Site Fabrication (4 points). Use either of the following alternatives to on-site framing:
      a. Panelized construction. Wall, roof, and floor components are delivered to the job site preframes.

b. Modular, prefabricated construction. All principal building sections are delivered to the job site as prefabricated modules.

Measure	Points
precut framing packages	1.0
open-web floor trusses	1.0
structural insulated panel (SIP) walls	1.0
SIP roof	1.0
SIP floors	1.0
Stud spacing greater than 16" o.c.	1.0
ceiling joists spacing greater than 16" o.c.	0.5
Floor joist spacing greater than 16"o.c.	0.5
roof rafters spacing greater than16" o.c.	0.5
implement any two of the following: size headers for actual load use ladder blocking or drywall clips use 2-stud corners	0.5

c. *Note: Alternative measures not listed n Table 2 may be eligible to earn points if they save comparable amounts of framing material. A formal credit interpretation request with full justification of any alternative measure's potential savings must be submitted by the Provider to USGBC.*

D. Synergies and Trade Offs: Reduced framing can reduce the number and size of thermal breaks and increase the amount of insulation installed, leading to better energy performance (EA 1 and 2). Credit MR 1.2 is a prerequisite for MR 1.3.A. A home that earns points for MR 1.2, 1.3 and 1.4 cannot earn points for MR 1.5 and vic versa. Optimizing the use of framing will educe the amount of construction waste (MR 3.2).

E. Calculations: Waste factor is designed as the percentage of material purchased for a project that is planned to be waste. Waste Factor = (Lumber Ordered - Lumber Needed) / Lumber Needed. The waste factor can be calculated based on total material (board feet of wood) or total cost. Individual framing components may exceed 10% waste, but the overall waste factor must be less than 10%. A sample calculation is provided in Table 2. Post construction calculations of actual framing waste are ot required, except as part of the total waste management assessment for MR 3.1.

F. Supporting Verification Materials, made available by the project team: Present calculations for the framing waste factor to the verification team.

G. Verification Team: Visually verify that all calculations related tot he framing waste factor have been completed.

2.30 MR 2: ENVIRONMENTALLY PREFERABLE PRODUCTS

A. Intent: Increase demand for environmentally preferable products and products or building components that are extracted, processed, and manufactured within the region.

B. Prerequisites:

1. FSC Certified Tropical Wood. Meet the following two requirements, as applicable:
   a. Provide all wood product suppliers with a notice (see Figure 1, below) containing all of the following elements:
      1) a statement that the builder's preference is to purchase products containing topical wood only if it is FSC-certified.
      2) a request for the country of manufacture of each project supplied; and
      3) a request for a list of FSC-certified tropical wood products the vendor can supply.

b. If tropical wood is intentionally used (i.e., specified in purchasing documents), use only FSC certified tropical wood products. revised or reclaimed materials are exempt. *Note: A specified of wood is considered tropical for the purposes of this perquisite if it is grown in a country that lies between the Tropics of Cancer and Capricorn.*

2. Credits:
   a. Environmentally Preferable Products (0.5 points each, maximum 8 points). Use building component materials that meet one or more of the criteria below. Except as noted in Table 1, a material must make up 90% of the component, by weight or volume. A single component that meets each criteria (i.e., environmentally preferable, low emissions, and local sourcing) can earn points for each.
      1) Environmentally preferable products (0.5 points per component). Use projects that meet the specifications in Table 1. *Note: Recycled contact products must contain a minimum of 25% postconsumer recycled contact, except as noted in Table 1. Postindustrial (preconsumer) recycled contact must be counted at half the rate of postconsumer content. AND/OR*
      2) Low emissions (0.5 point per component). Use products that meet the emissions specifications in Table 1. AND/OR
      3) Local production (0.5 point per component). Use products that were extracted, processed, and manufactured within 500 miles of the home.
      4) Table 1.Environmentally preferable Products
      5) Figure 1 Example Notice to Wood Products Suppliers **Notice to Vendors**: [The company] is required to purchase products that contain tropical wood only if they are certified according to the guidelines of the Forest Stewardship Council (FSC). Please provide the country of manufacture of each product you expect to supply us.
      6) Table 2. Standards for Environmentally Preferable Paints and Coatings

Types of paints and coating	Applicable standard (VOC content)	references
Architectural paints, coatings, and primers applied to interior elements	Flats: 50 g/l	Green Seal Standard GS-11, Paints, 1st Edition, May 20, 1993
Anticorrosive and antitrust paints applied to interior ferrous metal substrates	250 g/l	Green Seal Standard GC-30, Anti-Corrosive Paints, 2nd Edition January 7, 1997
Clear wood finishes	Varnish: 350 g/l	South Coast Air Quality Management District Rule 1113, Architectural Coatings
Sealers	Waterproofing 250 g/l Sanding 270 g/l All others 200 g/l	
Shellacs	Clear 730 g/l Pigmented: 500 g/l	
Stains	250 g/l	

3. Synergies and Trade Offs: Products with low emissions of volatile organic compounds (VOCs) may improve indoor air quality. Such products are included in this credit rather than in the EQ section in order to consolidate information pertaining to materials selection, specification, and purchase. A substantial amount of energy is used to transport materials

from product manufacturing plans to home construction sites. Choosing local products will reduce the embedded transportation energy usage associated with construction.

4. Table 3. Standards for Low Emissions Adhesives and Sealants (meet South Coast Air Quality Management District Rule #1168).

Architectural applications	Applicable standard (VOC content, g/l less water)
Indoor carpet adhesives	50
Carpet pad adhesives	50
Wood flooring adhesives	100
Rubber floor adhesives	60
Subfloor adhesives	50
VCT and asphalt adhesives	50
Drywall and panel adhesives	50
Cove base adhesives	50
Multipurpose construction adhesives	70
Structural glazing adhesives	100
Ceramic tile adhesives	65
Specialty applications	
PVC welding	510
CPVS welding	490
ABS welding	325
Plastic cement welding	250
Adhesive primer for plastic	550
Contact adhesive	80
Special purpose contact adhesive	250
Structural wood member adhesive	140
Sheet-applied rubber lining operations	850
Top and trim adhesive	250
Substrate specific applications	
Metal to metal	30
Plastic foams	50
Porous materials (except wood)	50
Wood	30
Fiberglass	80
Sealants	
Architectural	250
Nonmembrane roof	300
Roadway	250
Single-ply roof membrane	450
Other	420
Sealant Primers	
Architectural nonporous	250
Architectural porous	775

C. Supporting Verification Materials, made available by the project team:
   1. Provide the required notice to all wood product suppliers.
   2. Present the wood supplier notice to the Verification Team.
   3. Sign the Accountability Form confirming that no tropical woods were used except those that were FSC certified or reclaimed.

D. Verification Team:
   1. Visually verify that the wood supplier notice has been provided to vendors and that it meets the stated requirements.
   2. Verify no wood used in this project if from a tropical country, unless FSC certified, using information provided by supplies and vendors.
   3. Verify that an Accountability Form has been signed by the responsible party.

2.31 MR 3: WASTE MANAGEMENT

A. Intent: Reduce waste generation to a level below the industry norm.

B. Prerequisites:
   1. Construction Waste Management Planning. Complete the following tasks related to management of construction waste:
      a. Investigate and document local options for diversion (e.g. recycling, reuse) of all anticipated major constituents of the project waste stream, including cardboard packaging and household recyclables (e.g. beverage containers).
      b. Document the diversion rate for construction waste. Record the diversion rate for land clearing and/or demolition, if applicable (e.g. on gut rehab project), separately from the rate for the new construction phase of the project.

C. Credits:
   1. Construction Waste Reduction (maximum 3 points). Reduce or divert waste generated from new construction activities from landfills and incinerators to a level below the industry norm. Use either of two options:
      a. Reduced construction waste. Generate 2.5 pounds (or 0.016 cubic yards) or less of net waste (not including waste diverted from reclamation or recycling) per square foot of building floor area. Use column 1 or 2 and column 5 of Table 1 to determine the score.
      b. Increased waste diversion. Divert 25% or more of the total materials taken off the construction site from landfills and incinerators. Use column 3 or 4 and column 5 of Table 1 to determine the score; calculate the percentage using either weight or volume. *Note: Land cleaning and demolition waste (e.g. from removal of preexisting structures on the site) should not be counted in this calculation.*

D. Synergies and Trade offs: Waste can be minimized by creating a detailed framing plan and using advanced framing techniques or off-site fabrication (MR1). The use of products with reclaimed or recycled content (MR2.2) reduces both the production of new materials and the burden on landfills.

E. Table 1. Waste Diversion

Amount of landfills and incinerators				
Reduced construction waste		Increased waste diversion		
Pounds/Ft	Cubic yds 1,000 ft	Percentage waste	Percentage diverted	Points
4.0	25.5	100%	0%	0.0
3.5	22.3	87.5%	12.5%	0.0
3.0	19.1	75%	25%	0.5
2.5	15.9	62.5%	37.5%	1.0
2.0	12.8	50%	50%	1.5
1.5	9.6	37.5%	62.5%	2.0
1.0	6.4	25%	75%	2.5
0.5	3.2	12.5%	87.5%	3.0

F. Calculations: Do not include demolition or land clearing debris. D Document the waste totals with receipts from the waste hauling company, or keep track f waste hauling totals using a simple inventory like that provided in Table 2.

G. Supporting Verification Materials,made available by the project team:
   1. Present documentation to the Verification Tea, of local waste diversion options.
   2. Present calculations to the Verification Team demonstrating construction waste diversion rates, using documentation from the waste management company.

H. Verification Team:
   1. Verify documentation of local waste diversion options.
   2. Verify calculations of construction waste diversion rate.

2.32 EQ 1: EPA INDOOR AIRPLUS

A. Intent: Improve the overall quality of a home's indoor environment by installing an approved bundle of air equality measures.

B. Prerequisites: None

C. Credits:
   1. EPS Indoor airPLUS (13 points). Complete all the requirements of the US environmental Protection Agency's EPA Indoor airPLUS (IAP).

D. Synergies and Trade Offs: A project receiving points for this credit may skip the prerequisites in EQ 2-10 and is not eligible to earn points in EQ 2.2 3, 4.3, 6, 8.1, 8.3, 9 and 10. Achieving the measures in EPA's Indoor airPLUS may qualify a home to receive points in other categories of the LEED for Homes Rating System. See Table 1 for equivalencies.

E. Table 1 Applicability of EPA Indoor airPLUS Measures to LEED for Homes

LEED for H omes prerequisite/credits	Relevant Indoor airPLUS measures	Applicability
Innovation n Design Process 2.1, 2.2	various	Meeting Indoor airPLUS specifications will address many durability issues listed in durability inspection checklist template.
Sustainable Sites 5	3.1, 3.2	Depending on project location, meeting indoor airPLUS specifications may earn up to 2 LEED points
Energy & Atmosphere 6.1 (a) and EA 11.1	4.1, 7.1	Meeting Indoor airPLUS specifications achieves prerequisites EA 6.1(a) and EA 11.1
Materials and Resources 2.2	6.1-6.3	Depending on project details, meeting Indoor airPLUS specifications may earn up to 2 LEED points.

F. Calculations: Please see the requirements of the EPA Indoor airPLUS for details.

G. Supporting Verification Materials, made available by the project team: Present EPA Indoor airPLUS certification to the verification team.

H. Verification Team: Verify that EPA Indoor airPLUS certification has been achieved.

2.33 EQ 2: COMBUSTION VENTING

A. Intent: Minimize the leakage of combustion gases into the occupied spaces of the home.

B. Prerequisite:
   1. Basic Combustion Venting Measures
      a. No unvented combustion appliances (e.g. decorative logs) are allowed.
      b. A carbon monoxide (CO) monitor must be installed on each floor.
      c. All fireplaces and woodstoves must have doors.
      d. Space and water heating equipment that involves combustion must meet one of the following. Space heating systems in homes located in IECC-2007 Climate zone 1 or 2 are exempt.
         1) it must be designed and installed it with closed combustion (i.e., sealed supply air and exhaust ducting);
         2) it must be designed and installed with power-vented exhaust; or
         3) it must be localized in a detached utility building or open-air facility

C. Credits:
   1. Enhanced Combustion Venting Measures (maximum 2 points). Install no fireplace or woodstove, or design and install a fireplace or woodstove according to the requirements in Table 1.

D. Conducting a Back-Draft Potential Test: Using the results from a blower-door test, measure the pressure difference created by the presence of a chimney-vented appliance. To ensure a limited risk of back-drafting, the pressure difference (P) must be less than or equal to 5 Pascals, where P = (Q/C) (must be ,/- 5 Pascals) and Q is equal to the sum of the rated exhaust provided by the two biggest exhaust appliances in the home, and C and n are both constants produced by the lower-door test results.

E. Synergies and Trade Offs: A project receiving points from EQ 1 is not eligible to earn points in EQ 2.2. A project pursuing EQ 2.2 must meet all the prerequisites in EQ 2-10.

F. Table 1. Fireplace and stove combustion venting requirements

	Enhanced combustion-venting	measures
fireplace or stove	better practice (1 point)	best practice (2 points)
none	see "best practice"	granted automatically
masonry wood burning fireplace	install masonry heater as designed by American Society for Testing and Materials Standard E-1602 and International Building Code 2112.1	Meet requirements for "better practice", and conduct back-draft potential test to ensure
factory built wood burning fireplace	Install equipment listed by approved safety testing facility (e.g. UL, CSA, ETL) that either is EPA certified or meets the following: equipment with catalytic combustor must emit less than 4.1 g/hr of particulate matter, and equipment without catalytic combustor must emit less than 7.5 g/hr of particulate matter.	Meet requirements for better practice and conduct back-draft potential test to ensure P </- 5 Pascals (see conducting a back draft potention test below>
Woodstove and fireplace inserts	Install equipment listed by approved safety testing facility that either is EPA certified or meets following requirement: equipment with catalytic combustor must emit less than 4.1 g/hr of particulate matter, and equipment without catalytic combustor must emit less than 7.5 g/hr of particulate matter.	Meet requirement for better practice, and conduct back draft potential tet to ensure P>/- Pascals (see conducting a back-draft potential test, below).

Natural gas, propane, or alcohol stove.	install equipment listed by approved safety testing facility that is power-vented or direct-vented and has permanently fixed glass front or gasketed door.	Meet requirement for better practice, and include electronic (not standing) pilot.
Pellet stove	Install equipment that is either EPA certified or listed by approved safety testing facility to have met requirements of ATM E 1509-04, "Standard Specification for Room Heaters, Pellet Fuel-Burning Type".	Meet requirement for better practice and include power venting or direct venting.

2.34 EQ 3: MOISTURE CONTROL

A. Intent: Control indoor moisture levels to provide comfort, reduce the risk of mold, and increase the durability of the home.

B. Prerequisite: None

C. Credits:
   1. Moisture Load Control (1 point). Install dehumidification equipment with sufficient latent capacity to maintain relative humidity at or below 60%. Th is must be achieved through one of the following:
      a. Additional dehumidification system(s).
      b. A central HVAC system equipped with additional controls to operate in dehumidification mode. *Note: LEED for Homes does not encourage active dehumidification for all projects. Work with the HVAC contractor to determine whether this credit is appropriate and/or necessary.*

D. Synergies and Trade Offs: A project receiving points for EQ 1 is not eligible to earn points in EQ 3. A project pursuing EQ 3 must meet all of the prerequisites in EQ 2-10. Water leakage through the building envelope can cause mold and other indoor environmental problems. Improved foundation, exterior walls, and roof water management should be addressed in the durability inspection checklist (ID 2). In hot and humid climates, dehumidification can reduce the energy demands associated with air-conditioning (EA 1,6).

E. Calculations: An engineer or HVAC contractor should use infiltration and ventilation rates to calculate the amount of moisture removed in inter and added in summer. Use this estimate, together with industry estimates (e.g, ASHrAE data) of indoor moisture loads from occupants, to determine whether moisture control measures in addition to dehumidistats and advanced thermostats are necessary. Even he best calculations, however, require assumptions about occupant loads and design infiltration rates that may not reflect actual conditions. Calculations for this credit therefore cannot guarantee adequate moisture control in individual houses under all circumstances.

F. Supporting Verification Materials, made available by the project team:
   1. Present calculations of latent capacity to the Verification Team.
   2. Include dehumidification equipment literature in the occupant's operations and maintenance manual.

G. Verification Team:
   1. Visually verify that all calculations related to latent capacity are completed.
   2. Visually verify all applicable equipment in the home.

2.35 EQ 4: OUTDOOR AIR VENTILATION

A. Intent: reduce Occupancy exposure to indoor pollutants by ventilating with outdoor air.

B. Prerequisites:

1. Basic Outdoor Air Ventilation. Design and install a whole building ventilation system that complies with ASHrAE Standard 62.2-2007. A summary of alternatives is provided below, but the HVAC contractor should review and following the requirements of ASHRAE Standard 62.2-2007, Sections 4 and 7.
    a. Mild climate exemption. A home built in a climate with fewer than 4,500 infiltration degree-days is exempt from this prerequisite.
    b. Continuous ventilation. Meet the ventilation requirements in Table 1 below.
    c. Intermittent ventilation. Use Equation 4.2 of ASHRAE Standard 62.2-2007 to demonstrate adequate ventilation air flow.
    d. Passive ventilation. Have a passive ventilation system approved and verified by a licensed HVAC engineer as providing ventilation equivalent to that achieved by continuous ventilation systems as described in Table 1.

C. Credits:
1. Enhanced Outdoor Air Ventilation (2 points). Meet one of the following:
    a. In mild climates (fewer than 4,500 infiltration degree-days), install a whole-building active ventilation system that complied with ASHRAE Standard 62.2-2007. OR
    b. Install a system that provides heat transfer between the incoming outdoor air stream and the exhaust air stream, such as a heat-recovery ventilator (HRV) or energy-recovery ventilator (ERV). Th heat recovery system must be listed by a certified testing lab (e.g. UL, ETL).
2. Third-Party Performance Testing (1 point). Have a third-party test the flow rate of air brought into the home, and verify that the requirements of ASHRaE Standard 62.2-2007 are met. In exhaust-only ventilation systems, install exhaust ducts according to table 7.1 of ASHRAE Standard 62.2-2007, and either test the flow rate out of the home or conduct air flow tests to ensue back-pressure of </- 0.20 inches w.c.

D. Table 1. Minimum Air Flow Requirements for Continuous Ventilation Systems, in cfm. *Credit: ASHRAE Standard 62.2, 2007. American Society of Heating, Refrigeration and Air Conditioning Engineers, Inc., www.ashrae.org <http://www.ashrae.org/>*

		Bedrooms			
Conditioned floor area (ft)	0.1	2,3	4,5	6,7	<7
</-1,500	30	45	60	75	90
1,501-3,000	45	60	75	90	105
3,001-4,500	60	75	90	105	120
4,501-6,000	75	90	105	120	135
6,001-7,500	90	105	120	135	150
<7,500	105	120	135	150	165

E. Synergies and Trade Offs: A project receiving points for EQ 1 is not eligible to earn points for EQ4.3, but may earn points for EQ 4.2. A project pursuing EQ 4.3 must meet all the prerequisites in EQ 2-10. Natural air leakage through the envelope contributes to the overall ventilation rate of the home (EA 3.1-3.3). From a health perspectives, it is important not to under ventilate a home. From an energy perspective, it is important not to over ventilate. Exhaust fans, which also provide the local exhaust required by EQ 5.1, can simultaneously provide the outdoor air ventilation system for the home. A heat-recovery system can substantially reduce the energy used by the heating and cooling equipment (EA 6).

F. Calculations: The number of infiltration degree-days is equal to the sum of the cooling degree-days plus the heating degree-days for a particular location. These exemptions are based on ASHRAE Std. 62.2-2004, which references ASHRAE Std. 119-1988 (RA 2004). Following this standard, LEED for Homes used a base of 65 degrees F for heating degree-days 78 degrees F for cooling degree-days. ASHRAE prescribed a simple calculation for determining the minimum amount of mechanical ventilation. See Equations 4.1a and 4.1b in Standard 6.2.2,

Section 4. As an example, a three-bedroom home with a conditioned floor area of 2,500 square feet requires a minimum ventilation rate of 60 cfm. equation 4.2 in ASHRAE Standard 62.2 covers intermittent ventilation systems.

G. Supporting Verification Materials,made available by the project team:
   1. EQ4.B.1. Basic Outdoor Air Ventilation:
      a. For EQ 4 B.1 (b) and (c), present calculation to the verification team demonstrating that the ventilation system is designed to meet the requirements.
      b. For EQ 4 B.1. (d), present calculations, test results, or equivalent that demonstrates that the proposed designs meet ASHRAE Standard 62.2.
      c. Include equipment literature in the occupant's operations and maintenance manual.
      d. For EQ4 B.1. (b), (c) and (d), sign an Accountability Form to indicate that the system is installed according to the design standards.

H. Verification Team
   1. EQ 4 B.1. Basic Outdoor Air Ventilation
      a. For EQ 4.B.1. (b), (c) and (d), visually verify that all calculations related to outdoor air ventilation are completed.
      b. For EQ 4.B.1. (b), (c), and (d), verify that an Accountability form has been signed by the responsible party.
   2. EQ 4 Third Party Inspection.
      a. Test the outdoor ventilation air flow into the home and verify that it meets the requirements.

2.36 EQ 5: LOCAL EXHAUST

A. Intent: Reduce moisture and exposure to indoor pollutants in kitchens and bathrooms.

B. Prerequisites:
   1. Basic Local Exhaust. Meet all the following requirements:
      a. Design and install local exhaust systems in all bathrooms (including half-baths) and the kitchen to meet the requirements of Section 5 of ASHRAE Standard 62.2-2007. Sample requirements that relate to minimum intermittent local exhaust flow rates are shown in Table 1, below.
      b. Design and install the fans and ducts to meet the requirements of Section 7 of ASHRAE Standard 62.2-2007.
      c. Exhaust air to the outdoors (i.e., exhaust to attics or interstitial spaces is not permitted).
      d. Use ENERGY STAR labeled bathroom exhaust fans (except for exhaust fans serving multiple bathrooms).

C. Credits:
   1. Enhances Local Exhaust (1 point). Use one of the following strategies in every bathroom to control the use of the local exhaust fan:
      a. An occupancy sensor.
      b. An automatic humidistat controller.
      c. An automatic timer to operate the fan for the timed interval after occupant leaves the room.
      d. A continuous operating exhaust fan.
   2. Third Party Performance Testing (1 point). Perform a third-party test of each exhaust air flow rate for compliance with the requirements in Section 5 of ASHRAE Standard 62.2-2007.

D. Synergies and Trade Offs: A project receiving points for EQ1 is eligible to earn points for EQ 5.. If designed properly, exhaust fans Canals provide sufficient outdoor air ventilation system for the entire home, as required by EQ 4.1.

E. Table 1. Minimum Air Flow Requirements for Intermittent Local Exhaust

Location	Minimum Air Flow
Kitchen	100 cfm, vented range hood required if exhaust fan flow rate is less than 5 kitchen air changes per hour.
Bathroom	50 cfm

F. Calculations: Use the following equation to determine the total kitchen air changes per hour provided by the kitchen fan:
   1. ACH = Fan Capacity * 60 minuted / kitchen size where ACH is air changes per hour, fan capacity is measured in cfm, and kitchen size is measured in cubic feet. If ACH is less than 5, install the kitchen fan as a vented range hood.

G. Supporting Verification Materials, made available by the project team:
   1. EQ 5. Basic Local Exhaust:
      a. Present calculations to the Verification Team demonstrating that the local exhaust system if designed to meet the requirements.
      b. Include any equipment literature in the occupant's operations and maintenance manual.
      c. Sign and Accountability Form to indicate that the local exhaust system is installed according to the design specifications.
   2. EQ 5. Enhanced Local Exhaust:
      a. Include equipment literature on occupancy sensors, automatic humidistat controllers, automatic timers, or continuously operating exhaust fans in the occupant's operations and maintenance manual.

H. Verification team:
   1. EQ 5. Basic Local Exhaust:
      a. Visually verify that all calculations for local exhaust are completed.
      b. Visually verify all applicable equipment in th home.
      c. Verify that an accountability form has been signed by the responsible party.
   2. EQ 5. Enhanced Local Exhaust:
      a. Visually verify all applicable equipment in the home.
   3. EQ 5. Third-Party Performance Testing:
      a. Test exhaust air floor from the home and verify that it meets the requirements.

2.37 EQ 6: DISTRIBUTION OF SPACE HEATING COOLING:

A. Intent: Provide appropriate distribution of space heating and cooling in the home to improve thermal comfort and energy performance.

B. Forced Air Systems: Prerequisites:
   1. Room-by-Room Load Calculations. Perform design calculations (using ACCA Manuals J and D, the ASHrAE Handbook of Fundamentals, or an equivalent computation procedure) and install ducts accordingly.

C. Credits:
   1. Return Air Flow or Room-by-Room Controls (1 point). Ensure that every room (except baths, kitchens,closets, pantry, and laundry rooms) has adequate return air floor through the use of multiple returns, transfer grilles, or jump ducts. Meet one of the following requirements:
      a. Size of opening to 1 square inch per cfm of supply (this area may include free area undercut below door).
      b. Demonstrate that the pressure differential between closed rooms and adjacent space with return is no greater than 2.5 Pa (0.01 inch w.c.).
   2. Third Party Performance Test (2 points). Have the total supply air flow rates in each room tested using a flow hood with doors closed or one of the other acceptable methods cited by the ACCA Quality Installation Specifications. Supply air flow rates must be within +/- 15% (or +/- 10 cfm) of calculated values from ACCA Manual J (as requested by EA 6.1).

D. Nonducted HVAC Systems (e.g. Raditative Systems); Prerequisites:
   1. Room-by-Room Load Calculations. Perform design calculations (using ACCA Manual J and D, the ASHrAE Handbook of Fundamentals, o and equivalent computation procedure) and install system accordingly.

E. Credits:
   1. Room-by-Room COntrols (1 point). Design the HVAC system with flow control valves on each radiator.
   2. Multiple Zones (2 points). Install nonducted HVAC system with at least two distinct zones with independent thermostat controls.

F. Synergies and trade Offs: A project receiving points for EQ 1 is not eligible to earn points for EQ 6.2 or EQ 6.3. A project pursuing EQ 6.2 or EQ 6.3 must meet all the prerequisites in EQ 2-10. The choice of air filter (EQ 7) should be made prior to duct design, to ensure adequate air flow. Filters with a high MERV can create a large pressure drop that should be accommodated during system design. Space heating and cooling loads and room air flow rates must be calculated using ACCA Manual J (EA 6.1). The design calculations conducted for this credit should be based on those Manual J calculations. Duct installation should be visually inspected during the predrywall insulation inspection (EA 5).

G. Calculations: A full detailed CCA Manual D calculation is strongly recommended but may be more than is necessary. Various software programs can assist with HVAC distribution design. Have the HVAC contractor prepare design calculations or software printouts for the Verification Team's review.

H. Supporting Verifications Materials, made available by the project team:
   1. Room-by-Room Load Calculations:
      a. Present design calculations to the verification team.
      b. Include any equipment literature (e.g. users manuals, brochures,specifications) in the occupant's operations and maintenance manual.
      c. Sign an Accountability Form to indicate that the system is installed according tot he design specifications.
   2. EQ 6 REturn Air Flow or Room-by-Room Controls
      a. For ducted systems, provide calculations to the Verification Team demonstrating that the credit requirements have been met.

I. Verification Team:
   1. EQ 6 Room-by-Room Load Calculations
      a. Collect the Manual J and D calculations and verify that they were fully and properly completed, per LEED for Homes Verification and Submittal Guidelines.
      b. Verify that an Accountability Form has been signed by the responsible party.
   2. Radiative System:
      a. Verify that each radiator or radiative heating segment has a flow control installed.
   3. EQ 6 Third Party Performance Test or Multiple Zones
      a. For ducted systems, conduct testing of supply air-floor rates in each room and verify that the requirements are met.
      b. For non ducted systems, visually verify zones and thermostat controls.

2.38 EA 7: AIR FILTERING

A. Intent: Reduce particulate matter from the air supply system.

B. Forced-Air Systems. Prerequisites:
   1. Good Filters. Install air filters with a minimum efficiency reporting value (METV) >/- 8 and ensure that the handlers can maintain adequate pressure and air flow. Air filters housings must be airtight to present bypass or leakage. Non ducted units such as PTACs and mini-splits are exempt from this prerequisite per the requirements of ASHRAE Standard 62.2-2007, section 6.7, Minimum Filtration

C. Credits:
   1. Better Filters (1 point). Install air filers >/- MERV 10 an ensure that air handlers can maintain adequate pressure and air flow. Air filter housings must be airtight to prevent bypass or leakage. OR
   2. Best filters (2 points). Install air filers >/- MERV 13 and ensure that air handlers can maintain adequate pressure and air flow. Air filter housings mus be airtight to prevent bypass or leakage.

D. Nonducted HVAC Systems (e.g. Radiative Systems): Prerequisites:
   1. Good Filers. Install air filters >/- MerV 8 and maintain adequate pressure and air flow in any mechanical ventilation systems. A home in a climate with fewer than 4,500 infiltration degree-days or a home that uses only passive or exhaust only ventilating is except from this requirement.

E. Credits:
   1. Better Filers (1 point). Install air filters >/- MERV 10 and maintain adequate pressure and air-flow for any mechanical ventilation systems. OR
   2. Best Filters (2 points). Install air filters >/- MERV 13 and maintain adequate pressure and air flow for any mechanical ventilation systems.

F. Synergies and Trade Offs: A project receiving points for EQ 1 is eligible to earn points for EQ 7.2 or EQ 7.3. The choice of air filters should be made during or prior to duct design (EQ 6) to ensure adequate air flow. Filters with a high MERV can create a large pressure drop that should be accommodate during system design.

G. Supporting Verification Materials, made available by the Project Team:
   1. Present any air filter product literature to the Verification Team.
   2. Include product literature in the occupant's operations and maintenance manual.

H. Verification Team:
   1. Visually verify (using product literature, labels, etc.) that the applicable MERV rating has been met.
   2. Visually verify air filters and housings in the home.

2.39 EQ 8: CONTAMINATE CONTROL

A. Intent: Reduce occupants' and construction workers' exposure to indoor airborne contaminants throughs source control and removal.

B. Prerequisites: None

C. Credits:
   1. Indoor Contaminant Control during Construction (1 point). Upon installation, seal and permanent ducts and vents to minimize contamination during construction. Remove any seals after all phases of construction are completed.
   2. Indoor Contaminant Control (1 point each, maximum 2 points). Select from the following measures:
      a. Design and install permanent walk-off mats at each entry that are at least 4 feet in length and allow accessibility for cleaning (e.g. grating with catch basin).
      b. Design a shoe removal and storage space near th primary entryway, separated from living areas. This space may not have wall-to-wall carpeting, and it must be large enough to accommodate a bench and at least two pairs of shoes per bedroom.
      c. Install central vacuum system with exhaust to the outdoors. Ensure that the exhaust is not near any ventilation air intake.
   3. Preoccupancy Flush (1point). Flush the home with fresh air, according to the following guidelines:
      a. Flush prior to occupancy but after all phases of construction are completed.
      b. Flush the entire home,keeping all interior doors open.
      c. Flush for 48 total hours; the house may be nonconsecutive, if necessary.

d. Keep all windows open and run a fan (e.g. HVAC system fan) continuously or finish the home with all HVAC fans and exhaust fans operating continuously at the highest rate flow.
e. Use additional fans to circulate air within the home.
f. Replace or clean HVAC air filters afterward, as necessary

D. Synergies and Trade Offs: A project receiving points for EQ 1 is not eligible to earn points for EQ 8.1 or EQ 8.3,but may earn points for EQ 8.2. Products with low VOC emissions greatly benefit indoor air quality. Source control of thee kinds of emissions is addressed in MR2.

E. Supporting Verification Materials, made available by the project team:
1. Sign an accountability form to indicate that the system is installed according to the design specifications.

F. Verification Team
1. During construction, visually verify that ducts are sealed at the termination point.
2. After construction, conduct a visual inspection and swipe of duct interiors.
3. Verify that an accountability form has been signed by the responsible party.

2.40 EQ 9: RADON PROTECTION

A. Intent: Reduce occupant exposure to radon gas and other soil gas contaminants.

B. Prerequisites:
1. Radon-Resistant Construction in High Risk Areas. If the home is in EPA Radon Zone 1, design and build the home with radon-resistant construction techniques as prescribed in EPA, the International Residential Code, Washington State Ventilation and Indoor Air Quality Code, or some equivalent code or standard.

C. Credits:
1. Radon-Resistant Construction in Moderate Risk Area: (1 point). If the home is outside EPA Radon Zone 1, design and build the home with radon-resistant construction techniques as prescribed by EPA, the International Residential Code, Washington State Ventilation and Indoor Air Quality Code, or some equivalent code or standard. *Note: Radon-resistant construction doe snot guarantee that occupants will lnot be exposed to radon. The Surgeon General and EPA recommend that every home in the country be tested for radon. Information about radon testing is available at the EPA Web site, www.epa.gov/radon/radontest.html.*

D. Synergies and Trade Off: A project receiving points for EQ 1 is not eligible to earn points for EQ 9.2.

E. Supporting Verification Materials, made available by the project team:
1. Sign an Accountability Form to indicate that the home was built wit radon-resistant construction

F. Verification Team:
1. Visually verify radon-resistant construction.
2. Verify that an Accountability Form has been signed by the responsible party.

2.41 EQ 10: GARAGE POLLUTANT PROTECTION

A. Intent: Reduce occupant exposure to indoor pollutants originating from an adjacent garage.

B. Prerequisites: No HVAC in Garage. Place all air-handling equipment and ductwork outside the fire-rated envelope of the garage.

C. Credits:
1. Minimize Pollutant from Garage (2 points). Tightly seal shared surfaces between garage and conditioned spaces, including all of the following:
a. In conditioned spaces above the garage:
1) seal all penetrations; and
2) seal all connecting floor and ceiling joist bays.

b. In conditioned spaces next to the garage:
1) weather-strip all doors;
2) place carbon monoxide detectors in adjacent rooms that share a door with the garage;
3) seal all penetrations; and
4) seal all cracks at the base of the walls AND/OR

2. Exhaust Fan in Garage (1 point). Install an exhaust fa int he garage that is rated for continuous operation and designed to be operated in one of the following ways. Nonducted exhaust fans must be 70 cfm or greater, and ducted exhaust fan must be 100 cfm or greater.
a. Fan must run continuously; or
b. Fan must be designed with an automatic timer control linked to an occupant sensor, light switch, garage door opening-closing mechanism, carbon monoxide sensor, or equivalent. The timer must be set to provide at least three air changes each time the fan is turned on. OR

3. Detached Garage or no Garage (3points).

D. Synergies and Trad Offs: A project receiving points for EQ 1 is not eligible to earn points for EQ 10.2 EQ 10.3 or EQ 10.4. A project receiving points for EQ 10.4 is not eligible to earn points for EQ 10.2 or 10.3, and vice versa. EQ 10.1 should be taken into consideration when designing the HVAC and heating and cooling distribution system (EA 5, 6; EQ 4,6).

E. Calculations: If installing an exhaust fan in the garage, use the following equation to calculate the length f time, n minutes, that the garage fan must run to provide three air changes: Operating Time = Garage Size*3/fan capacity when garage size is measure in cubic feet and fan capacity is measured in cfm. Sample calculation: a 20x20x20 foot garage has 4,000 cubic feet. Three air changes is 12,000 cubic feet. A 100-cfm fan must thereby e set to run 120 minutes.

F. Supporting Verification Materials, made available by the project team
1. EQ 10 exhaust Fan in Garage
a. Provide calculations to the verification team demonstrating that the garage exhaust fan provides the necessary air changes.
b. Include garage exhaust fan equipment literature in the occupant's operating and maintenance manual.

G. Verification Team
1. EQ 10 No HVAC in Garage
a. Visually verify that the requirements have been met.
2. EQ 10 Minimization of Pollutants from Garage
a. Visually verify the calculations fro garage air changes
3. EQ 10 Exhaust Fan in Garage
a. Visually verify the calculations for garage air changes.
b. Visually verify that the appropriate garage exhaust equipment has been installed
4. EQ 10 Detached Garage or No Garage
a. Visually verify that the home has no attached garage.

2.42 AE 1: EDUCATION OF THE HOMEOWNER OR TENANT

A. Maintain the performance of the home by educating the occupants (i.e. the homeowner or tenant) about the Operations and maintenence of the home's LEED features and equipment.

B. Prerequisites:
1. Basic Operations Training. Provide the home's occupant(s) with the following:
a. An operations and maintenance manual or binder tat includes all the following items:
1) The completed checklist of LEED for Homes features.
2) A copy of each signed Accountability Form.
3) A copy of the durability inspection checklist.

4) The product manufacturers' manuals for all installed equipment, fixtures, and appliances.
5) General information on efficient use of energy, water and natural resources.
6) Operations and maintenance guidance for and LEED for Homes related equipment installed int he home, including:
   (a) space heating and cooling equipment;
   (b) mechanical ventilation equipment;
   (c) radon protection system;
   (d) renewable energy system; and
   (e) irrigation, rainwater harvesting, and or graywater system.
7) Guidance on occupant activities and choices, including the following:
   (a) cleaning materials, methods, and supplies;
   (b) water efficient landscaping;
   (c) impact of chemical fertilizers and pesticides;
   (d) irrigation;
   (e) lighting selection; and
   (f) appliance selection.
8) Educational information on "green power"

b. A minimum one-hour walk through of the home with the occupant(s), featuring the following:
   1) Identification of all installed equipment.
   2) Instruction on how to use the measures and operate the equipment.
   3) Information on how to maintain the measures and equipment.

C. Credits:
1. Enhanced training (1 point). Provide two hours of training for the occupant(s) in addition to the training provided for AE 1.1. Example of eligible training include:
   a. An additional walk-through or training held in another home that has similar green measures and equipment.
   b. A builder-or-developer-sponsored meeting of potential home buyers that informs participants of the unique features of a LEED home.
   c. A group home buyer training that includes discussion of the required items in the occupant's operations and maintenance manual, including information on efficient use of resources, appropriate use of measures and systems, and proper maintenance of measures and systems.
   d. A home buyer DVD with operations and maintenance information on the home's LEED for Homes measures.
2. Public Awareness (1 point). Promote general public awareness about LEeD for Homes by conducting at least three of the following activities:
   a. Hold an advertised, attended public open house that lasts at least four hours per day on at least four weekends or participate in a green building exhibition or tour. The home or building must display at least four informational stations about the LEED for Homes features (and/or offer a guided tour that highlights at least four LEeD for Homes features).
   b. Publish a web site with at least two pages that provides detailed information about the features and benefits of LEED homes.
   c. Generate a newspaper article on the LEED for Homes project.
   d. Display LEED for HOmes signage, measuring size square feet or more, on the exterior of the home or building.

D. Synergies and Trade offs: Many of the measures in the Rating System should be addressed in the operations manual and the on-site training, particularly any measures that require routines maintenance (e.g., air filters) or instruction for proper operation (e.g. heat-recovery systems).

2.43 AE 2: EDUCATE BUILDING MANAGER

A. Intent: Maintain the performance of the home by educating the building manager about the operations and maintenance of the home's LEED features and equipment.

B. Prerequisite: None

C. Credits:
   1. Education of Building Manager (1 point). For multifamily buildings (more than five units), provide the building manager with the following:
      a. A building owner's manual or binder that includes these items:
         1) The completed checklist of LEED for Homes features.
         2) A copy of each signed Accountability Form.
         3) A copy of the durability inspection checklist.
         4) The product manufacturers' manuals for all installed equipment, fixtures, and appliances.
         5) General information on efficient use of energy, water, and natural resources.
         6) Operations and maintenance guidance for any LEED for Homes related equipment installed in the home, including:
            (a) space heating and cooling equipment;
            (b) mechanical ventilation equipment;
            (c) humidity control equipment;
            (d) radon protection system;
            (e) renewable energy system;and
            (f) irrigation, rainwater harvesting, and/or graywater system.
         7) Guidance on occupant activities and choices, including the following:
            (a) cleaning materials,methods an supplies;
            (b) water-efficient landscaping;
            (c) impacts of chemical fertilizers and pesticides;
            (d) irrigation;
            (e) lighting selection; and
            (f) appliance selection.
         8) Educational information on "green power".
      b. A minimum one-hour walk through of the building before occupancy, featuring the following:
         1) Identification of all installed equipment.
         2) Instruction in how to use the measures and operate the equipment in each unit.
         3) Information on how to maintenance the measures and equipment in each unit.

D. Synergies and Trade Offs: Many of the measures in the rating System should be addressed in the building manager's manual and on-site training, particularly any measures that require routine maintenance (e.g., air filters) or specific instruction for proper operation (e.g. heat-recovery systems).

E. Verification and Submittals
   1. Builder/Project Team:
      a. Present the Operations and maintenance manual tot he green rater for review.
      b. Provide the operations and maintenance Manual to the building manager.
      c. Sign an Accountability Form to indicate that a walk through has been conducted with the building manager.
   2. Green Rater:
      a. Visually verify that the Operations and maintenance Manual meets the requirements.
      b. Verify that an Accountability Form has been signed by the responsible party.

END OF SECTION

SECTION 01 3553
SECURITY PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

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

1.02 RELATED REQUIREMENTS

A. Section 01 1000 - Summary: use of premises and occupancy.

B. Section 01 5000 - Temporary Facilities and Controls: Temporary lighting.

1.03 SECURITY PROGRAM

A. Protect Work, existing premises and Owner's operations from theft, vandalism, and unauthorized entry.

B. Initiate program at project mobilization.

C. Maintain program throughout construction period until Owner occupancy.

1.04 ENTRY CONTROL

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

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

1.05 PERSONNEL IDENTIFICATION

A. Provide identification badge to each person authorized to enter premises.

B. Badge To Include: Personal photograph, name, assigned number, expiration date and employer.

C. Require return of badges at expiration of their employment on the Work.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 4000

QUALITY REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Submittals.

B. Quality assurance.

C. References and standards.

D. Testing and inspection agencies and services.

E. Control of installation.

F. Tolerances.

G. Defect Assessment.

1.02 RELATED REQUIREMENTS

A. Document 00 3100 - Available Project Information: Soil investigation data.

B. Document 00 7200 - General Conditions: Inspections and approvals required by public authorities.

C. Section 01 2100 - Allowances: Allowance for payment of testing services.

D. Section 01 4216 - Definitions.

E.

1.03 REFERENCE STANDARDS

A. ASTM C1077 - Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation; 2014.

B. ASTM C1093 - Standard Practice for Accreditation of Testing Agencies for Masonry; 2013.

C. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection and/or Testing; 2014a.

D. IAS AC89 - Accreditation Criteria for Testing Laboratories; 2010.

1.04 SUBMITTALS

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

B. Testing Agency Qualifications:
   1. Prior to start of work, 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 NIST Construction Materials Reference Labratory during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection.
   3. Qualification Statement: Provide documentation showing testing labratory is accredited under IAS AC89.

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

D. Test Reports: After each test/inspection, promptly submit two copies of report to Architect and to Contractor.
   1. Include:
      a. Date issued.
      b. Project title and number.
      c. Name of inspector.
      d. Date and time of sampling or inspection.

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

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

E. Certificates: When specified in individual specification sections, submit certification by the manufacturer and Contractor 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.

F. 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.

G. Manufacturer's Field Reports: Submit reports for Architect's benefit as contract administrator or for Owner.
1. Submit for information for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents.

1.05 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 Substantial 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.

1.06 TESTING AND INSPECTION AGENCIES AND SERVICES

A. Owner will employ services of an independent testing agency to perform certain specified testing; payment for cost of services will be derived from allowance specified in Section 01 2100; see Section 01 2100 and applicable sections for description of services included in allowance.

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

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 CONTROL OF INSTALLATION

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

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

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

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

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

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

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

3.02 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.

3.03 TESTING AND INSPECTION

A. See individual specification sections for testing required.

B. Testing Agency Duties:
   1. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
   2. Perform specified sampling and testing of products in accordance with specified standards.
   3. Ascertain compliance of materials and mixes with requirements of Contract Documents.
   4. Promptly notify Architect and Contractor of observed irregularities or non-conformance of Work or products.
   5. Perform additional tests and inspections required by Architect.
   6. 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 Contractor.
   4. Agency has no authority to stop the Work.

D. Contractor Responsibilities:
   1. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.
   2. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.
   3. Provide incidental labor and facilities:
      a. To provide access to Work to be tested/inspected.

b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
c. To facilitate tests/inspections.
d. To provide storage and curing of test samples.

4. Notify 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 by Contractor beyond specified requirements.
6. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.

E. Re-testing required because of non-conformance to specified requirements shall be performed by the same agency on instructions by Architect.

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

3.04 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

SECTION 01 4216
DEFINITIONS

PART 1 GENERAL

1.01 SUMMARY

A. Other definitions are included in individual specification sections.

1.02 DEFINITIONS

A. Furnish: To supply, deliver, unload, and inspect for damage.

B. Install: To unpack, assemble, erect, apply, place, finish, cure, protect, clean, start up, and make ready for use.

C. Product: Material, machinery, components, equipment, fixtures, and systems forming the work result. Not materials or equipment used for preparation, fabrication, conveying, or erection and not incorporated into the work result. Products may be new, never before used, or re-used materials or equipment.

D. Provide: To furnish and install.

E. Supply: Same as Furnish.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 4533

CODE-REQUIRED SPECIAL INSPECTIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Code-required special inspections.

B. Testing services incidental to special inspections.

C. Submittals.

D. Manufacturers' field services.

E. Fabricators' field services.

1.02 RELATED REQUIREMENTS

A. Document 00 3100 - Available Project Information: Soil investigation data.

B. Document 00 7200 - General Conditions: Inspections and approvals required by public authorities.

1.03 DEFINITIONS

A. Code or Building Code: ICC (IBC), 2015 Edition of the International Building Code and specifically, Chapter 17 - Special Inspections and Tests.

B. Authority Having Jurisdiction (AHJ): Agency or individual officially empowered to enforce the building, fire and life safety code requirements of the permitting jurisdiction in which the Project is located.

C. International Accreditation Service, Inc. (IAS).

D. National Institute of Standards and Technology (NIST).

E. Special Inspection:
   1. Special inspections are inspections and testing of materials, installation, fabrication, erection or placement of components and connections mandated by the AHJ that also require special expertise to ensure compliance with the approved contract documents and the referenced standards.
   2. Special inspections are separate from and independent of tests and inspections conducted by Owner or Contractor for the purposes of quality assurance and contract administration.

1.04 REFERENCE STANDARDS

A. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; 2011.

B. ACI 530/530.1/ERTA - Building Code Requirements and Specification for Masonry Structures and Related Commentaries; 2011.

C. AISC 341 - Seismic Provisions for Structural Steel Buildings; 2010.

D. ASTM D3740 - 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; 2012a.

E. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection and/or Testing; 2014a.

F. ASTM E543 - Standard Specification for Agencies Performing Nondestructive Testing; 2013.

G. ASTM E605 - Standard Test Methods for Thickness and Density of Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members; 1993 (Reapproved 2011).

H. ASTM E736 - Standard Test Method for Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members; 2000 (Reapproved 2011).

I. AWCI 125 - Technical Manual 12-B: Standard Practice for the Testing and Inspection of Field-Applied Thin Film Intumescent Fire-Resistance Materials; 1998.

J. AWS D1.4/D1.4M - Structural Welding Code - Reinforcing Steel; 2011.

K. IAS AC89 - Accreditation Criteria for Testing Laboratories; 2010.

L. IAS AC291 - Accreditation Criteria for Special Inspection Agencies; 2012.

M. ICC (IBC) - International Building Code; 2015.

1.05 SUBMITTALS

A. Special Inspection Agency Qualifications: Prior to the start of work, the Special Inspection Agency shall:
   1. Submit agency name, address, and telephone number, names of full time registered Engineer and responsible officer.
   2. Submit copy of report of laboratory facilities inspection made by NIST Construction Materials Reference Laboratory during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection.
   3. Submit certification that Special Inspection Agency is acceptable to AHJ.

B. Testing Agency Qualifications: Prior to the start of work, the Testing Agency shall:
   1. 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 NIST Construction Materials Reference Laboratory during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection.
   3. Submit certification that Testing Agency is acceptable to AHJ.

C. Special Inspection Reports: After each special inspection, Special Inspector shall promptly submit two copies of report; one to Architect and one to the AHJ.
   1. Include:
      a. Date issued.
      b. Project title and number.
      c. Name of Special Inspector.
      d. Date and time of special inspection.
      e. Identification of product and specifications section.
      f. Location in the Project.
      g. Type of special inspection.
      h. Date of special inspection.
      i. Results of special inspection.
      j. Conformance with Contract Documents.
   2. Final Special Inspection Report: Document special inspections and correction of discrepancies prior to the start of the work.

D. Fabricator Special Inspection Reports: After each special inspection of fabricated items at the Fabricator's facility, Special Inspector shall promptly submit two copies of report; one to Architect and one to AHJ.
   1. Include:
      a. Date issued.
      b. Project title and number.
      c. Name of Special Inspector.
      d. Date and time of special inspection.
      e. Identification of fabricated item and specification section.
      f. Location in the Project.
      g. Results of special inspection.
      h. Verification of fabrication and quality control procedures.
      i. Conformance with Contract Documents.
      j. Conformance to referenced standard(s).

E. Test Reports: After each test or inspection, promptly submit two copies of report; one to Architect and one to AHJ.
   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 or inspection.
      h. Date of test or inspection.
      i. Results of test or inspection.
      j. Conformance with Contract Documents.

F. Certificates: When specified in individual special inspection requirements, Special Inspector shall submit certification by the manufacturer, fabricator, and installation subcontractor to Architect and AHJ, 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 and AHJ.

G. Manufacturer's Field Reports: Submit reports to Architect and AHJ.
   1. Submit for information for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents.

H. Fabricator's Field Reports: Submit reports to Architect and AHJ.
   1. Submit for information for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents.

1.06 SPECIAL INSPECTION AGENCY

A. Owner will employ services of a Special Inspection Agency to perform inspections and associated testing and sampling required by the building code .

B. The Contractor will coordinate with the Owner's Special Inspection Agency all required inspections and shall be responsible to arrange, schedule and notify the Special Inspection Agency accordingly.

C. The Special Inspection Agency may employ and pay for services of an independent testing agency to perform testing and sampling associated with special inspections and required by the building code.

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

1.07 TESTING AND INSPECTION AGENCIES

A. Owner may employ services of an independent testing agency to perform additional testing and sampling associated with special inspections but not required by the building code .

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

1.08 QUALITY ASSURANCE

A. Special Inspection Agency Qualifications:
   1. Independent firm specializing in performing testing and inspections of the type specified in this section.
   2. Accredited by IAS according to IAS AC291.

B. Testing Agency Qualifications:

1. Independent firm specializing in performing testing and inspections of the type specified in this section.
2. Accredited by IAS according to IAS AC89.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 SCHEDULE OF SPECIAL INSPECTIONS, GENERAL

A. Frequency of Special Inspections: Special Inspections are indicated as continuous or periodic.
   1. Continuous Special Inspection: Special Inspection Agency shall be present in the area where the work is being performed and observe the work at all times the work is in progress.
   2. Periodic Special Inspection: Special Inspection Agency shall be present in the area where work is being performed and observe the work part-time or intermittently and at the completion of the work.

3.02 SPECIAL INSPECTIONS FOR CONCRETE CONSTRUCTION

A. Reinforcing Steel, Including Prestressing of Tendons and Placement: Verify compliance with approved contract documents and ACI 318, Sections 3.5 and 7.1 through 7.7; periodic.

B. Reinforcing Steel Welding: Verify compliance with AWS D1.4/D1.4M and ACI 318, Section 3.5.2; periodic.

C. Design Mix: Verify plastic concrete complies with the design mix in approved contract documents and with ACI 318, Chapter 4 and 5.2; periodic.

D. Specified Curing Temperature and Techniques: Verify compliance with approved contract documents and ACI 318, Sections 5.11 through 5.13; periodic.

E. Concrete Strength in Situ: Verify concrete strength complies with approved contract documents and ACI 318, Section 6.2, for the following.

F. Formwork Shape, Location and Dimensions: Verify compliance with approved contract documents and ACI 318, Section 6.1.1; periodic.

3.03 SPECIAL INSPECTIONS FOR MASONRY CONSTRUCTION

A. Masonry Structures Subject to Special Inspection:
   1. Empirically designed masonry, glass unit masonry and masonry veneer in structures designated as "essential facilities".
   2. Engineered masonry in structures classified as "low hazard..." and "substantial hazard to human life in the event of failure".

B. Verify each item below complies with approved contract documents and the applicable articles of ACI 530/530.1/ERTA.
   1. Inspections and Approvals:
      a. Verify compliance with the required inspection provisions of the approved contract documents; periodic.
      b. Verify approval of submittals required by contract documents; periodic.
   2. Compressive Strength of Masonry: Verify compressive strength of masonry units prior to start of construction unless specifically exempted by code; periodic.
   3. Slump Flow and Visual Stability Index (VSI): Verify compliance as self consolidating grout arrives on site; continuous.
   4. Joints and Accessories: When masonry construction begins, verify:
      a. Proportions of site prepared mortar; periodic.
      b. Construction of mortar joints; periodic.
      c. Location of reinforcement, connectors, prestressing tendons, anchorages, etc; periodic.
   5. Structural Elements, Joints, Anchors, Protection: During masonry construction, verify:

a. Size and location of structural elements; periodic.
b. Type, size and location of anchors, including anchorage of masonry to structural members, frames or other construction; periodic.
c. Size, grade and type of reinforcement, anchor bolts and prestressing tendons and anchorages; periodic.
d. Welding of reinforcing bars; continuous.

6. Grouting Preparation: Prior to grouting, verify:
   a. Grout space is clean; periodic.
   b. Correct placement of reinforcing, connectors, prestressing tendons and anchorages; periodic.
   c. Correctly proportioned site prepared grouts and prestressing grout for bonded tendons; periodic.
   d. Correctly constructed mortar joints; periodic.
7. Preparation of Grout Specimens, Mortar Specimens and Prisms: Observe preparation of specimens; periodic.

3.04 SPECIAL INSPECTIONS FOR PREFABRICATED WOOD CONSTRUCTION

A. High Load Diaphragms: Verify compliance of each item below with approved contract documents.
   1. Grade and thickness of sheathing.
   2. Nominal size of framing members at adjacent panel edges.
   3. Nail or staple diameter and length.
   4. Number of fastener lines.
   5. Fastener spacing at lines and at edges.

B. Metal Plate Connected Wood Trusses with Clear Span of 60 feet or More: Verify compliance of each item below with approved contract documents in general and with approved truss submittal package in particular.
   1. Temporary restraint and bracing.
   2. Permanent individual truss member restraint and bracing.

3.05 SPECIAL INSPECTIONS FOR SOILS

A. Materials and Placement: Verify each item below complies with approved construction documents and approved geotechnical report.
   1. Design bearing capacity of material below shallow foundations; periodic.
   2. Design depth of excavations and suitability of material at bottom of excavations; periodic.
   3. Materials, densities, lift thicknesses; placement and compaction of backfill: continuous.
   4. Subgrade, prior to placement of compacted fill; periodic.

B. Testing: Classify and test excavated material; periodic.

3.06 SPECIAL INSPECTIONS FOR VERTICAL MASONRY FOUNDATION ELEMENTS

A. Vertical Masonry Foundation Elements are subject to the same special inspection requirements listed in the "Special Inspections for Masonry Construction" Article of this section.

3.07 SPECIAL INSPECTIONS FOR SPRAYED FIRE RESISTANT MATERIALS

A. Sprayed Fire Resistant Materials, General:
   1. Verify compliance of sprayed-fire resistant materials with specific fire-rated assemblies indicated in approved contract documents, and with applicable requirements of the building code.
   2. Perform special inspections after rough installation of electrical, mechanical, plumbing, automatic fire sprinkler and suspension systems for ceilings.

B. Physical and visual tests: Verify compliance with fire resistance rating.
   1. Condition of substrates; periodic.
   2. Thickness of sprayed fire resistant material; periodic.

3. Density of sprayed fire resistant material in pounds per cubic foot; periodic.
4. Bond strength (adhesion and cohesion); periodic.
5. Bond strength (cohesion); periodic.
6. Condition of finished application; periodic.

C. Structural member surface conditions:
1. Inspect structural member surfaces before application of sprayed fire resistant materials; periodic.
2. Verify preparation of structural member surfaces complies with approved contract documents and manufacturer's written instructions; periodic.

D. Application:
1. Ensure minimum ambient temperature before and after application complies with the manufacturer's written instructions; periodic.
2. Verify area where sprayed fire resistant material is applied is ventilated as required by the manufacturer's written instructions during and after application; periodic.

E. Thickness: Verify that no more than 10 percent of thickness measurements taken from sprayed fire resistant material are less than thickness required by fire resistance design in approved contract documents. In no case shall the thickness of the sprayed fire resistant material be less than the minimum below.
1. Minimum Allowable Thickness: Tested according to ASTM E605, periodic.
a. Design thickness 1 inch or greater: Design thickness minus 1/4 inch.
b. Design thickness greater than 1 inch: Design thickness minus 25 percent.

F. Density: Verify density of sprayed fire resistant material is no less than density required by the fire resistance design in the approved contract documents.

G. Bond Strength: Verify adhesive and cohesive bond strength of sprayed fire resistant materials is no less than 150 pounds per square foot when in-place samples of the cured material are tested according to ASTM E736 and as described below.

3.08 SPECIAL INSPECTIONS FOR MASTIC AND INTUMESCENT FIRE RESISTANT COATINGS

A. Verify mastic and intumescent fire resistant coatings comply with AWCI 117 and the fire resistance rating indicated on approved contract documents.

3.09 SPECIAL INSPECTIONS FOR SEISMIC RESISTANCE

A. Structural Steel: Comply with the quality assurance plan requirements of AISC 341.

B. Structural Wood:
1. Field gluing; continuous.
2. Nailing, bolting, anchoring and other fastening of components within the seismic force-resisting system; periodic.

C. Cold Formed Steel Light Frame Construction:
1. Field welding; periodic.
2. Screw attachment, bolting, anchoring and other fastening of components within the main seismic force-resisting system; periodic.

D. Designated Seismic System Verification: Verify label, anchorage or mounting conforms to certificate of compliance provided by manufacturer or fabricator.

E. Seismic Isolation System:
1. Fabrication and installation of isolator units; periodic.
2. Fabrication and isolation of energy dissipation devices; periodic.

F. Structural Observations for Seismic Resistance: Visually observe structural system for general conformance with the approved contract documents; periodic.

3.10 SPECIAL INSPECTIONS FOR WIND RESISTANCE

A. Structural Wood:

1. Field gluing of components in the main wind force-resisting system; continuous.
2. Nailing, bolting, anchoring and other fastening of components within the main wind force-resisting system; periodic.

B. Cold Formed Steel Light Frame Construction:
1. Field welding; periodic.
2. Screw attachment, bolting, anchoring and other fastening of components within the main wind force-resisting system; periodic

C. Structural Observations for Wind Resistance: Visually observe structural system for general conformance with the approved contract documents; periodic.

3.11 SPECIAL INSPECTION AGENCY DUTIES AND RESPONSIBILITIES

A. Special Inspection Agency shall:
1. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
2. Perform specified sampling and testing of products in accordance with specified reference standards.
3. Ascertain compliance of materials and products with requirements of Contract Documents.
4. Promptly notify Architect and Contractor of observed irregularities or non-conformance of work or products.
5. Perform additional tests and inspections required by Architect.
6. Submit reports of all tests or inspections specified.

B. Re-testing required because of non-conformance to specified requirements shall be performed by the same agency on instructions by Architect.

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

3.12 TESTING AGENCY DUTIES AND RESPONSIBILITIES

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

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

C. Re-testing required because of non-conformance to specified requirements shall be performed by the same agency on instructions by Architect.

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

3.13 CONTRACTOR DUTIES AND RESPONSIBILITIES

A. Contractor Responsibilities, General:
1. Deliver to agency at designated location, adequate samples of materials for special inspections that require material verification.

2. Cooperate with agency and laboratory personnel; provide access to the work, to manufacturers' facilities, and to fabricators' facilities.
3. Provide incidental labor and facilities:
    a. To provide access to work to be tested or inspected.
    b. To obtain and handle samples at the site or at source of Products to be tested or inspected.
    c. To facilitate tests or 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 or inspection services.
5. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.

B. Contractor Responsibilities, Seismic Force-Resisting Systems: Submit written statement of responsibility for each item listed to AHJ and Owner prior to starting work. Statement of responsibility shall acknowledge awareness of special construction requirements and other requirements listed.

C. Contractor Responsibilities, Wind Force-Resisting Systems: Submit written statement of responsibility for each item listed to AHJ and Owner prior to starting work. Statement of responsibility shall acknowledge awareness of special construction requirements and other requirements listed.

END OF SECTION

SECTION 01 5000

TEMPORARY FACILITIES

PART 1

1.01 SANITATION, LIGHT, POWER, HEAT & WATER

A. (Insert description of needs for Temporary Electricity, Heat, & Water)

B. It will be the Contractor's responsibility to provide such temporary toilet facilities as required and to introduce and enforce among his employees such regulations in regard to cleanliness and the disposal of garbage and waste as shall be required to maintain a neat and clean building and shall comply with all local ordinances. The Contractor shall take such means as the Architect may direct to effectually prevent the creation of a nuisance on the work or on any part of the property of the Owner.

1.02 OFFICE, STORAGE AND FACILITIES FOR ARCHITECT'S REPRESENTATIVE

A. The Contractor shall take charge of the work during construction and shall provide an office "area", at an approved location. This area shall have copies of all correspondence, construction drawings and specifications including all changes and revisions and shop drawings.

B. The Contractor shall provide any such waterproofed and secure storage sheds or trailers as required to protect his materials and the Owners materials. Remove all temporary structures upon completion of the work.

C. Storage sheds and trailers on site may be installed or used only with prior approval of the Owner. Locate as directed.

1.03 TELEPHONE SERVICE

A. The Contractor shall provide either a portable telephone (cellular phone) or a telephone at a fixed location on the job during the operations for his own use in the work and the use of all subcontractors engaged in the work. Toll charges will be paid by the persons making the long distance calls. The superintendent shall carry either a cordless phone or a pager so that he may be contacted any time during working hours.

1.04 DISPOSAL FACILITIES

A. The Contractor shall provide dumpsters at the project for the duration of the project, locate in areas as approved by the Owner. Use of the Owner's dumpsters (if applicable) is prohibited. The Contractor may choose to remove all refuse on a daily basis in lieu of providing a dumpster.

1.05 BARRICADES AND WARNINGS

A. The General Contractor shall construct and maintain all barricades as required to provide protection to the public and to the work. Danger signals, warning signs, red flags, lanterns and lights shall be provided and maintained as needed. All the above shall comply with all applicable codes and ordinances and shall be as approved by the Owner and the Architect.

END OF SECTION

SECTION 01 5480
UTILITY PROTECTION

SCOPE

1.01 RELATED REQUIREMENTS:

A. Conditions of the Contract.
   1. Section 011000 SUMMARY OF WORK.
   2. Division 2 - Sitework: Utilities.
   3. Division 15 - Mechanical.
   4. Division 16 - Electrical.

B. Job Requirements:
   1. Existing utility lines and structures indicated or known, and utility lines constructed for this project shall be protected from damage during construction operations. It is the Contractor's responsibility to contact the appropriate underground utility location agency to ensure that all recorded underground utility lines are properly marked. Repair to damaged utilities resulting from Contractor failing to take the proper precaution will be paid for at the Contractor's expense.
   2. Locate and flag all lines and structures before beginning excavation and other construction operations.

1.02 REMOVAL AND RELOCATION

A. When utility lines and structures that are to be removed or relocated are encountered within the area of operations, notify the Architect and affected utility in ample time for the necessary measures to be taken to prevent interruption of the services.

1.03 UNKNOWN LOCATIONS

A. Damage to existing utility lines or structures not indicated or known shall be reported immediately to the Architect and the affected utility. If determined that repairs are required under the Contract, the Contract Amount will be adjusted in accordance with the Conditions to the Contract

END OF SECTION

SECTION 01 5690

CLEANING

GENERAL

1.01 RELATED REQUIREMENTS: AS SPECIFIED ELSEWHERE:

A. Supplementary General Conditions: Section 00800
   1. Summary of Work: Section 011000
   2. Cleaning for Specific Products or Work
   3. Specification Section for that Work

B. All cleaning shall be the responsibility of the Contractor unless specifically noted otherwise.

C. Contractor shall police and clean-up on a continuing basis, during his presence in the project, in all areas in which he is performing work; maintain premises and public properties free from accumulation of waste, debris, and rubbish.

D. At the completion of the Work, Contractor shall remove waste materials, rubbish, tools, equipment, machinery, and surplus materials and clean all sight-exposed surfaces. Leave project clean and ready for final cleaning.

1.02 REQUIREMENTS OF REGULATORY AGENCIES

A. Maintain project in accordance with Occupational Safety and Health Act, latest edition, as it applies to clean-up.

B. Conduct cleaning and disposal operations in compliance with local ordinances and anti-pollution laws.
   1. Do not burn or bury rubbish and waste materials on site.
   2. Do not dispose or volatile waste, such as mineral spirits, oil, or paint thinner, in storm or sanitary drains.

1.03 PRODUCTS

A. Use only cleaning materials recommended by manufacturer of surface to be cleaned, and use cleaning materials only on surfaces recommended by cleaning material manufacturer.

1.04 EXECUTION

A. During Construction: Execute cleaning to ensure that the building, grounds, and public properties are maintained free from accumulation of waste and rubbish.
   1. Wet down dry materials and rubbish to lay dust and prevent blowing dust.
   2. At reasonable intervals during progress of work, clean site and public properties, and dispose of waste materials, debris, and rubbish.
   3. Provide on-site containers for collection of waste materials, debris, and rubbish.
   4. Remove waste materials, debris, and rubbish from site and legally dispose of at a public or private dumping area off Owner’s property.
   5. Handle materials in a controlled manner with as few handlings as possible; do not drop or throw materials from heights.
   6. Schedule cleaning operations so that dust and other contaminants resulting from cleaning process will not fall on wet, newly painted surfaces.

B. Final Cleaning: The Contractor shall be responsible for final cleaning.
   1. Employ experienced workmen, or professional cleaners for final cleaning.
   2. In preparation for substantial completion or occupancy, conduct final inspection of sight exposed interior and exterior surfaces and of concealed spaces.
   3. Remove grease, dust, dirt, stains, labels, fingerprints, and other foreign materials from sight-exposed surfaces; polish surfaces so designated to shine finish.
   4. Repair, patch and touch-up marred surfaces to specified finish, to match adjacent surfaces.
   5. Remove all foreign materials from site areas.

6. Broom clean paved surfaces; rake clean other surfaces of grounds.
7. Remove snow and ice from access to building if applicable.
8. Contractor shall be responsible for cleaning all equipment installed.
9. Maintain cleaning until project or portion thereof is occupied by Owner.

END OF SECTION

SECTION 01 5713

TEMPORARY EROSION AND SEDIMENT CONTROL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Prevention of erosion due to construction activities.

B. Prevention of sedimentation of waterways, open drainage ways, and storm and sanitary sewers due to construction activities.

C. Restoration of areas eroded due to insufficient preventive measures.

D. Performance bond.

E. Compensation of Owner for fines levied by authorities having jurisdiction due to non-compliance by Contractor.

1.02 RELATED REQUIREMENTS

A. Section 31 1000 - Site Clearing: Limits on clearing; disposition of vegetative clearing debris.

B. Section 32 9219 - Seeding: Permanent turf for erosion control.

C. Section 32 9300 - Plants: Permanent plantings for erosion control.

D. Section 03 3000 - Cast-in-Place Concrete: Concrete for temporary and permanent erosion control structures indicated on drawings.

1.03 REFERENCE STANDARDS

A. ASTM D4355/D4355M - Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc Type Apparatus; 2014.

B. ASTM D4491 - Standard Test Methods for Water Permeability of Geotextiles by Permittivity; 1999a (Reapproved 2014).

C. ASTM D4533 - Standard Test Method for Trapezoid Tearing Strength of Geotextiles; 2011.

D. ASTM D4632/D4632M - Standard Test Method for Grab Breaking Load and Elongation of Geotextiles; 2015a.

E. ASTM D4751 - Standard Test Method for Determining Apparent Opening Size of a Geotextile; 2012.

F. ASTM D4873 - Standard Guide for Identification, Storage, and Handling of Geosynthetic Rolls and Samples; 2002 (Reapproved 2009).

G. EPA (NPDES) - National Pollutant Discharge Elimination System (NPDES), Construction General Permit; Current Edition.

H. FHWA FLP-94-005 - Best Management Practices for Erosion and Sediment Control; 1995.

I. USDA TR-55 - Urban Hydrology for Small Watersheds; USDA Natural Resources Conservation Service; 2009.

1.04 PERFORMANCE REQUIREMENTS

A. Comply with requirements of EPA (NPDES) for erosion and sedimentation control, as specified by the NPDES, for Phases I and II, and in compliance with requirements of Construction General Permit (CGP), whether the project is required by law to comply or not.

B. Best Management Practices Standard: FHWA FLP-94-005.

C. Develop and follow an Erosion and Sedimentation Prevention Plan and submit periodic inspection reports.

D. Do not begin clearing, grading, or other work involving disturbance of ground surface cover until applicable permits have been obtained; furnish all documentation required to obtain applicable permits.

E. Provide to Owner a Performance Bond covering erosion and sedimentation preventive measures only, in an amount equal to 100 percent of the cost of erosion and sedimentation control work.

F. Timing: Put preventive measures in place as soon as possible after disturbance of surface cover and before precipitation occurs.

G. Storm Water Runoff: Control increased storm water runoff due to disturbance of surface cover due to construction activities for this project.
   1. Prevent runoff into storm and sanitary sewer systems, including open drainage channels, in excess of actual capacity or amount allowed by authorities having jurisdiction, whichever is less.
   2. Anticipate runoff volume due to the most extreme short term and 24-hour rainfall events that might occur in 25 years.

H. Erosion On Site: Minimize wind, water, and vehicular erosion of soil on project site due to construction activities for this project.
   1. Control movement of sediment and soil from temporary stockpiles of soil.
   2. Prevent development of ruts due to equipment and vehicular traffic.
   3. If erosion occurs due to non-compliance with these requirements, restore eroded areas at no cost to Owner.

I. Erosion Off Site: Prevent erosion of soil and deposition of sediment on other properties caused by water leaving the project site due to construction activities for this project.
   1. Prevent windblown soil from leaving the project site.
   2. Prevent tracking of mud onto public roads outside site.
   3. Prevent mud and sediment from flowing onto sidewalks and pavements.
   4. If erosion occurs due to non-compliance with these requirements, restore eroded areas at no cost to Owner.

J. Sedimentation of Waterways On Site: Prevent sedimentation of waterways on the project site, including rivers, streams, lakes, ponds, open drainage ways, storm sewers, and sanitary sewers.
   1. If sedimentation occurs, install or correct preventive measures immediately at no cost to Owner; remove deposited sediments; comply with requirements of authorities having jurisdiction.
   2. If sediment basins are used as temporary preventive measures, pump dry and remove deposited sediment after each storm.

K. Sedimentation of Waterways Off Site: Prevent sedimentation of waterways off the project site, including rivers, streams, lakes, ponds, open drainage ways, storm sewers, and sanitary sewers.
   1. If sedimentation occurs, install or correct preventive measures immediately at no cost to Owner; remove deposited sediments; comply with requirements of authorities having jurisdiction.

L. Open Water: Prevent standing water that could become stagnant.

M. Maintenance: Maintain temporary preventive measures until permanent measures have been established.

1.05 SUBMITTALS

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

B. Erosion and Sedimentation Control Plan:

1. Submit not less than 30 days prior to anticipated start of clearing, grading, or other work involving disturbance of ground surface cover.
2. Include:
    a. Site plan identifying soils and vegetation, existing erosion problems, and areas vulnerable to erosion due to topography, soils, vegetation, or drainage.
    b. Site plan showing grading; new improvements; temporary roads, traffic accesses, and other temporary construction; and proposed preventive measures.
    c. Where extensive areas of soil will be disturbed, include storm water flow and volume calculations, soil loss predictions, and proposed preventive measures.
    d. Schedule of temporary preventive measures, in relation to ground disturbing activities.
    e. Other information required by law.
    f. Format required by law is acceptable, provided any additional information specified is also included.
3. Obtain the approval of the Plan by authorities having jurisdiction.
4. Obtain the approval of the Plan by Owner.

C. Certificate: Mill certificate for silt fence fabric attesting that fabric and factory seams comply with specified requirements, signed by legally authorized official of manufacturer; indicate actual minimum average roll values; identify fabric by roll identification numbers.

D. Inspection Reports: Submit report of each inspection; identify each preventive measure, indicate condition, and specify maintenance or repair required and accomplished.

PART 2 PRODUCTS

2.01 MATERIALS

A. Grass Seed For Temporary Cover: Select a species appropriate to climate, planting season, and intended purpose. If same area will later be planted with permanent vegetation, do not use species known to be excessively competitive or prone to volunteer in subsequent seasons.

B. Silt Fence Fabric: Polypropylene geotextile resistant to common soil chemicals, mildew, and insects; non-biodegradable; in longest lengths possible; fabric including seams with the following minimum average roll lengths:
1. Average Opening Size: 30 U.S. Std. Sieve, maximum, when tested in accordance with ASTM D4751.
2. Permittivity: 0.05 sec^-1, minimum, when tested in accordance with ASTM D4491.
3. Ultraviolet Resistance: Retaining at least 70 percent of tensile strength, when tested in accordance with ASTM D4355/D4355M after 500 hours exposure.
4. Tensile Strength: 100 lb-f, minimum, in cross-machine direction; 124 lb-f, minimum, in machine direction; when tested in accordance with ASTM D4632/D4632M.
5. Elongation: 15 to 30 percent, when tested in accordance with ASTM D4632/D4632M.
6. Tear Strength: 55 lb-f, minimum, when tested in accordance with ASTM D4533.
7. Color: Manufacturer's standard, with embedment and fastener lines preprinted.

C. Silt Fence Posts: One of the following, minimum 5 feet long:

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine site and identify existing features that contribute to erosion resistance; maintain such existing features to greatest extent possible.

3.02 PREPARATION

A. Schedule work so that soil surfaces are left exposed for the minimum amount of time.

3.03 INSTALLATION

A. Silt Fences:

1. Store and handle fabric in accordance with ASTM D4873.
2. Where slope gradient is less than 3:1 or barriers will be in place less than 6 months, use nominal 16 inch high barriers with minimum 36 inch long posts spaced at 6 feet maximum, with fabric embedded at least 4 inches in ground.
3. Where slope gradient is steeper than 3:1 or barriers will be in place over 6 months, use nominal 28 inch high barriers, minimum 48 inch long posts spaced at 6 feet maximum, with fabric embedded at least 6 inches in ground.
4. Where slope gradient is steeper than 3:1 and vertical height of slope between barriers is more than 20 feet, use nominal 32 inch high barriers with woven wire reinforcement and steel posts spaced at 4 feet maximum, with fabric embedded at least 6 inches in ground.
5. Install with top of fabric at nominal height and embedment as specified.
6. Do not splice fabric width; minimize splices in fabric length; splice at post only, overlapping at least 18 inches, with extra post.
7. Wherever runoff will flow around end of barrier or over the top, provide temporary splash pad or other outlet protection; at such outlets in the run of the barrier, make barrier not more than 12 inches high with post spacing not more than 4 feet.

B. Temporary Seeding:
1. When hydraulic seeder is used, seedbed preparation is not required.
2. When surface soil has been sealed by rainfall or consists of smooth undisturbed cut slopes, and conventional or manual seeding is to be used, prepare seedbed by scarifying sufficiently to allow seed to lodge and germinate.
3. If temporary mulching was used on planting area but not removed, apply nitrogen fertilizer at 1 pound per 1000 sq ft.
4. On soils of very low fertility, apply 10-10-10 fertilizer at rate of 12 to 16 pounds per 1000 sq ft.
5. Incorporate fertilizer into soil before seeding.
6. Apply seed uniformly; if using drill or cultipacker seeders place seed 1/2 to 1 inch deep.
7. Irrigate as required to thoroughly wet soil to depth that will ensure germination, without causing runoff or erosion.
8. Repeat irrigation as required until grass is established.

3.04 MAINTENANCE

A. Inspect preventive measures weekly, within 24 hours after the end of any storm that produces 0.5 inches or more rainfall at the project site, and daily during prolonged rainfall.

B. Repair deficiencies immediately.

C. Silt Fences:
1. Promptly replace fabric that deteriorates unless need for fence has passed.
2. Remove silt deposits that exceed one-third of the height of the fence.
3. Repair fences that are undercut by runoff or otherwise damaged, whether by runoff or other causes.

D. Straw Bale Rows:
1. Promptly replace bales that fall apart or otherwise deteriorate unless need has passed.
2. Remove silt deposits that exceed one-half of the height of the bales.
3. Repair bale rows that are undercut by runoff or otherwise damaged, whether by runoff or other causes.

E. Clean out temporary sediment control structures weekly and relocate soil on site.

F. Place sediment in appropriate locations on site; do not remove from site.

3.05 CLEAN UP

A. Remove temporary measures after permanent measures have been installed, unless permitted to remain by Architect.

B. Clean out temporary sediment control structures that are to remain as permanent measures.

C. Where removal of temporary measures would leave exposed soil, shape surface to an acceptable grade and finish to match adjacent ground surfaces.

END OF SECTION

SECTION 01 6000
PRODUCT REQUIREMENTS

PART 1

1.01 SCOPE

A. This Section includes administrative and procedural requirements governing the Contractor's selection of products for use in the Project.
   1. Product standards and quality- substitutions
   2. Substitutions
   3. Manufacturer's directions
   4. Warranties
   5. Material delivery and responsibilities
   6. Protection
   7. Acceptance of equipment or systems

B. It is the intent of the Specifications and Drawings to accomplish a complete and first-grade installation in which there shall be installed new materials and products of the latest and best design and manufacturer. Workmanship shall be thoroughly first-class and complete, executed by competent and experienced workmen.

C. Equipment, specialties, and similar items shall be checked for compliance and fully approved prior to installation. Contractors are cautioned that work or equipment installed without approval is subject to condemnation, removal, and subsequent replacement with an approved item without extra remuneration.

D. Related Work Specified Elsewhere:
   1. Section 00200 INSTRUCTIONS TO BIDDERS.
   2. Section 013300 SUBMITTAL PROCEDURES.

E. Related Documents: The Work of this Section shall be included as a part of the Contract Documents of each Contractor or Subcontractor on this Project.

F. Definitions:
   1. Definitions used in this Article are not intended to change the meaning of other terms used in the Contract Documents, such as "specialties," "systems," "structure," "finishes," "accessories," and similar terms. Such terms are self explanatory and have well recognized meanings in the construction industry.
      a. "Products" are items purchased for incorporation in the Work, whether purchased for the project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
      b. "Named Products" are items identified by the manufacturer's product name, including make or model number or other designation, shown or listed in the manufacturer's published product literature, that is current as of the date of the Contract Documents.
   2. "Materials" are products substantially shaped, cut, worked, mixed, finished, refined, or otherwise fabricated, processed, or installed to form a part of the Work.
   3. "Equipment" is a product with operational parts, whether motorized or manually operated, that require service, connections, such as wiring or piping.

G. Quality Assurance:
   1. Source Limitations: To the fullest extent possible, provide products of the same kind from a single source.
   2. Compatibility of Options: When the Contractor is given the option of selecting between 2 or more products for use on the project, the product selected shall be compatible with products previously selected, even if previously selected products were also options.
      a. The Contractor is responsible for providing products and construction methods that are compatible with products and construction methods of subcontractors.

b. If a dispute arises between contractors over concurrently selectable, but incompatible products, the Architect will determine which products shall be retained and which are incompatible and must be replaced.

H. Product Delivery, Storage, and Handling:
1. Deliver, store, and handle products according to the manufacturer's recommendations, using means and methods that will prevent damage, deterioration, and loss, including theft.
a. Schedule delivery to minimize long term storage at the site and to prevent overcrowding of construction spaces.
b. Coordinate delivery with installation time to assure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
c. Deliver products to the site in an undamaged condition in the manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
d. Inspect products upon delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.
e. Store products on the site in a manner that will facilitate inspection and measurement of quality or counting of units.
f. Store heavy materials away from the project structure in a manner that will not endanger the supporting construction.
g. Store products subject to damage by elements above ground, under cover in a weathertight enclosure, with ventilation adequate to prevent condensation. Maintain temperature and humidity within range required by manufacturer's instructions.

PART 2

2.01 MATERIALS

A. Product Standards and Quality:
1. The Contract is based on the materials, equipment, and methods described in the Contract
a. Documents.
2. Where in the Drawings and Specifications certain products, manufacturer's trade names, or catalog numbers are given, it is done for the expressed purpose of establishing a basis of quality, durability, and efficiency of design in harmony with the work outlined and is not intended for the purpose of limiting competition.
3. The Architect will consider proposals for substitution of materials, equipment, and methods only when such proposals are accompanied by full and complete technical data and all other information required by the Architect to evaluate the proposed substitution.
4. Do not substitute materials, equipment, or methods unless such substitution has been specifically approved for this Work by the Architect.
a. Refer to Section 00200 INSTRUCTIONS TO BIDDERS.
5. "Or equal":
a. Where the phrase "or equal" or "or equal as approved by the Architect" occurs in the Contract Documents, do not assume that material, equipment, or methods will be approved as equal by the Architect unless the item has been specifically approved for this Work by the Architect in an Addendum.
b. The decision of the Architect shall be final.
6. Availability of Specified Items:
a. Verify prior to bidding that specified items will be available in time for installation during orderly and timely progress of the Work.
b. In the event specified item or items will not be so available, so notify the Architect prior to receipt of bids.

c. Costs of delays because of non-availability of specified items, when such delays could have been avoided by the Contractor, will be back charged as necessary and shall not be borne by the Owner.

7. Voluntary Alternates: Bidders may, if they wish, submit materials and methods other than those described in these Contract Documents as voluntary alternates, provided that they are clearly identified and described on the Bid Form and that the Base Bid is based on materials and methods as described in the Contract Documents. Refer to Instructions To Bidders and Alternates: Section 01230.
8. Where the questions of appearance, artistic effect, or harmony of design are concerned, the Architect reserves the right to refuse approval of substituted products proposed to be substituted for that specified, if in his opinion the item to be substituted is not harmonious to the finished effect and appearance desired, as portrayed in the Drawings and Specifications. The Architect's said refusal to approve, established by this paragraph, is final.

B. Substitutions:
1. Substitutions: Changes in products, materials of construction required by the Contract Documents proposed by the Contractor after award of the Contract are considered to be requests of substitutions. The following are not considered to be requests for substitutions.
a. Substitutions requested during the bidding period, accepted by Addendum prior to award of the Contract, are included in the Contract Documents and are not subject to requirements specified in this Section for substitutions.
b. Revisions to the Contract Documents requested by the Owner or Architect.
c. Specified options of products and construction methods included in the Contract Documents.
d. The Contractor's determination of and compliance with governing regulations and
e. orders issued by governing authorities.
2. Conditions: The Architect will receive and consider the Contractor's request for substitution when one or more of the following conditions are satisfied, as determined by the Architect. If the following conditions are not satisfied, the Architect will return the requests without action except to record non-compliance with these requirements:
a. Extensive revisions to the Contract Documents are not required.
b. Proposed changes are in keeping with the general intent of the Contract Documents.
c. The request is timely, fully documented, and properly submitted.
d. The specified product or method of construction cannot be provided within the Contract Time. The Architect will not consider the request if the product or method cannot be provided as a result of failure to pursue the Work promptly or coordinate activities properly.
e. The requested substitution offers the Owner a substantial advantage, in cost, time, energy conservation, or other considerations, after deducting additional responsibilities the Owner must assume. The Owner's additional responsibilities may include compensation to the Architect for redesign and evaluation services, increased cost of other construction by the Owner, and similar considerations.
f. The specified product or method of construction cannot receive necessary approval by a governing authority, and the requested substitution can be approved.
g. The specified product or method of construction cannot be provided in a manner that is compatible with other materials and where the Contractor certifies that the substitution will overcome the incompatibility.
h. The specified product or method of construction cannot provide a warranty required by the Contract Documents and where the Contractor certifies that the proposed substitutions provides the required warranty.

C. Manufacturer's Directions:
1. Manufactured products shall be applied, installed, connected, erected, used, cleaned, and conditioned in accordance with the manufacturer's printed directions, unless herein

specified to the contrary. Where manufacturer's printed directions are available and where reference is made to manufacturer's directions in the Specifications, the Contractor shall submit 2 copies of such directions to the Architect prior to the beginning of Work covered thereby.

2. Where specific installation instructions are not part of these Specifications and Drawings, equipment shall be installed in strict accordance with instructions from the respective manufacturers. Where installation instructions included in these Specifications or Drawings are at a variance with instructions furnished by the equipment manufacturer, the Contractor shall make written request for clarification from the Architect.
3. In accepting or assenting to the use of apparatus or material, or make, or arrangement thereof, the Architect in no way waives the requirements of these Specifications or the warranty embodied therein.

D. Warranties:
   1. Specific warranties or bonds called for in the Contract Documents, in addition to that falling under the general warranty as set forth in General Conditions, shall be furnished in accordance with the requirements of the Specifications.
      a. Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work that incorporates the products. Manufacturer's disclaimers and limitations on product warranties do not relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor.
      b. Owner's Recourse: Expressed warranties made to the Owner are in addition to implied warranties and shall not limit the duties, obligations, rights, and remedies otherwise available under law. Expressed warranty periods shall not be interpreted as limitations on the time in which the Owner can enforce such other duties, obligations, rights, or remedies.
         1) Rejection of Warranties: The Owner reserves the right to reject warranties and to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
   2. Each Contractor shall and does hereby agree to warrant for a period of one year, or for longer periods, where so provided m the Specifications, as evidenced by the date of Substantial Completion issued by the Architect, products installed under the Contract to be of good quality in every respect and to remain so for periods described herein.
   3. Should defects develop in the aforesaid Work within the specified periods, due to faults in products or their workmanship, the Contractor hereby agrees to make repairs and do necessary Work to correct defective Work to the Architect's satisfaction, in accordance with the General and Supplementary Conditions. Such repairs and corrective Work, including costs of making good other Work damaged by or otherwise affected by making repairs or corrective Work, shall be done, within 14 days after written notice to the Contractor by the Owner. without cost to the Owner and at the entire cost and expense of the Contractor.
      a. Related Damages and Losses: When correcting failed or damaged warranted construction, remove and replace construction that has been damaged as a result of such failure or must be removed and replaced to provide access for correction of warranted construction.
      b. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.
   4. Nothing herein intends or implies that the warranty shall apply to Work which has been abused or neglected or improperly maintained by the Owner or his successor in interest.
   5. Where service on products is required under this Article, it shall be promptly provided when notified by the Owner and no additional charge shall be made, unless it can be

established that the defect or malfunctioning was-caused by abuse or accidental damage not to be expected under conditions of ordinary wear and tear.

6. In the event movement in the adjoining structure or components causes malfunctioning, the Contractor responsible for the original installation of the adjoining structure or components shall provide such repair, replacement, or correction necessary to provide for proper functioning to bring the equipment back into the same operating condition as approved at the completion of the building.
7. The manufacturer and supplier expressly warrants that each item of equipment furnished by him and installed in this Project is suitable for the application shown and specified in the Contract Documents and includes features, accessories, and performing characteristics listed in the manufacturer's catalog in force on the date bids are requested for the Work. This warranty is intended as an assurance by the manufacturer that his equipment is not being misapplied and is fit and sufficient for the service intended. This warranty is in addition to and not in limitation of other warranties or remedies required by law or by the Contract Documents. It shall be the responsibility of the Contractor for the particular equipment to obtain this warranty in writing.
8. In case the Contractor fails to do Work so ordered, the Owner may have work done and charge the cost thereof against monies retained as provided for in the Agreement and, if said retained movies shall be insufficient to pay such cost or if no money is available, the Contractor and his Sureties shall agree to pay to the Owner the cost of such Work.

E. Material Delivery and Responsibilities:
   1. Contractor shall be responsible for materials he orders for delivery to the jobsite. Responsibility includes, but is not limited to, receiving, unloading, storing, protecting, and setting in place; ready for final connections.
      a. The Owner will not be responsible for deliveries related to the construction or operation of the Contractor. The Owner cannot sign delivery forms for the Contractor.
   2. Contractors shall insure that products are delivered to the Project in accordance with the Construction Schedule of the project. In determining date of delivery, sufficient time shall be allowed for shop drawings and sample approvals, including the possibility of having to resubmit improperly prepared submittals or products other than those specified and the necessary fabrication or procurement time along with the delivery method and distance involved.

F. Protection:
   1. Each Contractor shall protect building elements and products when subject to damage. Should workmen or other persons employed or commissioned by one Contractor be responsible for damage, the entire cost of repairing said damage shall be assumed by said individual Contractor. Should damage be done by a person or persons not employed or commissioned by a Contractor, the respective Contractors shall make repairs and charge the cost to the guilty person or persons. The affected Contractors shall be responsible for collecting such charges. If the person or persons responsible for damage cannot be discovered, full and satisfactory repairs shall be made by the respective Contractor, and
      a. the cost of Work shall be prorated against the Contractor.
   2. The respective Contractors shall protect their products prior to installation and final acceptance. Storage shall be dry, clean, and safe. Materials or equipment damaged, deteriorated, rusted or defaced due to improper storage, shall be repaired, refinished, or replaced, as required by the Architect. Products lost through theft or mishandling shall be replaced by the Contractor without cost to the Owner.

G. Acceptance of Equipment or Systems:

1. The Owner will not accept the start of the warranty period on systems or equipment until Substantial Completion notice is issued by the Architect to the Contractor releasing Owner's occupancy of the building, in part or whole. Each Contractor shall make such provisions as required to extend the manufacturer`s warranty from time of initial operation of systems or equipment until written notice of Substantial Completion is received.

END OF SECTION

SECTION 01 6116

VOLATILE ORGANIC COMPOUND (VOC) CONTENT RESTRICTIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. VOC restrictions for product categories listed below under "DEFINITIONS."

B. All products of each category that are installed in the project must comply; Owner's project goals do not allow for partial compliance.

1.02 RELATED REQUIREMENTS

A. Section 01 3000 - Administrative Requirements: Submittal procedures.

B. Section 01 3515 - LEED Certification Procedures.

C. Section 01 6000 - Product Requirements: Fundamental product requirements, substitutions and product options, delivery, storage, and handling.

1.03 DEFINITIONS

A. VOC-Restricted Products: All products of each of the following categories when installed or applied on-site in the building interior:

B. Interior of Building: Anywhere inside the exterior weather barrier.

1.04 REFERENCE STANDARDS

A. CAL (CHPS LEM) - Low-Emitting Materials Product List; California Collaborative for High Performance Schools (CHPS); current edition at www.chps.net/.

B. CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions From Indoor Sources Using Environmental Chambers; California Department of Public Health; v1.1, 2010.

C. CRI (GLCC) - Green Label Testing Program - Approved Product Categories for Carpet Cushion; Carpet and Rug Institute; Current Edition.

D. CRI (GLP) - Green Label Plus Testing Program - Certified Products; www.carpet-rug.org; current edition.

E. GreenSeal GS-11 - Paints; Green Seal, Inc.; 1993.

F. GreenSeal GS-36 - Commercial Adhesives; 2011.

G. SCAQMD 1113 - South Coast Air Quality Management District Rule No.1113; current edition.

H. SCAQMD 1168 - South Coast Air Quality Management District Rule No.1168; current edition.

I. SCS (CPD) - SCS Certified Products; current listings at www.scscertified.com.

1.05 SUBMITTALS

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

B. Evidence of Compliance: Submit for each different product in each applicable category.

C. Product Data: For each VOC-restricted product used in the project, submit evidence of compliance.

1.06 QUALITY ASSURANCE

A. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

PART 2 PRODUCTS

2.01 MATERIALS

A. All VOC-Restricted Products: Provide products having VOC content of types and volume not greater than those specified in State of California Department of Health Services Standard Practice for the Testing of Volatile Organic Emissions From Various Sources Using Small-Scale Environmental Chambers.
   1. Evidence of Compliance: Acceptable types of evidence are:
      a. Current GREENGUARD Children & Schools certification; www.greenguard.org.
      b. Current SCS Indoor Advantage Gold certification; www.scscertified.com.
      c. Product listing in the CHPS Low-Emitting Materials Product List at www.chps.net/manual/lem_table.htm.
      d. Current certification by any other agencies acceptable to CHPS.
      e. Report of laboratory testing performed in accordance with CHPS requirements for getting a product listed in the Low-Emitting Materials Product List; report must include laboratory's statement that the product meets the specified criteria.
   2. Product data submittals showing VOC content are NOT acceptable forms of evidence.

B. Paints and Coatings: Provide products having VOC content as specified in Section 09 9000.

C. Carpet Cushion: Provide products having VOC content not greater than that required for CRI Green Label certification.
   1. Evidence of Compliance: Acceptable types of evidence are:
      a. Current Green Label Certification.
      b. Report of laboratory testing performed in accordance with requirements.

D. Composite Wood and Agrifiber Products and Adhesives Used for Laminating Them: Provide products having no added urea-formaldehyde resins.
   1. Evidence of Compliance: Acceptable types of evidence are:
      a. Published product data showing compliance with requirements.

PART 3 EXECUTION

3.01 FIELD QUALITY CONTROL

A. Owner reserves the right to reject non-compliant products, whether installed or not, and require their removal and replacement with compliant products at no extra cost to Owner.

B. Additional costs to restore indoor air quality due to installation of non-compliant products will be borne by Contractor.

END OF SECTION

SECTION 01 6300

SUBSTITUTIONS AND PRODUCT OPTIONS

SCOPE

1.01 RELATED REQUIREMENTS:

A. Section 00200 INSTRUCTIONS TO BIDDERS: Article entitled SUBSTITUTIONS AND APPROVALS DURING BIDDING.
   1. Conditions of the Contract.
   2. Section 011000 SUMMARY OF WORK.

B. Standards and Named Products:
   1. The naming of products and materials is done for the express purpose of establishing a basis of durability, efficiency, appearance and simplification of maintenance and not for the purpose of limiting competition. Other manufacturer's materials or articles may be used providing the material or article is presented to and approved by the Architect, subject to conditions hereinafter described.
   2. Payment for changes in the work of others which are occasioned by substitutions shall be included as part of the substitution.
   3. Proposals for substitutions will be considered only if said proposals increase the quality of the project, decrease the expenditure on the part of the Owner or are clearly superior to the products, materials, equipment, and methods specified herein. Proposals must be submitted using the “Substitution Request Form” contained herein. Proposals for substitutions which appear to be submitted only to decrease the expenditures on the part of the Contractor without a corresponding proposal for a reduction in the contract amount will not be entertained.
   4. If a substitution is proposed resulting from availability problems with specified materials, proposals should also include consideration for modifications to the contract amount on behalf of the Owner. No request for an extension of the time of completion will be entertained by the Architect if such an extension is a result of the Contractor's lack of knowledge of the availability of the specified items.
   5. All substitution requests shall address the following issues as a minimum for consideration:
      a. Provide complete manufacturer’s product information as required by Section 01330 SUBMITTAL PROCEDURES.
      b. List the specified product which is to be substituted.
      c. If the product is equal to that specified, state the proposed credit to the +Owner.
      d. If the product is superior to that specified, explain in detail the advantages as well as any disadvantages.

END OF SECTION

SECTION 01 7000

EXECUTION

PART 1

1.01 SCOPE

A. This Section includes general procedural requirements governing execution of the Work including, but not limited to, the following:
   1. Construction Layout.
   2. Field Engineering and Surveying.
   3. Geotechnical/Soils Inspection/Sampling
   4. General Installation
   5. Coordination of Owner-Installed Products.
   6. Progress Cleaning.
   7. Starting and Adjusting Equipment
   8. Protection of Installed Construction.
   9. Correction of the Work.

B. Job Requirements: Immediately on discovery of the need for clarification of the Contract Documents, Contractor shall submit a request for information to Architect. Include a detailed description of problem encountered, together with recommendations for changing the Contract Documents. Do not overlook the requirements for the Certified Progress Surveys and the Final Property Survey.

C. Existing Condition Verification: The existence and location of site improvements, utilities, and other construction indicated as existing are not guaranteed. Before beginning work, investigate and verify the existence and location of mechanical and electrical systems and other construction affecting the Work. Verify the location and points of connection of utility services. 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 that may affect the Work. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; and underground electrical services. Furnish location data for work related to Project that must be performed by public utilities serving Project site. 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. 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.

1.02 CONSTRUCTION LAYOUT

A. 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.
   1. Engage a land surveyor to lay out the Work using accepted surveying practices.
      a. 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.
      b. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
      c. Inform installers of lines and levels to which they must comply.
      d. Check the location, level and plumb, of every major element as the Work progresses.
      e. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.

2. Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and invert elevations.
3. 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
4. Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, and weather conditions

PART 3

2.01 FIELD ENGINEERING AND SURVEYING

A. Identification: Owner will identify existing benchmarks, control points, and property corners.

B. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.
1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect before proceeding.
2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.

C. Benchmarks: Establish and maintain a minimum of two (2) permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.
1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

D. Certified Progress 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 sitework. Submit four (4) copies to the Architect, showing the work performed. Record survey data.

E. Final Property Survey: Upon completion of construction, the Contractor shall furnish to the Architect four (4) copies of an As-built ALTA/ACSM Land Title Survey prepared in accordance with the Minimum Standard Detail Requirements adopted in 1992, showing the location on the Property of all improvements constructed thereon, and showing the location of all water, sewer, gas, and electric lines and mains, and of all existing easements and/or rights-of-way. Such survey shall be prepared by a licensed professional surveyor or civil engineer acceptable to the Owner, and who shall certify that the Work is installed and erected entirely upon the Property and within any building restriction lines on the Property, and does not overhang or otherwise encroach upon any easement or right-of-way of others.
1. Include statement that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey.
2. Show boundary lines, monuments, streets, site improvements and utilities, existing improvements and significant vegetation, adjoining properties, acreage, grade contours, and the distance and bearing from a site corner to a legal point.
3. Include an elevation certificate in accordance with NFIP requirements for flood determination purposes.
4. At Substantial Completion, have the final property survey recorded by or with authorities having jurisdiction as the official "property survey."

2.02 PART 4

2.03 GEOTECHNICAL / SOILS INSPECTION / SAMPLING

A. The soils engineer shall be on site to review cut and fill procedures to review and verify that existing soil composition is consistent with soils report and that attained compaction levels are in compliance with the specified requirements.
   1. Perform soil inspections during construction of building pad and foundation excavations.
   2. Should conditions vary from the soils report, the soils engineer shall notify the Architect immediately and render a recommendation on how best to proceed,
   3. Promptly notify Architect of irregularities or deficiencies in the work which are observed during performance of duties
   4. Promptly submit one copy of the report of inspections and test data to the Architect, submit two copies of those reports to the Contractor at the project site, and submit a single copy to the Owner.

2.04 PART 5

2.05 INSTALLATION

A. Acceptance of Conditions: 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. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
   2. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
   3. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
   4. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

B. Location: 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.

C. Compliance: Comply with manufacturer's written instructions and recommendations for installing products in applications indicated. 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. Protection: 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. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels

F. 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.

G. Anchors and Fasteners: Provide anchors and fasteners as required to anchor each component securely in place, accurately located and aligned with other portions of the Work.
   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

H. 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.

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

2.06 PART 6

2.07 OWNER-INSTALLED PRODUCTS

A. Provide access to Project site for Owner's construction forces and coordinate construction and operations of the Work with work performed by Owner's construction forces as required.
   1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
   2. Preinstallation Conferences: Include Owner's construction forces at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction forces if portions of the Work depend on Owner's construction.

2.08 PART 7

2.09 PROGRESS CLEANING

A. Clean site and work areas daily, including common areas. Coordinate progress cleaning for joint-use areas where more than one installer has worked. Enforce requirements strictly. Dispose of materials lawfully. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris. Do not hold materials more than 7 days during normal weather or 3 days if the temperature is expected to rise above 80 deg F. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
   1. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
      a. Remove liquid spills promptly.
      b. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate
   2. 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.
   3. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
   4. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
   5. Waste Disposal: Burying or burning waste materials on-site will not be permitted. Washing waste materials down sewers or into waterways will not be permitted.

2.10 PART 8

2.11 STARTING AND ADJUSTING EQUIPMENT

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

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

C. Testing: 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: If a factory-authorized service representative is required to inspect field-assembled components and equipment installation, comply with qualification requirements.

2.12 PART 9

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

PART 10

3.01 CORRECTION OF THE WORK

A. Repair or remove and replace defective construction. Restore damaged substrates and finishes. Comply with requirements for "Cutting and Patching." Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Restore permanent facilities used during construction to their specified condition. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

B.

3.02 ALTERATIONS

A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
   1. Verify that construction and utility arrangements are as shown.
   2. Report discrepancies to Architect before disturbing existing installation.
   3. Beginning of alterations work constitutes acceptance of existing conditions.

B. Keep areas in which alterations are being conducted separated from other areas that are still occupied.
   1. Provide, erect, and maintain temporary dustproof partitions of construction specified in Section 01 5000 in locations indicated on drawings.
   2. Provide sound retardant partitions of construction indicated on drawings in locations indicated on drawings.

C. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.
   1. Where openings in exterior enclosure exist, provide construction to make exterior enclosure weatherproof.
   2. Insulate existing ducts or pipes that are exposed to outdoor ambient temperatures by alterations work.

D. Remove existing work as indicated and as required to accomplish new work.
   1. Remove items indicated on drawings.
   2. Relocate items indicated on drawings.
   3. Where new surface finishes are to be applied to existing work, perform removals, patch, and prepare existing surfaces as required to receive new finish; remove existing finish if necessary for successful application of new finish.
   4. Where new surface finishes are not specified or indicated, patch holes and damaged surfaces to match adjacent finished surfaces as closely as possible.

E. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, Telecommunications, and _____): Remove, relocate, and extend existing systems to accommodate new construction.
   1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components; if necessary, modify installation to allow access or provide access panel.
   2. Where existing systems or equipment are not active and Contract Documents require reactivation, put back into operational condition; repair supply, distribution, and equipment as required.
   3. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
      a. Disable existing systems only to make switchovers and connections; minimize duration of outages.
      b. See Section 01 1000 for other limitations on outages and required notifications.
      c. Provide temporary connections as required to maintain existing systems in service.
   4. Verify that abandoned services serve only abandoned facilities.
   5. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification; patch holes left by removal using materials specified for new construction.

F. Protect existing work to remain.
   1. Prevent movement of structure; provide shoring and bracing if necessary.
   2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
   3. Repair adjacent construction and finishes damaged during removal work.

G. Adapt existing work to fit new work: Make as neat and smooth transition as possible.
   1. When existing finished surfaces are cut so that a smooth transition with new work is not possible, terminate existing surface along a straight line at a natural line of division and make recommendation to Architect.
   2. Where removal of partitions or walls results in adjacent spaces becoming one, rework floors, walls, and ceilings to a smooth plane without breaks, steps, or bulkheads.
   3. Where a change of plane of 1/4 inch or more occurs in existing work, submit recommendation for providing a smooth transition for Architect review and request instructions.
   4. Trim existing wood doors as necessary to clear new floor finish. Refinish trim as required.

H. Patching: Where the existing surface is not indicated to be refinished, patch to match the surface finish that existed prior to cutting. Where the surface is indicated to be refinished, patch so that the substrate is ready for the new finish.

I. Refinish existing surfaces as indicated:
   1. Where rooms or spaces are indicated to be refinished, refinish all visible existing surfaces to remain to the specified condition for each material, with a neat transition to adjacent finishes.
   2. If mechanical or electrical work is exposed accidentally during the work, re-cover and refinish to match.

J. Clean existing systems and equipment.

K. Remove demolition debris and abandoned items from alterations areas and dispose of off-site; do not burn or bury.

L. Do not begin new construction in alterations areas before demolition is complete.

M. Comply with all other applicable requirements of this section.

END OF SECTION

SECTION 01 7200
PROJECT RECORD DOCUMENTS

PART 1

1.01 SCOPE

A. At the site, maintain a “Project Record” copy of each of the following for Architect’s and Owner’s use:
   1. Drawings.
   2. Specifications.
   3. Addenda.
   4. Change Orders and other modifications to the Contract.
   5. Architect field orders or written instructions.
   6. Approved shop drawings, product data and samples.
   7. Field test records.
   8. Label each document “PROJECT RECORD” in neat, large printed letters.

B. Job Requirements: At contract close-out, deliver to the Architect (for the Owner) one set of reproducible as-builts of all sheets of the Contract Documents which have been corrected (by Contractor) to indicate all changes along with one Project Manual including addenda which have been corrected by Contractors to indicate all changes. Cost of reproducible mylars or sepias shall be borne by the General Contractor. All corrections shall be made using the same quality of linework, lettering, symbols, etc., as appears on the original Contract Documents.

PART 2

2.01 RECORDING

A. Record information concurrently with construction progress. Do not physically conceal any Work until required information is recorded.
   1. Drawings: Legibly mark to record actual construction.
      a. Horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
      b. Location of internal utilities and appurtenances concealed in the construction, referenced to visible and accessible features of the structure.
      c. Field changes of dimension and detail.
      d. Changes made by Field Order or by Change Order.
      e. Details not on original Contract Drawings.
   2. Specifications and Addenda: Legibly mark each section to record:
      a. Manufacturer, trade name, catalog number and supplier of each product and item of equipment actually installed.
      b. Changes made by Field Order or by Change Order.

END OF SECTION

SECTION 01 7400
WARRANTIES AND BONDS

PART 1

1.01 SCOPE

A. Unless otherwise specified in respective specificatin section the General Contractor shall warrant all materials and workmanship for a period of 12 months beginning at the date of Substantial Completion or Permission to Occupy.
   1. Any defective materials or workmanship shall be corrected or replaced without cost to the Owner during the warranty period.

B. This section covers furnishing two (2) copies of all warranties and bonds as part of the close-out requirements.
   1. Related Requirements:
      a. Conditions of the contract: Performance Bond and Payment Bonds.
      b. Section 017300 OPERATIONS AND MAINTENANCE DATA.
      c. Each Specification Section: Warranties and bonds required for specific products or work.

PART 2

2.01 FORM OF SUBMITTALS

A. Bind in commercial quality 8-1/2" x 11" three-ring side binders with durable and cleanable plastic covers.

B. Label cover of each packet with typed or printed title "WARRANTIES AND BONDS", with title of project, name, address and telephone number of Contractor, and name of responsible principal.

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

D. Separate each warranty or bond with index tab sheets, keyed to the Table of Contents listing. Provide full information, using separate type sheet as necessary.
   1. Subcontractor, supplier and manufacturer, with name, address and telephone number of responsible principal.
   2. Date of beginning and duration of warranty or bond.
   3. Scope of responsibilities.
   4. Instances which might affect the validity of warranty or bond.
   5. Owner's procedures in the event of failure of product or work.

PART 3

3.01 PREPARATION OF SUBMITTALS

A. Obtain warranties and bonds, executed in duplicate by responsible subcontractor, suppliers and manufacturers, within ten days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave data of beginning of time of warranty until the date of substantial completion is determined. Verity that documents are in proper form, full information is provided, and notarized. Co-execute submittals.

3.02 PART 4

3.03 TIME OF SUBMITTALS

A. Make submittals within ten days after date of Substantial Completion, prior to final application for payment.

B. For items of work when acceptance is delayed beyond date of Substantial Completion, submit within ten days after acceptance by Architect, listing the date of acceptance as the beginning of the warranty period

END OF SECTION

SECTION 01 7800
CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Project Record Documents.

B. Operation and Maintenance Data.

C. Warranties and bonds.

1.02 RELATED REQUIREMENTS

A. Section 01 3000 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.

B. Individual Product Sections: Specific requirements for operation and maintenance data.

C. Individual Product Sections: Warranties required for specific products or Work.

1.03 SUBMITTALS

A. Project Record Documents: Submit documents to Architect with claim for final Application for Payment.

B. Operation and Maintenance Data:
   1. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Architect will review draft and return one copy with comments.
   2. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within ten days after acceptance.
   3. Submit one copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with Architect comments. Revise content of all document sets as required prior to final submission.
   4. Submit two sets of revised final documents in final form within 10 days after final inspection.

C. Warranties and Bonds:
   1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.
   2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.
   3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PROJECT RECORD DOCUMENTS

A. Maintain on site two sets of the following record documents to be provided to thw owner; record actual revisions to the Work:
   1. Drawings.
   2. Addenda.
   3. Change Orders and other modifications to the Contract.
   4. Reviewed shop drawings, product data, and samples.
   5. Manufacturer's instruction for assembly, installation, and adjusting.

B. Ensure entries are complete and accurate, enabling future reference by Owner.

C. Store record documents separate from documents used for construction.

D. Record information concurrent with construction progress.

E. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
   1. Field changes of dimension and detail.
   2. Details not on original Contract drawings.
   3. Record Prints: Maintain one set of blue- or black-line white prints of the Contract Drawings and Shop Drawings.
      a. 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 prepare the marked-up Record Prints.
         1) Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
         2) Accurately record information in an understandable drawing technique.
         3) Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.
      b. Content: Types of items requiring marking include, but are not limited to, the following:
         1) Dimensional changes to Drawings.
         2) Revisions to details shown on Drawings.
         3) Depths of foundations below first floor.
         4) Locations and depths of underground utilities.
         5) Revisions to routing of piping and conduits.
         6) Revisions to electrical circuitry.
         7) Actual equipment locations.
         8) Duct size and routing.
         9) Locations of concealed internal utilities.
         10) Retain Work Change Directive in first subparagraph below if using EJCDC Document 1910-8.
         11) Changes made by Change Order or Construction Change Directive.
         12) Changes made following Architect's written orders.
         13) Details not on the original Contract Drawings.
         14) Field records for variable and concealed conditions.
         15) Record information on the Work that is shown only schematically.
      c. Mark the Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. If Shop Drawings are marked, show cross-reference on the Contract Drawings.
      d. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
      e. Mark important additional information that was either shown schematically or omitted from original Drawings.
      f. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

F. Record Specifications:
   1. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
   2. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
   3. Delete two subparagraphs below if provisions are too elaborate, or revise to suit Project.
   4. Retain first subparagraph below with or without subparagraph above, where this record is desired.

a. For each principal product, indicate whether Record Product Data has been submitted in operation and maintenance manuals instead of submitted as Record Product Data.
b. Note related Change Orders, Record Product Data, and Record Drawings where applicable.

G. As Built Survey:
1. General Contractor shall be responsible for contracting with surveying company to complete an as built survey to document final construction and site conditions.
2. Survey requirements shall meet ALTA standards: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
a. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.

H. Record Product Data:
1. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
a. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
b. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
c. If possible, a Change Order proposal should include resubmitting updated Product Data. This eliminates the need to mark up the previous submittal.
d. Note related Change Orders, Record Specifications, and Record Drawings where applicable.
2.

3.02 OPERATION AND MAINTENANCE DATA

A. Source Data: For each product or system, list names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.

B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.

C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.

D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

3.03 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

A. For Each Product, Applied Material, and Finish:

B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.

C. Moisture protection and weather-exposed products: Include product data listing applicable reference standards, chemical composition, and details of installation. Provide recommendations for inspections, maintenance, and repair.

D. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

3.04 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

A. For Each Item of Equipment and Each System:
1. Description of unit or system, and component parts.
2. Identify function, normal operating characteristics, and limiting conditions.

3. Include performance curves, with engineering data and tests.
4. Complete nomenclature and model number of replaceable parts.

B. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

C. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.

D. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

E. Provide servicing and lubrication schedule, and list of lubricants required.

F. Include manufacturer's printed operation and maintenance instructions.

G. Include sequence of operation by controls manufacturer.

H. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

I. Provide Contractor's coordination drawings, with color coded piping diagrams as installed.

J. Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

K. Additional Requirements: As specified in individual product specification sections.

3.05 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS

A. Assemble operation and maintenance data into durable manuals for Owner's personnel use, with data arranged in the same sequence as, and identified by, the specification sections.

B. Where systems involve more than one specification section, provide separate tabbed divider for each system.

C. Prepare instructions and data by personnel experienced in maintenance and operation of described products.

D. Prepare data in the form of an instructional manual.

E. Binders: Commercial quality, 8-1/2 by 11 inch three D side ring binders with durable plastic covers; 2 1/2 inch maximum ring size. When multiple binders are used, correlate data into related consistent groupings.

F. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.

G. Project Directory: Title and address of Project; names, addresses, and telephone numbers of Architect, Consultants,Contractorand subcontractors, with names of responsible parties.

H. Tables of Contents: List every item separated by a divider, using the same identification as on the divider tab; where multiple volumes are required, include all volumes Tables of Contents in each volume, with the current volume clearly identified.

I. Dividers: Provide tabbed dividers for each separate product and system; identify the contents on the divider tab; immediately following the divider tab include a description of product and major component parts of equipment.

J. Text: Manufacturer's printed data, or typewritten data on 24 pound paper.

K. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

L. Arrange content by systems under section numbers and sequence of Table of Contents of this Project Manual.

M. Contents: Prepare a Table of Contents for each volume, with each product or system description identified, in three parts as follows:
   1. Part 1: Directory, listing names, addresses, and telephone numbers of Architect, Contractor, Subcontractors, and major equipment suppliers.
   2. Part 2: Operation and maintenance instructions, arranged by system and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
      a. Significant design criteria.
      b. List of equipment.
      c. Parts list for each component.
      d. Operating instructions.
      e. Maintenance instructions for equipment and systems.
      f. Maintenance instructions for special finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.
   3. Part 3: Project documents and certificates, including the following:
      a. Shop drawings and product data.

N. In addition to hard printed copies of all instruction manuals provide same information digitally to the owner on CD or DVD in standard software format. Clearly label contents of each disk.

3.06 WARRANTIES AND BONDS

A. Unless otherwise specified in respective specification section the General Contractor and each Subcontractor shall warrant all materials and workmanship for a period of 12 months beginning at the date of Substantial Completion or Permission to Occupy.
   1. Any defective materials or workmanship shall be corrected or replaced without cost to the Owner during the warranty period.

B. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial completion is determined.

C. Verify that documents are in proper form, contain full information, and are notarized.

D. Co-execute submittals when required.

E. Retain warranties and bonds until time specified for submittal.

F. Manual: Bind in commercial quality 8-1/2 by 11 inch three D side ring binders with durable plastic covers.

G. Cover: Identify each binder with typed or printed title WARRANTIES AND BONDS, with title of Project; name, address and telephone number of Contractor and equipment supplier; and name of responsible company principal.

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

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

END OF SECTION

SECTION 01 7823

OPERATING AND MAINTENANCE DATA

PART1

1.01 SCOPE

A. This section covers furnishing two (2) hard copies and two (2) electronic copies of Operating and Maintenance Data as part of the Close-Out Requirements.

PART 2

2.01 CONTENT AND FORMAT

A. Provide bound operations and maintenance data manuals covering all systems, equipment and materials as installed. Manuals shall contain the following:
   1. Diagrams of all systems, including temperature control system.
   2. Approved equipment drawings and data clearly marked for equipment furnished.
   3. Complete operating and maintenance instructions for each system and item of equipment, setting forth in detail and step-by-step the procedure for starting, stopping, operating and maintaining the entire system as installed.
   4. Exploded view and a parts list of all items of equipment.
   5. A complete valve tag list including the name and function of the pipe in which the valve is mounted.
   6. Any special emergency operating instructions and a list of service organizations (including addresses and telephone numbers) capable of rendering emergency service to the various parts of the system.
   7. A certified log of air quantities at all air supply, return and exhaust openings as approved by the Architect.
   8. ASME and State pressure vessel inspection forms.
   9. All motor data, including standard and actual operating in service data.
   10. Manufacturer's equipment guarantees.
   11. Complete maintenance instructions for all materials installed, i.e., flooring, wall coverings, windows, builders hardware, etc.

B. Provide, in a separately indexed section of the manual, a complete comprehensive schedule of maintenance intervals for each system and each piece of equipment installed requiring any periodic maintenance, i.e., daily, bi-weekly, or bi-monthly, monthly, quarterly, semi-annually and annually. Include in the manual a schedule of filters, to include size, media type, cleaning interval, listed by A.H.U. No. and location.

C. Instruct the Owner or his selected representatives (via demonstration) as to the proper care and maintenance of each system, item of equipment and materials and provide signed acknowledgment from personnel receiving such instruction in the bound manuals following the data for that system or item.

D. Hard-copy Manuals shall be loose leaf with fiberboard covers. Each sheet shall be reinforced to prevent tearing from continued use, and each manual shall have the following information clearly printed on its cover:
   1. Project name, name of Owner and address.
   2. Name and address of Architect.
   3. Contractor and Subcontractor names, addresses, department to contact and telephone numbers, including night and emergency numbers.
   4. Supplier names and telephone numbers.
   5. Name and telephone number of manufacturer's authorized representative.

E. Electronic Manuals shall be supplied by CD submittal, containing all information in PDF or CAD format. CD shall be organized and contain an index of information. Each electronic manual shall have the following information printed on its cover:
   1. Project name, name of Owner and address

2. Name and address of Architect.
3. Contractor and Subcontractor names, addresses, department to contact and telephone numbers, including night and emergency numbers.

F. Job Requirements: Operating and maintenance data submittals shall be reviewed by the Architect prior to authorizing release of final retainage at completion and shall be updated to include additions, changes and acknowledgments which shall be approved by the Architect prior to authorizing final payment.

END OF SECTION

SECTION 01 7900
DEMONSTRATION AND TRAINING

PART 1 GENERAL

1.01 SUMMARY

A. Demonstration of products and systems to be commissioned and where indicated in specific specification sections.

B. Training of Owner personnel in operation and maintenance is required for:
   1. All software-operated systems.
   2. HVAC systems and equipment.
   3. Plumbing equipment.
   4. Electrical systems and equipment.
   5. Conveying systems.
   6. Landscape irrigation.

C. Training of Owner personnel in care, cleaning, maintenance, and repair is required for:
   1. Items specified in individual product Sections.

1.02 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures; except:
   1. Make all submittals specified in this section, and elsewhere where indicated for commissioning purposes, directly to the Commissioning Authority.
   2. Submit one copy to the Commissioning Authority, not to be returned.
   3. Make commissioning submittals on time schedule specified by Commissioning Authority.
   4. Submittals indicated as "Draft" are intended for the use of the Commissioning Authority in preparation of overall Training Plan; submit in editable electronic format, Microsoft Word 2003 preferred.

B. Draft Training Plans: Owner will designate personnel to be trained; tailor training to needs and skill-level of attendees.
   1. Submit to Commissioning Authority for review and inclusion in overall training plan.
   2. Submit not less than four weeks prior to start of training.
   3. Revise and resubmit until acceptable.
   4. Provide an overall schedule showing all training sessions.
   5. Include at least the following for each training session:
      a. Identification, date, time, and duration.
      b. Description of products and/or systems to be covered.
      c. Name of firm and person conducting training; include qualifications.
      d. Intended audience, such as job description.
      e. Objectives of training and suggested methods of ensuring adequate training.
      f. Methods to be used, such as classroom lecture, live demonstrations, hands-on, etc.
      g. Media to be used, such a slides, hand-outs, etc.
      h. Training equipment required, such as projector, projection screen, etc., to be provided by Contractor.

C. Training Manuals: Provide training manual for each attendee; allow for minimum of two attendees per training session.
   1. Include applicable portion of O&M manuals.
   2. Include copies of all hand-outs, slides, overheads, video presentations, etc., that are not included in O&M manuals.
   3. Provide one extra copy of each training manual to be included with operation and maintenance data.

D. Training Reports:
   1. Identification of each training session, date, time, and duration.

2. Sign-in sheet showing names and job titles of attendees.
3. List of attendee questions and written answers given, including copies of and references to supporting documentation required for clarification; include answers to questions that could not be answered in original training session.
4. Include Commissioning Authority's formal acceptance of training session.

E. Video Recordings: Submit digital video recording of each demonstration and training session for Owner's subsequent use.
1. Format: DVD Disc.
2. Label each disc and container with session identification and date.

1.03 QUALITY ASSURANCE

A. Instructor Qualifications: Familiar with design, operation, maintenance and troubleshooting of the relevant products and systems.
1. Provide as instructors the most qualified trainer of those contractors and/or installers who actually supplied and installed the systems and equipment.
2. Where a single person is not familiar with all aspects, provide specialists with necessary qualifications.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 DEMONSTRATION - GENERAL

A. Demonstrations conducted during system start-up do not qualify as demonstrations for the purposes of this section, unless approved in advance by Owner.

B. Demonstrations conducted during Functional Testing need not be repeated unless Owner personnel training is specified.

C. Demonstration may be combined with Owner personnel training if applicable.

D. Operating Equipment and Systems: Demonstrate operation in all modes, including start-up, shut-down, seasonal changeover, emergency conditions, and troubleshooting, and maintenance procedures, including scheduled and preventive maintenance.
1. Perform demonstrations not less than two weeks prior to Substantial Completion.
2. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.

E. Non-Operating Products: Demonstrate cleaning, scheduled and preventive maintenance, and repair procedures.
1. Perform demonstrations not less than two weeks prior to Substantial Completion.

3.02 TRAINING - GENERAL

A. Commissioning Authority will prepare the Training Plan based on draft plans submitted.

B. Conduct training on-site unless otherwise indicated.

C. Owner will provide classroom and seating at no cost to Contractor.

D. Do not start training until Functional Testing is complete, unless otherwise specified or approved by the Commissioning Authority.

E. Provide training in minimum two hour segments.

F. The Commissioning Authority is responsible for determining that the training was satisfactorily completed and will provide approval forms.

G. Training schedule will be subject to availability of Owner's personnel to be trained; re-schedule training sessions as required by Owner; once schedule has been approved by Owner failure to conduct sessions according to schedule will be cause for Owner to charge Contractor for personnel "show-up" time.

H. Review of Facility Policy on Operation and Maintenance Data: During training discuss:

1. The location of the O&M manuals and procedures for use and preservation; backup copies.
2. Typical contents and organization of all manuals, including explanatory information, system narratives, and product specific information.
3. Typical uses of the O&M manuals.

I. Product- and System-Specific Training:
1. Review the applicable O&M manuals.
2. For systems, provide an overview of system operation, design parameters and constraints, and operational strategies.
3. Review instructions for proper operation in all modes, including start-up, shut-down, seasonal changeover and emergency procedures, and for maintenance, including preventative maintenance.
4. Provide hands-on training on all operational modes possible and preventive maintenance.
5. Emphasize safe and proper operating requirements; discuss relevant health and safety issues and emergency procedures.
6. Discuss common troubleshooting problems and solutions.
7. Discuss any peculiarities of equipment installation or operation.
8. Discuss warranties and guarantees, including procedures necessary to avoid voiding coverage.
9. Review recommended tools and spare parts inventory suggestions of manufacturers.
10. Review spare parts and tools required to be furnished by Contractor.
11. Review spare parts suppliers and sources and procurement procedures.

J. Be prepared to answer questions raised by training attendees; if unable to answer during training session, provide written response within three days.

END OF SECTION

SECTION 02 3010
SUBSURFACE CONDITIONS

PART 1 GENERAL

1.01 DESCRIPTION

A. General: Soils borings have been taken from the subject site and a report generated which is included as part of the project manual.

B. Use of Data:
   1. Bidders should visit the site and acquaint themselves with all existing conditions. Prior to bidding, bidders may make their own subsurface investigations to satisfy themselves as to site and subsurface conditions, but all such investigations shall be performed only under time schedules and arrangements approved in advance by the General Contractor.
   2. To that extent necessary all of the recommendations by the Soil Engineer have been incorporated as part of this Project Manual or the Construction Drawings.
   3. If conditions are encountered in the field during construction which vary from the facts of this report, the Soils Engineer should be contacted immediately to examine such changed conditions in the field and make the appropriate recommendations in light of the contract documents.
   4. The earthwork recommendations of the soils report presume that the earthwork will be monitored continuously by an Engineering Technician under the direction of a Registered Professional Geotechnical Engineer. The Contractor will contract these services directly with the Soils Engineer of record.
   5. A preconstruction meeting should be held at the site with the Owner, the Architect, the Structural Engineer, the General Contractor, the Excavating Contractor, the Soils Engineer and any other interested parties to review the scope and schedule of the proposed earthwork and foundation installation.

1.02 QUALITY ASSURANCE

A. Soil Engineer will be retained by the Contractor during the construction period to observe performance of work in connection with excavating, trenching, filling, backfilling, and grading.
   1. Soil Engineer will issue written reports for each site visit documenting his findings and all actions and/or recommendations made to the contractor during the site visit.
   2. Distribute reports to the Architect and Owner.

B. Adjustment of work: Readjust all work performed that does not meet technical or design requirements, but make no deviations from the Contract Documents without specific and written approval from the Architect.

PART 2 PRODUCTS (NOT APPLICABLE)

END OF SECTION

SECTION 02 4100
DEMOLITION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Selective demolition of built site elements.

B. Selective demolition of building elements for alteration purposes.

C. Abandonment and removal of existing utilities and utility structures.

1.02 RELATED REQUIREMENTS

A. Section 01 1000 - Summary: Limitations on Contractor's use of site and premises.

B. Section 01 1000 - Summary: Sequencing and staging requirements.

C. Section 01 1000 - Summary: Description of items to be salvaged or removed for re-use by Contractor.

D. Section 01 5000 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.

E. Section 01 6000 - Product Requirements: Handling and storage of items removed for salvage and relocation.

F. Section 01 7000 - Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products; temporary bracing and shoring.

G. Section 01 7419 - Construction Waste Management and Disposal: Limitations on disposal of removed materials; requirements for recycling.

H. Section 31 2323 - Fill: Filling holes, pits, and excavations generated as a result of removal operations.

1.03 REFERENCE STANDARDS

A. 29 CFR 1926 - U.S. Occupational Safety and Health Standards; current edition.

B. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2013.

1.04 SUBMITTALS

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

B. Site Plan: Showing:
   1. Vegetation to be protected.
   2. Areas for temporary construction and field offices.
   3. Areas for temporary and permanent placement of removed materials.

C. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction.

1.05 QUALITY ASSURANCE

A. Demolition Firm Qualifications: Company specializing in the type of work required.
   1. Minimum of five (5) years of documented experience.

PART 2 PRODUCTS

2.01 MATERIALS

PART 3 EXECUTION

3.01 SCOPE

A. Remove the entire building designated on the drawings.

B. Remove portions of existing buildings as indicated on the drawings.

C. Within area of new construction, remove foundation walls and footings to a minimum of 2 feet below finished grade.

D. Outside area of new construction, remove foundation walls and footings to a minimum of 2 feet below finished grade.

E. Break up concrete slabs on grade within site boundaries to permit natural moisture drainage; leave pieces not larger than 1 square yard.

F. Remove other items indicated, for salvage, relocation, and recycling.

3.02 GENERAL PROCEDURES AND PROJECT CONDITIONS

A. Comply with other requirements specified in Section 01 7000.

B. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
   1. Obtain required permits.
   2. Comply with applicable requirements of NFPA 241.
   3. Use of explosives is not permitted.
   4. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.
   5. Provide, erect, and maintain temporary barriers and security devices.
   6. Use physical barriers to prevent access to areas that could be hazardous to workers or the public.
   7. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
   8. Do not close or obstruct roadways or sidewalks without permit.
   9. Conduct operations to minimize obstruction of public and private entrances and exits; do not obstruct required exits at any time; protect persons using entrances and exits from removal operations.
   10. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon or limit access to their property.

C. Do not begin removal until receipt of notification to proceed from Owner.

D. Do not begin removal until built elements to be salvaged or relocated have been removed.

E. Protect existing structures and other elements that are not to be removed.
   1. Provide bracing and shoring.
   2. Prevent movement or settlement of adjacent structures.
   3. Stop work immediately if adjacent structures appear to be in danger.

F. Minimize production of dust due to demolition operations; do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.

G. If hazardous materials are discovered during removal operations, stop work and notify Architect and Owner; hazardous materials include regulated asbestos containing materials, lead, PCB's, and mercury.

H. Perform demolition in a manner that maximizes salvage and recycling of materials.
   1. Comply with requirements of Section 01 7419 - Waste Management.
   2. Dismantle existing construction and separate materials.
   3. Set aside reusable, recyclable, and salvageable materials; store and deliver to collection point or point of reuse.

3.03 EXISTING UTILITIES

A. Coordinate work with utility companies; notify before starting work and comply with their requirements; obtain required permits.

B. Protect existing utilities to remain from damage.

C. Do not disrupt public utilities without permit from authority having jurisdiction.

D. Do not close, shut off, or disrupt existing life safety systems that are in use without at least 7 days prior written notification to Owner.

E. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without at least 3 days prior written notification to Owner.

F. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.

G. Remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.

H. Prepare building demolition areas by disconnecting and capping utilities outside the demolition zone; identify and mark utilities to be subsequently reconnected, in same manner as other utilities to remain.

3.04 SELECTIVE DEMOLITION FOR ALTERATIONS

A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
   1. Verify that construction and utility arrangements are as indicated.
   2. Report discrepancies to Architect before disturbing existing installation.
   3. Beginning of demolition work constitutes acceptance of existing conditions that would be apparent upon examination prior to starting demolition.

B. Separate areas in which demolition is being conducted from other areas that are still occupied.
   1. Provide, erect, and maintain temporary dustproof partitions of construction specified in Section 01 5000 in locations indicated on drawings.

C. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.

D. Remove existing work as indicated and as required to accomplish new work.
   1. Remove items indicated on drawings.

E. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, Telecommunications, and _____): Remove existing systems and equipment as indicated.
   1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components.
   2. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
   3. Verify that abandoned services serve only abandoned facilities before removal.
   4. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification.

F. Protect existing work to remain.
   1. Prevent movement of structure; provide shoring and bracing if necessary.
   2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
   3. Repair adjacent construction and finishes damaged during removal work.
   4. Patch as specified for patching new work.

3.05 DEBRIS AND WASTE REMOVAL

A. Remove debris, junk, and trash from site.

B. Remove from site all materials not to be reused on site; comply with requirements of Section 01 7419 - Waste Management.

C. Leave site in clean condition, ready for subsequent work.

D. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION

SECTION 03 0100
MAINTENANCE OF CONCRETE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Cleaning of existing concrete surfaces.

B. Repair of exposed structural, shrinkage, and settlement cracks.

C. Resurfacing of concrete surfaces having spalled areas and other damage.

D. Repair of deteriorated concrete.

E. Repair of internal concrete reinforcement.

1.02 RELATED REQUIREMENTS

1.03 REFERENCE STANDARDS

A. ASTM A775/A775M - Standard Specification for Epoxy-Coated Steel Reinforcing Bars; 2007b (Reapproved 2014).

B. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2016.

C. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 2015a.

D. ASTM C150/C150M - Standard Specification for Portland Cement; 2016.

E. ASTM C404 - Standard Specification for Aggregates for Masonry Grout; 2011.

F. ASTM C928/C928M - Standard Specification for Packaged, Dry, Rapid-Hardening Cementitious Material for Concrete Repairs; 2013.

G. ASTM C1059/C1059M - Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete; 2013.

1.04 SUBMITTALS

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

B. Product Data: Indicate product standards, physical and chemical characteristics, technical specifications, limitations, maintenance instructions, and general recommendations regarding each material.

C. Project Record Documents: Accurately record actual locations of structural reinforcement repairs and type of repair.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with minimum of 3 years of documented experience.

1.06 MOCK-UP(S)

A. Crack Injection: Prepare one sample of each type of injection.

B. Horizontal Surface Repair: Total of 10 foot square area, demonstrating each type of repair.

C. Vertical Surface Repair: Total of 10 foot square area, demonstrating each type of repair.

D. Where color or texture matching is required, first prepare a small size sample on cementitious board.

E. Re-work mock-up(s) until satisfactory to Architect.

F. Satisfactory mock-up(s) may remain as part of the work.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Comply with manufacturers' instructions for storage, shelf life limitations, and handling of products.

PART 2 PRODUCTS

2.01 CLEANING MATERIALS

A. Degreaser:
   1. Manufacturers:
      a. Euclid Chemical Company; Euco Clean and Strip: www.euclidchemical.com/#sle.
      b. L&M Construction Chemicals, Inc, a subsidiary of Laticrete International, Inc; CITREX: www.lmcc.com/#sle.
      c. SpecChem, LLC; Orange Peel-Citrus Cleaner: www.specchemllc.com/#sle.

B. Detergent: Non-ionic detergent.

2.02 CEMENTITIOUS PATCHING AND REPAIR MATERIALS

A. Manufacturers:
   1. Adhesives Technology Corporation: www.atcepoxy.com/#sle.
   2. ARDEX Engineered Cements: www.ardexamericas.com/#sle.
   3. Dayton Superior Corporation: www.daytonsuperior.com/#sle.
   4. The QUIKRETE Companies: www.quikrete.com/#sle.
   5. W. R. Meadows, Inc: www.wrmeadows.com/#sle.

B. Bonding Slurry: Water-based latex admixture complying with ASTM C1059/C1059M, combined with Portland cement and sand in accordance with admixture manufacturer's instructions.
   1. Admixture Manufacturers:
      a. Dayton Superior Corporation; Acrylic Bonding Agent J40: www.daytonsuperior.com/#sle.
      b. The QUIKRETE Companies; QUIKRETE® Concrete Bonding Adhesive: www.quikrete.com/#sle.
      c. W. R. Meadows, Inc; Acry-lok: www.wrmeadows.com/#sle.
      d. Substitutions: See Section 01 6000 - Product Requirements.

C. Cementitious Repair Mortar, Trowel Grade: One- or two-component, factory-mixed, polymer-modified cementitious mortar.
   1. In-place material resistant to freeze/thaw conditions.
   2. Dry Material: Complies with ASTM C928/C928M.
   3. Integral corrosion inhibitor.
   4. Products:
      a. Adhesives Technology Corporation; HARD-ROK JET PATCH: www.atcepoxy.com/#sle.
      b. Kaufman Products Inc; Patchwell Deep Light: www.kaufmanproducts.net/#sle.
      c. The QUIKRETE Companies; QUIKRETE® FastSet Repair Mortar: www.quikrete.com/#sle.
      d. W. R. Meadows, Inc; Meadow-Crete GPS: www.wrmeadows.com/#sle.
      e. Substitutions: See Section 01 6000 - Product Requirements.

D. Cementitious Pavement Repair Mortar: Fast hardening, flowable; composed of cement, sand, and additives; capable of setting in cold weather conditions without the aid of chloride- or gypsum-based accelerators; in-place material resistant to freeze/thaw conditions.
   1. Dry Material: Complies with ASTM C928/C928M.
   2. Integral corrosion inhibitor.
   3. Manufacturers:
      a. ARDEX Engineered Cements; ARDEX ERM: www.ardexamericas.com/#sle.
      b. ARDEX Engineered Cements; ARDEX CD: www.ardexamericas.com/#sle.

c. ARDEX Engineered Cements; ARDEX Fine CD: www.ardexamericas.com/#sle.
d. SpecChem, LLC; RepCon 928: www.specchemllc.com/#sle.
e. SpecChem, LLC; RepCon 928 FS: www.specchemllc.com/#sle.
f. Substitutions: See Section 01 6000 - Product Requirements.

2.03 ACCESSORIES

A. Anchoring Adhesive: Self-leveling or non-sag as applicable.
1. Self-Leveling Polyester-Based Products:
2. Self-Leveling Epoxy Products:
3. Non-Sag Epoxy Products:

PART 3 EXECUTION

3.01 CLEANING EXISTING CONCRETE

A. Clean concrete surfaces of dirt or other contamination using the gentlest method that is effective.
1. Try the gentlest method first, then, if not clean enough, use a less gentle method taking care to watch for impending damage.
2. Clean out cracks and voids using same methods.

B. The following are acceptable cleaning methods, in order from gentlest to less gentle:
1. Water washing using low-pressure, maximum of 100 psi, and, if necessary, brushes with natural or synthetic bristles.
2. Increasing the water washing pressure to maximum of 400 psi.
3. Adding detergent to washing water; with final water rinse to remove residual detergent.
4. Steam-generated low-pressure hot-water washing.

3.02 PAINT AND GRAFFITI REMOVAL

3.03 CONCRETE STRUCTURAL MEMBER REPAIR

3.04 CONCRETE SURFACE REPAIR USING CEMENTITIOUS MATERIALS

A. Clean concrete surfaces, cracks, and joints of dirt, laitance, corrosion, and other contamination using method(s) specified above and allow to dry.

B. Apply coating of bonding agent to entire concrete surface to be repaired.

C. Fill voids with cementitious mortar flush with surface.

D. Apply repair mortar by steel trowel to a minimum thickness of 1/4 inch over entire surface, terminating at a vertical change in plane on all sides.

E. Trowel finish to match adjacent concrete surfaces.

END OF SECTION

SECTION 03 2000
CONCRETE REINFORCING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Reinforcing steel for cast-in-place concrete.

B. Supports and accessories for steel reinforcement.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete.

B. Section 04 2000 - Unit Masonry: Reinforcement for masonry.

1.03 REFERENCE STANDARDS

A. ACI 301 - Specifications for Structural Concrete; 2010 (Errata 2012).

B. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; 2011.

C. ACI SP-66 - ACI Detailing Manual; 2004.

D. ASTM A82/A82M - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement; 2007.

E. ASTM A184/A184M - Standard Specification for Welded Deformed Steel Bar Mats for Concrete Reinforcement; 2006 (Reapproved 2011).

F. ASTM A185/A185M - Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete; 2007.

G. ASTM A497/A497M - Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete; 2007.

H. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement; 2015.

I. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2015.

J. CRSI (DA4) - Manual of Standard Practice; 2009.

K. CRSI (P1) - Placing Reinforcing Bars; 2011.

1.04 SUBMITTALS

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

B. Shop Drawings: Comply with requirements of ACI SP-66. Include bar schedules, shapes of bent bars, spacing of bars, and location of splices.
   1. Prepare shop drawings under seal of a Professional Structural Engineer experienced in design of work of this type and licensed in Ohio.

1.05 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI 301.
   1. Maintain one copy of each document on project site.

PART 2 PRODUCTS

2.01 REINFORCEMENT

A. Reinforcing Steel: ASTM A615/A615M Grade 60 (420).
   1. Plain billet-steel bars.
   2. Unfinished.

B. Stirrup Steel: ASTM A1064/A1064M steel wire, unfinished.

C. Steel Welded Wire Reinforcement (WWR): Galvanized, deformed type; ASTM A1064/A1064M.
   1. Form: Flat Sheets.
   2. WWR Style: 4 x 8-W6 x W10.
   3. Wire Gage: _2.1_x_2.1_.

D. Use Fiber Reinforcement at all slabs to receive floor finish: Polypropylene fibers engineered and designed for secondary reinforcement of concrete slabs, complying with ASTM C 1116, Type III, 1 1/2 inch long, mixed at a dosage rate of 1.5 pounds per cubic yard of concrete.

E. Reinforcement Accessories:
   1. Tie Wire: Annealed, minimum 16 gage, 0.0508 inch.
   2. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for adequate support of reinforcement during concrete placement.

2.02 FABRICATION

A. Fabricate concrete reinforcing in accordance with CRSI (DA4) - Manual of Standard Practice.

B. Welding of reinforcement is not permitted.

PART 3 EXECUTION

3.01 PLACEMENT

A. Place, support and secure reinforcement against displacement. Do not deviate from required position.

B. Do not displace or damage vapor barrier.

C. Accommodate placement of formed openings.

D. Maintain concrete cover around reinforcing as follows:
   1. Walls (exposed to weather or backfill): 3 inch.
   2. Footings and Concrete Formed Against Earth: 3 inch.

3.02 FIELD QUALITY CONTROL

A. An independent testing agency, as specified in Section 01 4000, will inspect installed reinforcement for conformance to contract documents before concrete placement.

END OF SECTION

SECTION 04 0100
MAINTENANCE OF MASONRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Water cleaning of masonry surfaces.

B. Repointing mortar joints.

C. Repair of damaged masonry.

1.02 RELATED REQUIREMENTS

A. Section 04 0511 - Mortar and Masonry Grout.

B. Section 04 2000 - Unit Masonry: Brick masonry units.

C. Section 04 2000 - Unit Masonry: Mortar and grout.

1.03 PRICE AND PAYMENT PROCEDURES

A. See Section 01 2200 - Unit Prices, for additional unit price requirements.

1.04 REFERENCE STANDARDS

A. ACI 530/530.1/ERTA - Building Code Requirements and Specification for Masonry Structures and Related Commentaries; 2011.

1.05 SUBMITTALS

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

B. Product Data: Provide data on cleaning compounds.

1.06 QUALITY ASSURANCE

A. Comply with provisions of ACI 530/530.1/ERTA, except where exceeded by requirements of the contract documents.

1.07 MOCK-UP

A. Restore and repoint an existing masonry wall area sized 8 feet long by 6 feet high; include in mock-up area instances of mortar, accessories, wall openings, and flashings.

B. Clean a 10 ft by 10 ft panel of wall to determine extent of cleaning.

C. Locate where agreed to by all parties..

D. Acceptable panel and procedures employed will become the standard for work of this section.

E. Mock-up may remain as part of the Work.

1.08 FIELD CONDITIONS

A. Cold and Hot Weather Requirements: Comply with requirements of ACI 530/530.1/ERTA or applicable building code, whichever is more stringent.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Restoration and Cleaning Chemicals:
   1. Diedrich Technologies, Inc; Product ____: www.diedrichtechnologies.com.
   2. PROSOCO; Product ____: www.prosoco.com.
   3. _____; Product ____.
   4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 CLEANING MATERIALS

A. Cleaning Agent: Detergent type.

B. Cleaning Agent: 0.5 lb of sodium hydrosulphite mixture to one gallon of water.

2.03 MORTAR MATERIALS

A. Conform to requirements of Section 04 0511.

2.04 MASONRY MATERIALS

A. Brick: Section 04 2000.

B. Stone Veneer: Section 04 4200.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces to be cleaned are ready for work of this section.

3.02 PREPARATION

A. Protect surrounding elements from damage due to restoration procedures.

B. Carefully remove and store removable items located in areas to be restored, including fixtures, fittings, finish hardware, and accessories; reinstall upon completion.

C. Separate areas to be protected from restoration areas using means adequate to prevent damage.

D. Cover existing landscaping with tarpaulins or similar covers.

E. Mask immediately adjacent surfaces with material that will withstand cleaning and restoration procedures.

F. Close off adjacent occupied areas with dust proof and weatherproof partitions.

G. Protect roof membrane and flashings from damage with 1/2 inch plywood laid on roof surfaces over full extent of work area and traffic route.

H. When using cleaning methods that involve water or other liquids, install drainage devices to prevent runoff over adjacent surfaces unless those surfaces are impervious to damage from runoff.

I. Do not allow cleaning runoff to drain into sanitary or storm sewers.

3.03 REBUILDING

A. Cut out damaged and deteriorated masonry with care in a manner to prevent damage to any adjacent remaining materials.

B. Support structure as necessary in advance of cutting out units.

C. Cut away loose or unsound adjoining masonry as directed.

D. Build in new units following procedures for new work specified in other section(s).

E. Mortar Mix: Colored and proportioned to match existing work.

F. Ensure that anchors are correctly located and built in.

G. Install built in masonry work to match and align with existing, with joints and coursing true and level, faces plumb and in line. Build in all openings, accessories and fittings.

3.04 REPOINTING

A. Perform repointing prior to cleaning masonry surfaces.

B. Cut out loose or disintegrated mortar in joints to minimum 1/2 inch depth or until sound mortar is reached.

C. Use power tools only after test cuts determine no damage to masonry units will result.

D. Do not damage masonry units.

E. When cutting is complete, remove dust and loose material by brushing.

F. Premoisten joint and apply mortar. Pack tightly in maximum 1/4 inch layers. Form a smooth, compact concave joint to match existing.

G. Moist cure for 72 hours.

3.05 CLEANING EXISTING MASONRY

A. Low Pressure Steam Cleaning: Apply 100-300 psi pressure to masonry surfaces at designated locations, maintaining uniform depth and surface texture throughout.

3.06 CLEANING NEW MASONRY

A. Verify mortar is fully set and cured.

B. Clean surfaces and remove large particles with wood scrapers, brass or nylon wire brushes.

C. Scrub walls with detergent type cleaning agent solution using stiff brush. Thoroughly rinse and wash off cleaning solution, dirt and mortar crumbs using clean, pressurized water.

D. Protect area below cleaning operation and keep masonry soaked with water and flushed free of acid and dissolved mortar continuously for duration of cleaning.

3.07 RESTORATION CLEANING

A. Clean surfaces and remove large particles with wood scrapers or non-ferrous wire brush.

B. Spray coat masonry with detergent restoration cleaner, mixed into solution in accordance with manufacturer's instructions.

C. Provide a second application if required to match mock-up area.

D. Allow sufficient time for solution to remain on masonry and agitate with soft fiber brush or sponge.

E. Rinse from the bottom up with potable water applied at 300 psi and at a rate of 4 gal/min.

3.08 CLEANING

A. Immediately remove stains, efflorescence, or other excess resulting from the work of this section.

B. Remove excess mortar, smears, and droppings as work proceeds and upon completion.

END OF SECTION

SECTION 04 0511
MORTAR AND MASONRY GROUT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Mortar for masonry.

1.02 RELATED REQUIREMENTS

A. Section 04 0100 - Maintenance of Masonry: Bedding and pointing mortar for masonry restoration work.

B. Section 04 2000 - Unit Masonry: Installation of mortar and grout.

C. Section 04 2001 - Masonry Veneer: Installation of mortar.

D. Section 04 2723 - Cavity Wall Unit Masonry: Installation of mortar and grout.

1.03 REFERENCE STANDARDS

A. ACI 530/530.1/ERTA - Building Code Requirements and Specification for Masonry Structures and Related Commentaries; 2011.

B. ASTM C5 - Standard Specification for Quicklime for Structural Purposes; 2010.

C. ASTM C91/C91M - Standard Specification for Masonry Cement; 2012.

D. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar; 2011.

E. ASTM C150/C150M - Standard Specification for Portland Cement; 2016.

F. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes; 2006 (Reapproved 2011).

G. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2014a.

H. ASTM C387/C387M - Standard Specification for Packaged, Dry, Combined Materials for Concrete and High Strength Mortar; 2011b.

I. ASTM C404 - Standard Specification for Aggregates for Masonry Grout; 2011.

J. ASTM C476 - Standard Specification for Grout for Masonry; 2010.

K. ASTM C780 - Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry; 2012.

L. ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete; 2010.

M. ASTM C1019 - Standard Test Method for Sampling and Testing Grout; 2013.

N. ASTM C1142 - Standard Specification for Extended Life Mortar for Unit Masonry; 1995 (Reapproved 2013).

1.04 SUBMITTALS

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

B. Product Data: Include design mix and indicate whether the Proportion or Property specification of ASTM C270 is to be used. Also include required environmental conditions and admixture limitations.

C. Samples: Submit two samples of mortar, illustrating mortar color and color range.

D. Reports: Submit reports on mortar indicating conformance of mortar to property requirements of ASTM C270 and test and evaluation reports per ASTM C780.

E. Reports: Submit reports on grout indicating conformance of component grout materials to requirements of ASTM C476 and test and evaluation reports to requirements of ASTM C1019.

1.05 QUALITY ASSURANCE

A. Comply with provisions of ACI 530/530.1/ERTA, except where exceeded by requirements of the contract documents.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Maintain packaged materials clean, dry, and protected against dampness, freezing, and foreign matter.

1.07 FIELD CONDITIONS

A. Cold and Hot Weather Requirements: Comply with requirements of ACI 530/530.1/ERTA or applicable building code, whichever is more stringent.

PART 2 PRODUCTS

2.01 MORTAR AND GROUT APPLICATIONS

A. At Contractor's option, mortar and grout may be field-mixed from packaged dry materials, made from factory premixed dry materials with addition of water only, or ready-mixed.

B. Mortar Color: As selected by Architect. At existing masonry match existing.

C. Mortar Mix Designs: ASTM C270, Property Specification.
   1. Historic Exterior Masonry Pointing Mortar: Type O; color to match existing.
   2. Masonry below grade and in contact with earth: Type S.
   3. Exterior Masonry Veneer: Type N.
   4. Exterior Cavity Walls: Type S mortar with Type N pointing mortar.
   5. Exterior, Loadbearing Masonry: Type N.
   6. Exterior, Non-loadbearing Masonry: Type N.
   7. Exterior Repointing Mortar: Type N with maximum 2 percent ammonium stearate or calcium stearate per cement weight.
   8. Interior, Loadbearing Masonry: Type N.
   9. Interior, Non-loadbearing Masonry: Type O.

2.02 MATERIALS

A. Packaged Dry Material for Mortar for Unit Masonry: Premixed Portland cement, hydrated lime, and sand; complying with ASTM C387/C387M and capable of producing mortar of the specified strength in accordance with ASTM C270 with the addition of water only.

B. Packaged Dry Material for Mortar for Repointing: Premixed Portland cement, hydrated lime, and graded sand; capable of producing Type O mortar in accordance with ASTM C270 with the addition of water only.
   1. Color: Standard gray.

C. Packaged Dry Material for Grout for Masonry: Premixed cementitious materials and dried aggregates; capable of producing grout of the specified strength in accordance with ASTM C476 with the addition of water only.

D. Portland Cement: ASTM C150/C150M.
   1. Type: Type I - Normal; ASTM C150/C150M.
   2. Color: Standard gray.

E. Masonry Cement: ASTM C91/C91M.
   1. Type: Type N; ASTM C91/C91M.

F. Hydrated Lime: ASTM C207, Type S.

G. Quicklime: ASTM C5, non-hydraulic type.

H. Mortar Aggregate: ASTM C144.

I. Grout Aggregate: ASTM C404.

J. Pigments for Colored Mortar: Pure, concentrated mineral pigments specifically intended for mixing into mortar and complying with ASTM C979/C979M.

K. Water: Clean and potable.

L. Accelerating Admixture: Nonchloride type for use in cold weather.

M. Moisture-Resistant Admixture: Water repellent compound designed to reduce capillarity.

N. Bonding Agent: Latex type.

2.03 MORTAR MIXING

A. Ready Mixed Mortar: ASTM C1142, Type equivalent to that specified according to ASTM C270.

B. Thoroughly mix mortar ingredients using mechanical batch mixer, in accordance with ASTM C270 and in quantities needed for immediate use.

C. Maintain sand uniformly damp immediately before the mixing process.

D. Do not use anti-freeze compounds to lower the freezing point of mortar.

E. If water is lost by evaporation, re-temper only within two hours of mixing.

PART 3 EXECUTION

3.01 INSTALLATION

A. Work grout into masonry cores and cavities to eliminate voids.

B. Do not install grout in lifts greater than 16 inches without consolidating grout by rodding.

C. Do not displace reinforcement while placing grout.

D. Remove excess mortar from grout spaces.

END OF SECTION

SECTION 05 5213
PIPE AND TUBE RAILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall mounted handrails.

B. Stair railings and guardrails.

C. Free-standing railings at steps.

1.02 RELATED REQUIREMENTS

A. Section 04 2000 - Unit Masonry: Placement of anchors in masonry.

B. Section 06 2000 - Finish Carpentry: Wood handrail.

1.03 REFERENCE STANDARDS

A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2012.

B. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels; 2013.

C. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.

D. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2015.

E. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2013.

F. ASTM B241/B241M - Standard Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube; 2012.

G. ASTM B429/B429M - Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube; 2010.

H. ASTM B483/B483M - Standard Specification for Aluminum and Aluminum-Alloy Drawn Tubes for General Purpose Applications; 2013.

I. ASTM E935 - Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings; 2013.

J. ASTM E985 - Standard Specification for Permanent Metal Railing Systems and Rails for Buildings; 2000 (Reapproved 2006).

K. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 1999 (Ed. 2004).

1.04 SUBMITTALS

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

B. Shop Drawings: Indicate profiles, sizes, connection attachments, anchorage, size and type of fasteners, and accessories.

C. Samples: Submit two, 12 inch long samples of handrail. Submit two samples of elbow, wall bracket, and end stop.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Handrails and Railings:
   1. C.R. Laurence Company, Inc; CRL Welded Post Railing Systems (WRS): www.crl-arch.com/sle.
   2. KaneSterling; ____: www.sterlingdula.com.
   3. Superior Aluminum Products: www.superioraluminum.com

4. The Wagner Companies; ____: www.wagnercompanies.com.

B. Non-Weld Pipe Fittings:

2.02 RAILINGS - GENERAL REQUIREMENTS

A. Design, fabricate, and test railing assemblies in accordance with the most stringent requirements of ASTM E985 and applicable local code.

B. Distributed Loads: Design railing assembly, wall rails, and attachments to resist distributed force of 75 pounds per linear foot applied to the top of the assembly and in any direction, without damage or permanent set. Test in accordance with ASTM E 935.

C. 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.

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.

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.

G. Provide slip-on non-weld mechanical fittings to join lengths, seal open ends, and conceal exposed mounting bolts and nuts, including but not limited to elbows, T-shapes, splice connectors, flanges, escutcheons, and wall brackets.

2.03 ALUMINUM MATERIALS

A. Aluminum Pipe: Schedule 40; ASTM B429/B429M, ASTM B241/B241M, or ASTM B483/B483M.

B. Non-Weld Mechanical Fittings: Slip-on cast aluminum, for Schedule 40 pipe, with flush setscrews for tightening by standard hex wrench, no bolts or screw fasteners.

C. Exposed Fasteners: No exposed bolts or screws.

2.04 STEEL RAILING SYSTEM

A. Steel Tube: ASTM A500/A500M, Grade B cold-formed structural tubing.

B. Welding Fittings: Factory- or shop-welded from matching pipe or tube; seams continuously welded; joints and seams ground smooth.

C. Exposed Fasteners: No exposed bolts or screws.

D. Straight Splice Connectors: Steel concealed spigots.

E. Galvanizing: In accordance with requirements of ASTM A123/A123M.

F. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

2.05 FABRICATION

A. Accurately form components to suit specific project conditions and for proper connection to building structure.

B. Fit and shop assemble components in largest practical sizes for delivery to site.

C. Fabricate components with joints tightly fitted and secured. Provide spigots and sleeves to accommodate site assembly and installation.

D. Welded Joints:

1. Exterior Components: Continuously seal joined pieces by intermittent welds and plastic filler. Drill condensate drainage holes at bottom of members at locations that will not encourage water intrusion.

2. Interior Components: Continuously seal joined pieces by intermittent welds and plastic filler.
3. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

2.06 ALUMINUM FINISHES

A. Where indicated as Clear Anodized provide Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils thick.

B. Superior Performance Organic Coating System: AAMA 2605 multiple coat, thermally cured polyvinylidene fluoride system.

C. Color: To be selected by Architect from manufacturer's standard line.

D. Touch-Up Materials: As recommended by coating manufacturer for field application.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

A. Apply one coat of bituminous paint to concealed aluminum surfaces that will be in contact with cementitious or dissimilar materials.

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.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per floor level, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

C. Maximum Out-of-Position: 1/4 inch.

END OF SECTION

SECTION 06 1000

ROUGH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Structural dimension lumber framing.

B. Non-structural dimension lumber framing.

C. Rough opening framing for doors, windows, and roof openings.

D. Sheathing.

E. Subflooring.

F. Preservative treated wood materials.

G. Miscellaneous framing and sheathing.

H. Communications and electrical room mounting boards.

I. Concealed wood blocking, nailers, and supports.

1.02 RELATED REQUIREMENTS

A. Section 07 2500 - WEATHER BARRIERS: Water-resistive barrier over sheathing.

1.03 REFERENCE STANDARDS

A. AWC (WFCM) - Wood Frame Construction Manual for One- and Two-Family Dwellings; 2015.

B. APA PRP-108 - Performance Standards and Qualification Policy for Structural-Use Panels (Form E445); 2001.

C. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.

D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

F. AWPA U1 - Use Category System: User Specification for Treated Wood; 2012.

G. PS 1 - Structural Plywood; 2009.

H. PS 2 - Performance Standard for Wood-Based Structural-Use Panels; 2010.

I. PS 20 - American Softwood Lumber Standard; 2010.

J. SPIB (GR) - Grading Rules; 2014.

K. WWPA G-5 - Western Lumber Grading Rules; 2011.

1.04 SUBMITTALS

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

B. Product Data: Provide technical data on insulated sheathing, wood preservative materials, and application instructions.

C. Structural Composite Lumber: Submit manufacturer's published structural data including span tables, marked to indicate which sizes and grades are being used; if structural composite lumber is being substituted for dimension lumber or timbers, submit grading agency structural tables marked for comparison.

D. ABAA Field Quality Control Submittals: Submit third-party reports of testing and inspection required by ABAA QAP.

E. Manufacturer's Certificate: Certify that wood products supplied for rough carpentry meet or exceed specified requirements.

F. ABAA Manufacturer Qualification: Submit documentation of current evaluation of proposed manufacturer and materials.

G. ABAA Installer Qualification: Submit documentation of current contractor accreditation and current installer certification. Keep copies of all contractor accreditation and installer certification on site during and after installation. Present on-site documentation upon request.

H. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Air Barrier Association of America (ABAA) Quality Assurance Program (QAP); www.airbarrier.org/sle:
   1. Installer Qualification: Use accredited contractor, certified installers, evaluated materials, and third-party field quality control audit.
   2. Manufacturer Qualification: Use evaluated materials from a single manufacturer regularly engaged in air barrier material manufacture. Use secondary materials approved in writing by primary material manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
   1. If no species is specified, provide any species graded by the agency specified; if no grading agency is specified, provide lumber graded by any grading agency meeting the specified requirements.
   2. Grading Agency: Any grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee (www.alsc.org) and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.
   3. Lumber of other species or grades is acceptable provided structural and appearance characteristics are equivalent to or better than products specified.

B. Lumber fabricated from old growth timber is not permitted.

2.02 DIMENSION LUMBER FOR CONCEALED APPLICATIONS

A. Grading Agency: Western Wood Products Association; WWPA G-5.

B. Sizes: Nominal sizes as indicated on drawings, S4S.

C. Moisture Content: S-dry or MC19.

D. Stud Framing (2 by 2 through 2 by 6):
   1. Species: Any allowed under referenced grading rules and meeting requirements stipulated on the drawings or elswhere in the project manual.
   2. Grade: No. 2.

E. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
   1. Lumber: S4S, No. 2 or Standard Grade.
   2. Boards: Standard or No. 3.

2.03 EXPOSED DIMENSION LUMBER

A. Submit manufacturer's certificate that products meet or exceed specified requirements, in lieu of grade stamping.

B. Grading Agency: Western Wood Products Association; WWPA G-5.

C. Sizes: Nominal sizes as indicated on drawings.

D. Surfacing: S4S.

E. Moisture Content: S-dry or MC19.

2.04 STRUCTURAL COMPOSITE LUMBER

A. At Contractor's option, structural composite lumber may be substituted for concealed dimension lumber and timbers.

B. Structural Composite Lumber: Factory fabricated beams, headers, and columns, of sizes and types indicated on drawings; structural capacity as published by manufacturer.
   1. Beams: Use laminated veneer lumber, laminated strand lumber, or parallel strand lumber with manufacturer's published E (modulus of elasticity): 1,800,000 psi, minimum.
   2. Manufacturers:
      a. Weyerhaeuser: www.weyerhaeuser.com.
      b. Boise Cascade; ____: www.bc.com.
      c. Georgia-Pacific Corp.; _____: www.buildgp.com.

2.05 CONSTRUCTION PANELS

A. Subfloor/Underlayment Combination: Any PS 2 type, rated Single Floor.
   1. Bond Classification: Exterior.
   2. Span Rating: 24.
   3. Performance Category: 3/4 PERF CAT.
   4. Thickness: 3/4 inches, nominal.
   5. Edges: Tongue and groove.

B. Subflooring: APA PRP-108: Rated Sheathing.
   1. Exposure Class: Exterior.
   2. Span Rating: 32/16 inches.
   3. Thickness: 3/4 inch, nominal.

C. Roof Sheathing: APA PRP-108, Rated Sheathing, Exterior Exposure Class, and as follows:
   1. Span Rating: 24/0.
   2. Thickness: ,7/16" nominal.

D. Roof Sheathing: Oriented strand board wood structural panel; PS 2.
   1. Grade: Sheathing.
   2. Performance Category: 1/2 PERF CAT.
   3. Span Rating: 32/16.
   4. Edges: Square with panel clips.
   5. Exposure Time: Sheathing will not delaminate or require sanding due to moisture absorption from exposure to weather for up to 500 days.
   6. Provide fastening guide on top panel surface with separate markings indicating fastener spacing for 16 inches and 24 inches on center, respectively.
   7. Manufacturers:
      a. Huber Engineered Woods, LLC; AdvanTech Sheathing: www.huberwood.com/sle.
      b. Substitutions: See Section 01 6000 - Product Requirements.

E. Wall Sheathing: APA PRP-108, Structural I Rated Sheathing, Exterior Exposure Class, and as follows:
   1. Span Rating: 24/0.

F. Wall Sheathing: Oriented strand board structural wood panel; PS 2.

1. Bond Classification: Exposure 1.
2. Size: 4 feet wide by 8 feet long.
3. Edge Profile: Square edge.

G. Communications and Electrical Room Mounting Boards: PS 1 A-D plywood, or medium density fiberboard; 3/4 inch thick; flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.

2.06 ACCESSORIES

A. Fasteners and Anchors:
1. Metal and Finish: Hot-dipped galvanized steel complying with ASTM A153/A153M for high humidity and preservative-treated wood locations, unfinished steel elsewhere.
2. Drywall Screws: Bugle head, hardened steel, power driven type, length three times thickness of sheathing.

B. Die-Stamped Connectors: Hot dipped galvanized steel, sized to suit framing conditions.
1. For contact with preservative treated wood in exposed locations, provide minimum G185 galvanizing complying with ASTM A653/A653M.

C. Joist Hangers: Hot dipped galvanized steel, sized to suit framing conditions.

D. Sill Gasket on Top of Foundation Wall: 1/4 inch thick, plate width, closed cell plastic foam from continuous rolls.

E. Subfloor Glue: Waterproof, air cure type, cartridge dispensed.

F. Water-Resistive Barrier: As specified in Section 07 2500.

2.07 FACTORY WOOD TREATMENT

A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
1. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWPA standards.

B. Preservative Treatment:
1. Preservative Pressure Treatment of Lumber Above Grade: AWPA U1, Use Category UC3B, Commodity Specification A using waterborne preservative.
a. Kiln dry lumber after treatment to maximum moisture content of 19 percent.
b. Treat lumber exposed to weather.
c. Treat lumber in contact with roofing, flashing, or waterproofing.
d. Treat lumber in contact with masonry or concrete.

PART 3 EXECUTION

3.01 PREPARATION

A. Install sill gasket under sill plate of framed walls bearing on foundations; puncture gasket cleanly to fit tightly around protruding anchor bolts.

3.02 INSTALLATION - GENERAL

A. Select material sizes to minimize waste.

B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.

C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

3.03 FRAMING INSTALLATION

A. Set structural members level, plumb, and true to line. Discard pieces with defects that would lower required strength or result in unacceptable appearance of exposed members.

B. Make provisions for temporary construction loads, and provide temporary bracing sufficient to maintain structure in true alignment and safe condition until completion of erection and installation of permanent bracing.

C. Install structural members full length without splices unless otherwise specifically detailed.

D. Comply with member sizes, spacing, and configurations indicated, and fastener size and spacing indicated, but not less than required by applicable codes, AWC (WFCM) Wood Frame Construction Manual, and _____.

E. Install horizontal spanning members with crown edge up and not less than 1-1/2 inches of bearing at each end.

F. Construct double joist headers at floor and ceiling openings and under wall stud partitions that are parallel to floor joists; use metal joist hangers unless otherwise detailed.

G. Provide bridging at joists in excess of 8 feet span at mid-span. Fit solid blocking at ends of members.

H. Frame wall openings with two or more studs at each jamb; support headers on cripple studs.

3.04 BLOCKING, NAILERS, AND SUPPORTS

A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.

B. In framed assemblies that have concealed spaces, provide solid wood fireblocking as required by applicable local code, to close concealed draft openings between floors and between top story and roof/attic space; other material acceptable to code authorities may be used in lieu of solid wood blocking.

C. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.

D. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.

E. Provide the following specific non-structural framing and blocking:
   1. Cabinets and shelf supports.
   2. Wall brackets.
   3. Handrails.
   4. Grab bars.
   5. Towel and bath accessories.
   6. Wall-mounted door stops.
   7. Chalkboards and marker boards.
   8. Wall paneling and trim.
   9. Joints of rigid wall coverings that occur between studs.

3.05 INSTALLATION OF CONSTRUCTION PANELS

A. Subflooring/Underlayment Combination: Glue and nail to framing; staples are not permitted.

B. Subflooring: Glue and nail to framing; staples are not permitted.

C. Space or gap subflooring in accordance with the manufacturer's instructions.

D. Roof Sheathing: Secure panels with long dimension perpendicular to framing members, with ends staggered and over firm bearing.
   1. At long edges provide solid edge blocking where joints occur between roof framing members.
   2. Nail panels to framing; staples are not permitted.

E. Wall Sheathing: Secure with long dimension perpendicular to wall studs, with ends over firm bearing and staggered, using nails or screws.

1. Provide 1/8" gap minimum between panel ends and edges. Use a spacer tool to assure accurate and consistent spacing.
2. Place water-resistive barrier horizontally over wall sheathing, weather lapping edges and ends.

F. Communications and Electrical Room Mounting Boards: Secure with screws to studs with edges over firm bearing; space fasteners at maximum 24 inches on center on all edges and into studs in field of board.
1. At fire-rated walls, install board over wall board indicated as part of the fire-rated assembly.
2. Where boards are indicated as full floor-to-ceiling height, install with long edge of board parallel to studs.
3. Install adjacent boards without gaps.

G. Wall Sheathing and Roof Sheathing with Laminated Water-Resistive Barrier and Air Barrier: Secure to studs as recommended by manufacturer.
1. Install with laminated water-resistive and air barrier on exterior side of sheathing.
2. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.
3. Use only mechanically attached and drainable EIFS and exterior insulation with wall sheathing with laminated water-resistive and air barrier.
4. Apply manufacturer's standard seam tape to joints between sheathing panels. Use tape gun or hard rubber roller as recommended by manufacturer.

3.06 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.

3.07 CLEANING

A. Waste Disposal: Comply with the requirements of Section 01 7419 - Construction Waste Management and Disposal.
1. Comply with applicable regulations.
2. Do not burn scrap on project site.
3. Do not burn scraps that have been pressure treated.
4. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or “waste-to-energy” facilities.

B. Do not leave any wood, shavings, sawdust, etc. on the ground or buried in fill.

C. Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION

SECTION 06 2000

FINISH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Finish carpentry items.

B. Installation of wood door frames, glazed frames.

C. Wood casings and moldings.

D. Installation of hardware and attachment accessories.

E. Installation of window sills.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Support framing, grounds, and concealed blocking.

B. Section 06 4100 - Architectural Wood Casework: Shop fabricated custom cabinet work.

C. Section 08 1416 - Flush Wood Doors.

D. Section 09 9123 - Interior Painting: Painting and finishing of finish carpentry items.

E. Section 12 3530 - Residential Casework: Shop fabricated cabinet work.

1.03 REFERENCE STANDARDS

A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014.

B. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.0; 2016.

C. AWPA U1 - Use Category System: User Specification for Treated Wood; 2012.

D. BHMA A156.9 - American National Standard for Cabinet Hardware; 2010.

E. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood; 2009.

1.04 SUBMITTALS

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

B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.

1. Provide the information required by AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS).
2. Include certification program label.

C. Certificate: Submit labels and certificates required by quality assurance and quality control programs.

1.05 QUALITY ASSURANCE

A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.

1. Accredited participant in the specified certification program prior to the commencement of fabrication and throughout the duration of the project.

B. Quality Certification:

1. Provide labels or certificates indicating that the work complies with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade or grades specified.
2. Provide designated labels on shop drawings as required by certification program.
3. Provide designated labels on installed products as required by certification program.
4. Submit certifications upon completion of installation that verifies this work is in compliance with specified requirements.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect work from moisture damage.

PART 2 PRODUCTS

2.01 FINISH CARPENTRY ITEMS

A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.

B. Interior Woodwork Items: (see drawings for wood species and finish)

2.02 WOOD-BASED COMPONENTS

A. Wood fabricated from old growth timber is not permitted.

2.03 FASTENINGS

A. Adhesive for Purposes Other Than Laminate Installation: Suitable for the purpose; not containing formaldehyde or other volatile organic compounds.

B. Fasteners: Of size and type to suit application; concealed.

2.04 ACCESSORIES

A. Wood Filler: Solvent base, tinted to match surface finish color.

2.05 HARDWARE

A. Hardware: Comply with BHMA A156.9.

2.06 WOOD TREATMENT

A. Wood Preservative by Pressure Treatment (PT Type): Provide AWPA U1 treatment using waterborne preservative with 0.25 percent retainage.

B. Provide identification on fire retardant treated material.

C. Deliver fire retardant treated materials cut to required sizes. Minimize field cutting.

D. Redry wood after pressure treatment to maximum ____ percent moisture content.

2.07 FABRICATION

A. Shop assemble work for delivery to site, permitting passage through building openings.

B. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify adequacy of backing and support framing.

3.02 INSTALLATION

A. Install work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade indicated.

B. Set and secure materials and components in place, plumb and level.

C. Carefully scribe work abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim to conceal larger gaps.

3.03 PREPARATION FOR SITE FINISHING

A. Set exposed fasteners. Apply wood filler in exposed fastener indentations. Sand work smooth.

3.04 TOLERANCES

A. Maximum Variation from True Position: 1/16 inch.

B. Maximum Offset from True Alignment with Abutting Materials: 1/32 inch.

END OF SECTION

SECTION 06 4100

ARCHITECTURAL WOOD CASEWORK

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Specially fabricated cabinet units.

B. Cabinet hardware.

1.02 RELATED REQUIREMENTS

A. Section 12 3600 - Countertops.

1.03 REFERENCE STANDARDS

A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014.

B. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.0; 2016.

1.04 SUBMITTALS

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

B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.

C. Product Data: Provide data for hardware accessories.

1.05 QUALITY ASSURANCE

A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.

1. Company with at least one project in the past 5 years with value of woodwork within 20 percent of cost of woodwork for this Project.

1.06 MOCK-UP

A. Provide mock-up of typical base cabinet, wall cabinet, and countertop, including hardware, finishes, and plumbing accessories.

B. Locate where directed.

C. Mock-up may remain as part of the Work.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect units from moisture damage.

1.08 FIELD CONDITIONS

A. During and after installation of custom cabinets, maintain temperature and humidity conditions in building spaces at same levels planned for occupancy.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Substitutions: See Section 01 6000 - Product Requirements.

2.02 CABINETS

A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.

B. Wood Veneer Faced Cabinet:

C. Plastic Laminate Faced Cabinets: Custom grade.

D. Cabinets at Living Units:

1. Finish - Exposed Exterior Surfaces: Wood.

2. Finish - Concealed Surfaces: Manufacturer's option.
3. Casework Construction Type: Type B - Face-frame.
4. Interface Style for Cabinet and Door: Style 1 - Overlay; Full Overlay.
5. Cabinet Style: Flush overlay.
6. Cabinet Doors and Drawer Fronts: Flush style.
7. Drawer Side Construction: Multiple-dovetailed.
8. Drawer Construction Technique: Dovetail joints.

2.03 WOOD-BASED COMPONENTS

A. Wood fabricated from old growth timber is not permitted.

2.04 COUNTERTOPS

A. Countertops are specified in Section 12 3600.

2.05 ACCESSORIES

A. Adhesive: Type recommended by fabricator to suit application.

2.06 HARDWARE

A. Adjustable Shelf Supports: Standard back-mounted system using surface mounted metal shelf standards and coordinated cantilevered shelf brackets, satin chrome finish, for nominal 1 inch spacing adjustments.

B. Drawer and Door Pulls: "U" shaped wire pull, steel with satin finish, 4 inch centers.

C. Cabinet Locks: Keyed cylinder, two keys per lock, master keyed, steel with satin finish. Where shown on drawings.

D. Drawer Slides:
1. Type: Extension types as indicated.
2. Static Load Capacity: Commercial grade.
3. Mounting: Side mounted.
4. Stops: Integral type.
5. Manufacturers:
   a. Accuride International, Inc; ____: www.accuride.com.
   b. Grass America Inc; ____: www.grassusa.com.
   c. Hettich America, LP; _____: www.hettich.com/sle.
   d. Knape & Vogt Manufacturing Company; _____: www.knapeandvogt.com.

E. Hinges: European style concealed self-closing type, steel with polished finish.
1. Manufacturers:
   a. Grass America Inc; ____: www.grassusa.com.
   b. Hardware Resources; _____: www.hardwareresources.com.
   c. Hettich America, LP; _____: www.hettich.com/sle.
   d. Blum, Inc; _____: www.blum.com.
   e. Substitutions: See Section 01 6000 - Product Requirements.

2.07 FABRICATION

A. Assembly: Shop assemble cabinets for delivery to site in units easily handled and to permit passage through building openings.

B. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length.

C. Matching Wood Grain: Comply with requirements of quality standard for specified Grade and as follows:
1. Provide center matched panels at each elevation.

2.08 SHOP FINISHING

A. Sand work smooth and set exposed nails and screws.

B. For opaque finishes, apply wood filler in exposed nail and screw indentations and sand smooth.

C. On items to receive transparent finishes, use wood filler matching or blending with surrounding surfaces and of types recommended for applied finishes.

D. Finish work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and as follows:
   1. Transparent:
      a. Stain: As selected by Architect.
      b. Sheen: Flat.
   2. Opaque: (where indicated)
      a. System - 1, Lacquer, Nitrocellulose.
      b. Color: As selected by Architect.
      c. Sheen: Flat.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify adequacy of backing and support framing.

B. Verify field measurements.

3.02 INSTALLATION

A. Set and secure custom cabinets in place, assuring that they are rigid, plumb, and level.

B. Use fixture attachments in concealed locations for wall mounted components.

C. Use concealed joint fasteners to align and secure adjoining cabinet units.

D. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim for this purpose.

E. Secure cabinets to floor using appropriate angles and anchorages.

F. Countersink anchorage devices at exposed locations. Conceal with solid wood plugs of species to match surrounding wood; finish flush with surrounding surfaces.

3.03 CLEANING

A. Clean casework, counters, shelves, hardware, fittings, and fixtures.

END OF SECTION

SECTION 06 8316

FIBERGLASS REINFORCED PANELING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fiberglass reinforced plastic panels.

1.02 REFERENCE STANDARDS

A. ASTM D256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics; 2010.

B. ASTM D2583 - Standard Test Method for Indentation Hardness of Rigid Plastics by Means of Barcol Impressor; 2013a.

C. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2012.

D. ASTM D5319 - Standard Specification for Glass-Fiber Reinforced Polyester Wall and Ceiling Panels; 2012.

E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

F. FDA Food Code - Chapter 6 - Physical Facilities; current edition with Supplements, if any.

1.03 SUBMITTALS

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

B. Samples: Submit two samples 6 by 6" inch in size illustrating material and surface design of panels.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Store panels flat, indoors, on a clean, dry surface. Remove packaging and allow panels to acclimate to room temperature for 48 hours prior to installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Glass Fiber Reinforced Plastic Panels: A. Basis-of-Design Product: Subject to compliance with requirements, provide Marlite Standard FRP

2.02 PANEL SYSTEMS

A. Wall Panels:
   1. Panel Size: 4 by 8 feet.
   2. Panel Thickness: 0.10 inch.
   3. Surface Design: Embossed.
   4. Attachment Method: Adhesive only, sealant joints, no trim.

2.03 MATERIALS

A. Panels: Fiberglass reinforced plastic (FRP), complying with ASTM D5319.
   1. Surface Burning Characteristics: Maximum flame spread index of 25 and smoke developed index of 450; when system tested in accordance with ASTM E84.
   2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
   3. Scratch Resistance: Barcol hardness score greater than 35, when tested in accordance with ASTM D2583.
   4. Impact Strength: Greater than 6 ft lb force per inch, when tested in accordance with ASTM D256.
   5. Surface Characteristics and Cleanability: Provide products that are smooth, durable, and easily cleanable, in compliance with FDA Food Code, Chapter 6 - Physical Facilities.

B. Sealant: Type recommended by panel manufacturer; white.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions and substrate flatness before starting work.

B. Verify that substrate conditions are ready to receive the work of this section.

3.02 INSTALLATION - WALLS

A. Install panels in accordance with manufacturer's instructions.

B. Cut and drill panels with carbide tipped saw blades, drill bits, or snips.

C. Apply adhesive to the back side of the panel using trowel as recommended by adhesive manufacturer.

D. Apply panels to wall with seams plumb and pattern aligned with adjoining panels.

E. Install panels with manufacturer's recommended gap for panel field and corner joints.

F. Seal gaps at floor, ceiling, and between panels with applicable sealant to prevent moisture intrusion.

G. Remove excess sealant after paneling is installed and prior to curing.

END OF SECTION

SECTION 07 1900
WATER REPELLENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Water repellents applied to exterior concrete surfaces.

B. Water repellents applied to exerior concrete masonry surfaces.

C. Water repellents applied to above grade masonry where indicated on the drawings.

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 07 9005 - Joint Sealers.

1.03 REFERENCE STANDARDS

A. ASTM C140/C140M - Standard Test Methods of Sampling and Testing Concrete Masonry Units and Related Units; 2014.

1.04 SUBMITTALS

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

B. Product Data: Provide product description.

C. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention; cautionary procedures required during application.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.06 MOCK-UP

A. Prepare a representative surface 36 by 36 inch in size using specified materials and preparation and application methods on surfaces identical to those to be coated; approved mock-up constitutes standard for workmanship.

1.07 FIELD CONDITIONS

A. Protect liquid materials from freezing.

B. Do not apply water repellent when ambient temperature is lower than 50 degrees F or higher than 100 degrees F.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Silane, Siloxane, Silane-Siloxane Blend, and Siliconate Water Repellents:
   1. Tnemec Company, Inc: www.tnemec.com.
   2. BASF Construction Chemicals: www.buildingsystems.basf.com.
   3. Sherwin-Williams Company: www.sherwin-williams.com.
   4. Pecora Corporation: www.pecora.com.
   5. PROSOCO, Inc: www.prosoco.com.

2.02 MATERIALS

A. Water Repellent: Non-glossy, colorless, penetrating, water-vapor-permeable, non-yellowing sealer, that dries invisibly leaving appearance of substrate unchanged.
   1. Applications: Vertical surfaces and non-traffic horizontal surfaces.
   2. Number of Coats: Two.
   3. Products: Silane, siloxane, silane-siloxane blend, or siliconate that reacts chemically with concrete and masonry; minimum 90 percent nonvolatile content.

a. Advanced Chemical Technologies, Inc; SIL-ACT ATS-100 [VOC < 350 g/L].
b. Dayton Superior Corporation; Weather Worker 100% J29A [VOC < 228 g/L].
c. Pecora Corporation; ____.
d. PROSOCO, Inc; Consolideck SL100 Water Repellent [VOC < 400 g/L].
e. Substitutions: See Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify joint sealants are installed and cured.

C. Verify surfaces to be coated are dry, clean, and free of efflorescence, oil, or other matter detrimental to application of water repellent.

3.02 PREPARATION

A. Protection of Adjacent Work:
   1. Protect adjacent landscaping, property, and vehicles from drips and overspray.
   2. Protect adjacent surfaces not intended to receive water repellent.

B. Prepare surfaces to be coated as recommended by water repellent manufacturer for best results.

C. Do not start work until masonry mortar substrate is cured a minimum of 60 days.

D. Remove loose particles and foreign matter.

E. Remove oil and foreign substances with a chemical solvent that will not affect water repellent.

3.03 APPLICATION

A. Apply water repellent in accordance with manufacturer's instructions, using procedures and application methods recommended as producing the best results.

B. Apply at rate recommended by manufacturer, continuously over entire surface.

C. Apply two coats, minimum.

D. Remove water repellent from unintended surfaces immediately by a method instructed by water repellent manufacturer.

END OF SECTION

SECTION 07 2100
THERMAL INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Board insulation and integral vapor retarder at cavity wall construction, perimeter foundation wall, underside of floor slabs, over roof deck, over roof sheathing, and exterior wall behind _____ wall finish.

B. Batt insulation and vapor retarder in exterior wall, ceiling, and roof construction.

C. Batt insulation for filling perimeter window and door shim spaces and crevices in exterior wall and roof.

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 06 1000 - Rough Carpentry: Supporting construction for batt insulation.

C. Section 06 1000 - Rough Carpentry: Installation requirements for board insulation over steep slope roof sheathing or roof structure.

D. Section 07 2126 - Blown Insulation: Blown-in, gravity-held fibrous insulation.

E. Section 07 2500 - WEATHER BARRIERS: Separate air barrier and vapor retarder materials.

1.03 REFERENCE STANDARDS

A. ASTM C240 - Standard Test Methods of Testing Cellular Glass Insulation Block; 2008 (Reapproved 2012).

B. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2010.

C. ASTM C552 - Standard Specification for Cellular Glass Thermal Insulation; 2015.

D. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2013.

E. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2015a.

F. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2014.

G. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2012.

H. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

I. ASTM E136 - Standard Test Method for Behavior of Materials in a Vertical Tube Furnace At 750 Degrees C; 2016.

J. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components; 2012.

1.04 SUBMITTALS

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

B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.

C. Manufacturer's Installation Instructions: Include information on special environmental conditions required for installation and installation techniques.

1.05 FIELD CONDITIONS

A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

2.02 APPLICATIONS

A. Insulation in Wood Framed Walls: Batt insulation with separate vapor retarder.

B. Insulation in Wood Framed Ceiling Structure: Batt insulation with separate vapor retarder.

C. Insulation Above Lay-In Acoustical Ceilings: Batt insulation with no vapor retarder.

2.03 FOAM BOARD INSULATION MATERIALS

A. Extruded Polystyrene Board Insulation: Extruded polystyrene board; ASTM C578; with either natural skin or cut cell surfaces, and the following characteristics:
   1. Flame Spread Index (FSI): Class B - 26 to 75, when tested in accordance with ASTM E84.
   2. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
   3. R-value; 1 inch of material at 72 degrees F: 5, minimum.
   4. Complies with fire resistance requirements shown on the drawings as part of an exterior non-load-bearing exterior wall assembly when tested in accordance with NFPA 285.
   5. Board Thickness: 3/4 inches.
   6. Board Edges: Tongue-and-groove.
   7. Manufacturers:
      a. Dow Chemical Company; _____: www.dow.com.
      b. Owens Corning Corp: www.owenscorning.com.
      c. Kingspan Insulation LLC; GreenGuard XPS TYPE IV 25 PSI: www.trustgreenguard.com/#sle.
   8. Substitutions: See Section 01 6000 - Product Requirements.

2.04 BATT INSULATION MATERIALS

A. Where batt insulation is indicated, either glass fiber or mineral fiber batt insulation may be used, at Contractor's option; unless specifically indicated one or the other.

B. Glass Fiber Batt Insulation: Flexible preformed batt or blanket, complying with ASTM C665; friction fit.
   1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
   2. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.
   3. Combustibility: Non-combustible, when tested in accordance with ASTM E136, except for facing, if any.
   4. Facing: Unfaced.
   5. Manufacturers:
      a. CertainTeed Corporation; _____: www.certainteed.com.
      b. Johns Manville; _____: www.jm.com.
      c. Owens Corning Corp: www.owenscorning.com.

C. Mineral Fiber Batt Insulation: Flexible or semi-rigid preformed batt or blanket, complying with ASTM C665; friction fit; unfaced flame spread index of 0 (zero) when tested in accordance with ASTM E84.
   1. Smoke Developed Index: 0 (zero), when tested in accordance with ASTM E84.

2.05 ACCESSORIES

A. Sheet Vapor Retarder: Specified in Section 07 2500.

B. Tape: Reinforced polyethylene film with acrylic pressure sensitive adhesive.
   1. Application: Sealing of interior circular penetrations, such as pipes or cables.

2. Width: Are required for application.

C. Flashing Tape: Special polyolefin film with high performance adhesive.
   1. Application: Interior window and door sill flashing tape.
   2. Width: Are required for application.

D. Tape: Bright aluminum self-adhering type, mesh reinforced, 2 inch wide.

E. Tape joints of rigid insulation in accordance with roofing and insulation manufacturers' instructions.

F. Insulation Fasteners: Impaling clip of unfinished steel with washer retainer and clips, to be adhered to surface to receive insulation, length to suit insulation thickness and substrate, capable of securely and rigidly fastening insulation in place.

G. Nails or Staples: Steel wire; electroplated or galvanized; type and size to suit application.

H. Adhesive: Type recommended by insulation manufacturer for application.

I. Spray foam insulation: Non-expanded foam spray for application into cracks around exterior doors and windows, closely spaced framing members, holes and penetrations.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation.

B. Verify substrate surfaces are flat, free of honeycomb, fins, irregularities, or materials or substances that may impede adhesive bond.

3.02 GENERAL

A. Provide complete insulation package for proposed structure including foundation, walls, floors, attics and any assembly exposed to the exterior.

B. Insulate all crevices at exterior openings and penetrations either with batt insulation or non expanding foam.

C. Fill all holes in top and bottom wall plates of attics and crawl spaces with nonexpanding foam.

3.03 BOARD INSTALLATION AT FOUNDATION PERIMETER

3.04 BATT INSTALLATION

A. Install insulation and vapor retarder in accordance with manufacturer's instructions.

B. Install in exterior wall and roof spaces without gaps or voids. Do not compress insulation.

C. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.

D. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.

E. At wood framing, place vapor retarder on warm side of insulation by stapling at 6 inches on center. Lap and seal sheet retarder joints over member face.

F. At metal framing, place vapor retarder on warm side of insulation; lap and seal sheet retarder joints over member face.

G. Tape seal tears or cuts in vapor retarder.

H. Extend vapor retarder tightly to full perimeter of adjacent window and door frames and other items interrupting the plane of the membrane. Tape seal in place.

3.05 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

3.06 PROTECTION

A. Do not permit installed insulation to be damaged prior to its concealment.

END OF SECTION

SECTION 07 2126
BLOWN INSULATION

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. ASTM C739 - Standard Specification for Cellulosic Fiber (Wood-Base) Loose-Fill Thermal Insulation; 2011.

B. ASTM C1015 - Standard Practice for Installation of Cellulosic and Mineral Fiber Loose-Fill Thermal Insulation; 2006 (Reapproved 2011).

1.02 SUBMITTALS

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

B. Product Data: Provide data on product characteristics, performance criteria, limitations .

C. Manufacturer's Installation Instructions: Indicate procedure for preparation and installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Blown Insulation:
   1. CertainTeed Corporation: www.certainteed.com.
   2. GreenFiber: www.greenfiber.com.
   3. Johns Manville: www.jm.com.
   4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MATERIALS

A. Loose Fill Insulation: ASTM C739, cellulose fiber type, bulk for pneumatic placement.
   1. Thermal Conductivity: 0.27 BTU in/(hr sq ft deg F).
   2. Installed Thickness: As indicated on drawings to achieve required R Value indicated.

B. Ventilation Baffles: Formed plastic or cardboard.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate, adjacent materials, and insulation are dry and ready to receive insulation.

B. Verify that light fixtures have thermal cut-out device to restrict over-heating in soffit or ceiling spaces.

C. Verify spaces are unobstructed to allow placement of insulation.

3.02 INSTALLATION

A. Install insulation and ventilation baffle in accordance with ASTM C1015 and manufacturer's instructions.

B. Completely fill intended spaces. Leave no gaps or voids.

3.03 CLEANING

A. Remove loose insulation residue.

END OF SECTION

SECTION 07 2500

WEATHER BARRIERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Vapor Retarders: Materials to make exterior walls, joints between exterior walls and roof, joints around frames of openings in exterior walls, and ____ water vapor resistant and air tight.

B. Air Barriers: Materials that form a system to stop passage of air through exterior walls, joints between exterior walls and roof, and joints around frames of openings in exterior walls.

1.02 RELATED REQUIREMENTS

A. Section 07 9005 - Joint Sealers: Sealant materials and installation techniques.

1.03 DEFINITIONS

A. Weather Barrier: Assemblies that form either water-resistive barriers, air barriers, or vapor retarders.

B. Air Barrier: Air tight barrier made of material that is relatively air impermeable but water vapor permeable, both to the degree specified, with sealed seams and with sealed joints to adjacent surfaces. Note: For the purposes of this specification, vapor impermeable air barriers are classified as vapor retarders.

C. Vapor Retarder: Air tight barrier made of material that is relatively water vapor impermeable, to the degree specified, with sealed seams and with sealed joints to adjacent surfaces.
   1. Water Vapor Permeance: For purposes of conversion, 57.2 ng/(Pa s sq m) = 1 perm.

1.04 REFERENCE STANDARDS

A. AATCC Test Method 127 - Water Resistance: Hydrostatic Pressure Test; 2014.

B. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection; 2015a.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

D. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2014.

E. ASTM E2178 - Standard Test Method for Air Permeance of Building Materials; 2013.

F. ICC-ES AC38 - Acceptance Criteria for Water-Resistive Barriers; ICC Evaluation Service, Inc; 2013.

1.05 SUBMITTALS

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

B. Product Data: Provide data on material characteristics.

C. ABAA Field Quality Control Submittals: Submit third-party reports of testing and inspection required by ABAA QAP.

D. ABAA Manufacturer Qualification: Submit documentation of current evaluation of proposed manufacturer and materials.

E. ABAA Installer Qualification: Submit documentation of current contractor accreditation and current installer certification. Keep copies of all contractor accreditation and installer certification on site during and after installation. Present on-site documentation upon request.

1.06 QUALITY ASSURANCE

A. Air Barrier Association of America (ABAA) Quality Assurance Program (QAP); www.airbarrier.org/#sle:
   1. Installer Qualification: Use accredited contractor, certified installers, evaluated materials, and third-party field quality control audit.

2. Manufacturer Qualification: Use evaluated materials from a single manufacturer regularly engaged in air barrier material manufacture. Use secondary materials approved in writing by primary material manufacturer.

1.07 FIELD CONDITIONS

A. Maintain temperature and humidity recommended by the materials manufacturers before, during and after installation.

PART 2 PRODUCTS

2.01 WEATHER BARRIER ASSEMBLIES

A. Air Barrier:
   1. On outside surface of inside wythe of exterior masonry cavity walls use air barrier coating.
   2. On outside surface of sheathing of exterior walls use air barrier coating.

B. Interior Vapor Retarder:
   1. On inside face of studs of exterior walls, under cladding, use mechanically fastened vapor retarder sheet.

2.02 AIR BARRIER MATERIALS (WATER VAPOR PERMEABLE AND WATER-RESISTIVE)

A. Air Barrier Sheet, Mechanically Fastened:
   1. Air Permeance: 0.004 cubic feet per minute per square foot, maximum, when tested in accordance with ASTM E2178.
   2. Water Vapor Permeance: 5 perms, minimum, when tested in accordance with ASTM E96/E96M Procedure A (desiccant procedure).
   3. Water Penetration Resistance: Withstand a water head of 21 inches, minimum, for minimum of 5 hours, when tested in accordance with AATCC Test Method 127.
   4. Ultraviolet and Weathering Resistance: Approved in writing by manufacturer for minimum of 180 days weather exposure.
   5. Surface Burning Characteristics: Flame spread index of 25 or less, and smoke developed index of 50 or less, when tested in accordance with ASTM E84.
   6. Water Resistance: Comply with applicable water-resistive requirements of ICC-ES AC38.
   7. Seam and Perimeter Tape: Polyethylene self adhering type, mesh reinforced, 2 inches wide, compatible with sheet material; unless otherwise specified.
   8. Products:
      a. DuPont Building Innovations; Tyvek Commercial Wrap with FlexWrap NF and Tyvek Tape: www.dupont.com.
      b. National Shelter Products, Inc; DRYLine HP: www.drylinewrap.com/#sle.
      c. Kingspan Insulation LLC; GreenGuard MAX Building Wrap: www.trustgreenguard.com.
      d. VaproShield, LLC; WrapShield: www.vaproshield.com.
      e. Substitutions: See Section 01 6000 - Product Requirements.

2.03 VAPOR RETARDER MATERIALS (AIR BARRIER AND WATER-RESISTIVE)

A. Vapor Retarder Sheet: Type: Dynamic permeability sheeting.
   1. Water Vapor Permeance: dynamic ranging from less than .1 perm to greater than 10 perms varying with prevailing relative humidity levels; when tested in accordance with ASTM E96/E96M.
   2. Fire resistance: Class A, max smoke development 85, meeting ASTM E84.
   3. Seam and Perimeter Tape: As recommended by sheet manufacturer.
   4. Products:
      a. Membrain as manufactured by Certainteed Saint-Gobain.
      b. Intello Plus as provided by 475 High Perforamnce Building Supply.

2.04 SEALANTS

A. Butyl Sealant: Type ____ as specified in Section 07 9005 .

2.05 ADHESIVES

A. Mastic Adhesive : Compatible with sheet seal and substrate, thick mastic of uniform knife grade consistency.

2.06 ACCESSORIES

A. Flexible Flashing: Self-adhesive sheet flashing complying with ASTM D1970/D1970M, except slip resistance requirement is waived if not installed on a roof.
   1. Composition: Any material that meets physical requirements of ASTM D1970/D1970M with exceptions indicated.
   2. Products:
      a. DuPont Building Innovations; FlexWrap NF: www.dupont.com/#sle.
      b. DuPont Building Innovations; StraightFlash: www.dupont.com/#sle.
      c. DuPont Building Innovations; StraightFlash VF: www.dupont.com/#sle.
      d. Substitutions: See Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces and conditions are ready to accept the work of this section.

3.02 PREPARATION

A. Remove projections, protruding fasteners, and loose or foreign matter that might interfere with proper installation.

3.03 INSTALLATION

A. Install materials in accordance with manufacturer's instructions.

B. Air Barriers: Install continuous air tight barrier over surfaces indicated, with sealed seams and with sealed joints to adjacent surfaces.

C. Vapor Retarders: Install continuous air tight barrier over surfaces indicated, with sealed seams and with sealed joints to adjacent surfaces.
   1. All seams, tears or punctures shall be taped.
   2. Seal top and botom of vapor retarder with continuous bead of sealant.

D. Apply sealants and adhesives within recommended application temperature ranges. Consult manufacturer if temperature is out of this range.

E. Mechanically Fastened Sheets - On Exterior:
   1. Install sheets shingle-fashion to shed water, with seams generally horizontal.
   2. Overlap seams as recommended by manufacturer but at least 6 inches.
   3. Overlap at outside and inside corners as recommended by manufacturer but at least 12 inches.
   4. For applications specified to be air tight, seal seams, laps, penetrations, tears, and cuts with self-adhesive tape; use only large-headed, gasketed fasteners recommended by the manufacturer.
   5. Install air barrier and vapor retarder UNDER jamb flashings.
   6. Install head flashings under weather barrier.
   7. At openings to be filled with frames having nailing flanges, wrap excess sheet into opening; at head, seal sheet over flange and flashing.

F. Mechanically Fastened Sheets - Vapor Retarder On Interior:
   1. When insulation is to be installed in assembly, install vapor retarder over insulation.
   2. Anchor to wood framing using large-headed nails or staples at 12 to 18 inches on center along each framing member covered; cover fasteners with seam tape.
   3. Seal seams, laps, perimeter edges, penetrations, tears, and cuts with self-adhesive tape, making air tight seal.

4. Locate laps at a framing member; at laps fasten one sheet to framing member then tape overlapping sheet to first sheet.
5. Seal entire perimeter to structure, window and door frames, and other penetrations.
6. Where conduit, pipes, wires, ducts, outlet boxes, and other items are installed in insulation cavity, pass vapor retarder sheet behind item but over insulation and maintain air tight seal.

G. Self-Adhesive Sheets:
1. Prepare substrate in manner recommended by sheet manufacturer; fill and tape joints in substrate and between dissimilar materials.
2. Lap sheets shingle-fashion to shed water and seal laps air tight.
3. Once sheets are in place, press firmly into substrate with resilient hand roller; ensure that all laps are firmly adhered with no gaps or fishmouths.
4. Use same material, or other material approved by sheet manufacturer for the purpose, to seal to adjacent construction and as flashing.
5. At wide joints, provide extra flexible membrane allowing joint movement.

H. Openings and Penetrations in Exterior Weather Barriers:
1. Install flashing over sills, covering entire sill frame member, extending at least 5 inches onto weather barrier and at least 6 inches up jambs; mechanically fasten stretched edges.
2. At openings to be filled with frames having nailing flanges, seal head and jamb flanges using a continuous bead of sealant compressed by flange and cover flanges with at least 4 inches wide; do not seal sill flange.
3. At openings to be filled with non-flanged frames, seal weather barrier to all sides of opening framing, using flashing at least 9 inches wide, covering entire depth of framing.
4. At head of openings, install flashing under weather barrier extending at least 2 inches beyond face of jambs; seal weather barrier to flashing.
5. At interior face of openings, seal gap between window/door frame and rough framing, using joint sealant over backer rod.
6. Service and Other Penetrations: Form flashing around penetrating item and seal to weather barrier surface.

3.04 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Coordination of ABAA Tests and Inspections:
1. Provide testing and inspection required by ABAA QAP.
2. Notify in ABAA writing of schedule for air barrier work. Allow adequate time for testing and inspection.
3. Cooperate with ABAA testing agency.
4. Allow access to air barrier work areas and staging.
5. Do not cover air barrier work until tested, inspected, and accepted.

C. Take digital photographs of each portion of the installation prior to covering up.

3.05 PROTECTION

A. Do not leave materials exposed to weather longer than recommended by manufacturer.

END OF SECTION

SECTION 07 3113
ASPHALT SHINGLES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Asphalt shingle roofing.

B. Flexible sheet membranes for eave protection, underlayment, and valley protection.

C. Associated metal flashings and accessories.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Roof sheathing.

B. Section 07 6200 - Sheet Metal Flashing and Trim: Edge and cap flashings.

1.03 REFERENCE STANDARDS

A. ASTM D226/D226M - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing; 2009.

B. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection; 2015a.

C. ASTM D3161/D3161M - Standard Test Method for Wind-Resistance of Steep Slope Roofing Products (Fan-Induced Method); 2014.

D. ASTM D3462/D3462M - Standard Specification for Asphalt Shingles Made From Glass Felt and Surfaced with Mineral Granules; 2010a.

E. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free; 2007 (Reapproved 2012).

F. ASTM D6380/D6380M - Standard Specification for Asphalt Roll Roofing (Organic Felt); 2003 (Reapproved 2013).

G. ICC-ES AC188 - Acceptance Criteria for Roof Underlayments; 2012.

H. NRCA MS104 - The NRCA Roofing Manual: Steep-slope Roof Systems; 2013.

I. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

1.04 SUBMITTALS

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

B. Product Data: Provide data indicating material characteristics.

C. Shop Drawings: For metal flashings, indicate specially configured metal flashings.

D. Samples: Submit two samples of each shingle color indicating color range and finish texture/pattern; for color selection.

E. Manufacturer's Installation Instructions: Indicate installation criteria and procedures.

F. Warranty: Provide copy of shingle warranty.

G. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

H. 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 Shingles: 160 sq ft of each type and color.

1.05 QUALITY ASSURANCE

A. Perform Work in accordance with the recommendations of 1.

B. Shingles shall carry a minimum 30 year limited lifetime warranty from the manufacturer.

1.06 FIELD CONDITIONS

A. Do not install shingles or eave protection membrane when surface temperatures are below 45 degrees F.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Asphalt Shingles:
   1. NRCA (RM) - The NRCA Roofing Manual; 2017.
   2. GAF; Timberline HD Reflector Series: www.gaf.com/sle.
   3. Owens Corning Corp: www.owenscorning.com.
   4. IKO
   5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 ASPHALT SHINGLES

A. Asphalt Shingles: Asphalt-coated glass felt, mineral granule surfaced, complying with ASTM D3462/D3462M.
   1. Fire Resistance: Class A.
   2. Wind Resistance: Class F, when tested in accordance with ASTM D3161/D3161M.
   3. Warranted Wind Speed: Not less than tested wind resistance.
   4. Weight: minimum 250 lb/100 sq ft.
   5. Self-sealing type.
   6. Style: Laminated overlay.

2.03 SHEET MATERIALS

A. Smooth Surfaced Roll Roofing: Asphalt-coated organic felt, with smooth asphalt coating both sides, complying with ASTM D6380/D6380M, Class S, Type III, 51.1 lb/100 sq ft.

B. Eave Protection Membrane: Self-adhering polymer-modified asphalt sheet complying with ASTM D1970/D1970M; 40 mil total thickness; with strippable treated release paper and polyethylene sheet top surface.

C. Underlayment: Asphalt-saturated organic roofing felt, unperforated, complying with ASTM D226/D226M, Type I ("No.15").

2.04 ACCESSORIES

A. Nails: Standard round wire shingle type, of hot-dipped zinc coated steel, 10 wire gage, 0.1019 inch shank diameter, 3/8 inch head diameter, of sufficient length to penetrate through roof sheathing or 3/4 inch into roof sheathing or decking.
   1. Staples are not permitted to be used.

B. Plastic Cement: ASTM D4586/D4586M, asphalt roof cement.

C. Ridge Vents: Shall be type which can be shingled over: ‘VentSure Rigid Roll Ridge Vent’ as manufactured by Owens Corning providing 12.5 square inches of ventilation per lineal foot.

D. Under single attic vents: Shall be "SmartVent" by DCi Products where indicated on drawings.

2.05 METAL FLASHINGS

A. Metal Flashings: Provide sheet metal eave edge, gable edge, ridge vents, open valley flashing, and other flashing indicated.
   1. Form flashings to profiles indicated on Drawings.
   2. Form sections square and accurate to profile, in maximum possible lengths, free from distortion or defects detrimental to appearance or performance.
   3. Hem exposed edges of flashings minimum 1/4 inch on underside.
   4. Coat concealed surfaces of flashings with bituminous paint.

B. Aluminum Sheet Metal: Prefinished aluminum, 26 gage, 0.017 inch minimum thickness; PVC coating, color as selected by Architect.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions prior to beginning work.

B. Verify that deck is of sufficient thickness to accept fasteners.

C. Verify that roof penetrations and plumbing stacks are in place and flashed to deck surface.

D. Verify roof openings are correctly framed.

E. Verify deck surfaces are dry, free of ridges, warps, or voids.

3.02 PREPARATION

A. Broom clean deck surfaces before installing underlayment or eave protection.

B. Install eave edge flashings tight with fascia boards. Weather lap joints 2 inches and seal with plastic cement. Secure flange with nails spaced ____ inches on center.

3.03 INSTALLATION - EAVE PROTECTION MEMBRANE

A. Install eave protection membrane from eave edge to minimum 4 ft up-slope beyond interior face of exterior wall.

B. Install eave protection membrane in accordance with manufacturer's instructions and NRCA (RM) applicable requirements.

3.04 INSTALLATION - UNDERLAYMENT

A. Underlayment At Roof Slopes Up to 4:12: Install two layers of underlayment over area not protected by eave protection, with ends and edges weather lapped minimum 4 inches. Stagger end laps of each consecutive layer. Nail in place.

B. Underlayment At Roof Slopes Greater Than 4:12: Install underlayment perpendicular to slope of roof, with ends and edges weather lapped minimum 4 inches. Stagger end laps of each consecutive layer. Nail in place. Weather lap minimum 4 inches over eave protection.

C. Items projecting through or mounted on roof: Weather lap and seal watertight with plastic cement.

3.05 INSTALLATION - VALLEY PROTECTION

A. Install valley protection in accordance with SMACNA (ASMM), Detail ____.

B. Install one ply of smooth surfaced roll roofing, minimum 18 inches wide, centered over valleys.

C. Weather lap joints minimum 2 inches.

D. Nail in place minimum 18 inches on center, 1 inch from edges.

E. At Exposed Valleys: Install one layer of sheet metal flashing, minimum 24 inches wide, centered over open valley and crimped to guide water. Weather lap joints minimum 2 inch wide band of lap cement along each edge of first, press roll roofing into cement, and nail in place minimum 18 inches on center, 1 inch from edges.

3.06 INSTALLATION - METAL FLASHING AND ACCESSORIES

A. Install flashings in accordance with manufacturer's instructions and NRCA (RM) applicable requirements.

B. Weather lap joints minimum 2 inches and seal weather tight with plastic cement.

C. Secure in place with nails. Conceal fastenings .

D. Items Projecting Through or Mounted on Roofing: Flash and seal weather tight with plastic cement.

3.07 INSTALLATION - SHINGLES

A. Install shingles in accordance with manufacturer's instructions manufacturer's instructions and NRCA (RM) applicable requirements.

1. Fasten individual shingles using 2 nails per shingle, or as required by code, whichever is greater.
2. Fasten strip shingles using 4 nails per strip, or as required by code, whichever is greater.

B. Place shingles in straight coursing pattern with 5 inch weather exposure to produce double thickness over full roof area. Provide double course of shingles at eaves.

C. Project first course of shingles 3/4 inch beyond fascia boards.

D. Extend shingles 1/2 inch beyond face of gable edge fascia boards.

E. Extend shingles on one slope across valley and fasten. Trim shingles from other slope 2 inches from valley center line to achieve closed cut valley, concealing the valley protection.

F. Cap hips with individual shingles, maintaining 5 inch weather exposure. Place to avoid exposed nails.

G. After installation, place one daub of plastic cement, one inch diameter under each individual shingle tab exposed to weather, to prevent lifting.

H. Coordinate installation of roof mounted components or work projecting through roof with weather tight placement of counterflashings.

I. Complete installation to provide weather tight service.

END OF SECTION

SECTION 07 6200

SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fabricated sheet metal items, including flashings, counterflashings, gutters, downspouts, and aluminum wrapped trim / fascias..

B. Aluminum soffits.

C. Sealants for joints within sheet metal fabrications.

D. Precast concrete splash pads.

1.02 RELATED REQUIREMENTS

A. Section 04 2000 - Unit Masonry: Metal flashings embedded in masonry.

B. Section 06 1000 - Rough Carpentry: Field fabricated roof curbs.

C. Section 07 3113 - Asphalt Shingles: Non-metallic flashings associated with shingle roofing.

D. Section 07 7200 - Roof Accessories: Manufactured metal roof curbs.

E. Section 07 9200 - Joint Sealants: Sealing non-lap joints between sheet metal fabrications and adjacent construction.

1.03 REFERENCE STANDARDS

A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2012.

B. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels; 2013.

C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

D. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

E. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate [Metric]; 2014.

F. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2014.

G. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free; 2007 (Reapproved 2012).

H. CDA A4050 - Copper in Architecture - Handbook; current edition.

I. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

1.04 SUBMITTALS

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

B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.

C. Samples: Submit two samples ____by____ inch in size illustrating metal finish color.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with SMACNA (ASMM) and CDA A4050 requirements and standard details, except as otherwise indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.

B. Prevent contact with materials that could cause discoloration or staining.

PART 2 PRODUCTS

2.01 SHEET MATERIALS

A. Pre-Finished Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 0.02 inch thick base metal, shop pre-coated with PVDF coating.
   1. PVDF (Polyvinylidene Fluoride) Coating: Superior Performance Organic Finish, AAMA 2605; multiple coat, thermally cured fluoropolymer finish system.
   2. Color: As selected by Architect from manufacturer's standard colors.

B. Aluminum: ASTM B209 (ASTM B209M); 20 gage, (0.032 inch) thick; anodized finish of color as selected.

C. Pre-Finished Aluminum: ASTM B209 (ASTM B209M); [.063] inch thick; plain finish shop pre-coated with fluoropolymer coating
   1. Fluoropolymer Coating: High Performance Organic Finish, AAMA 2605; multiple coat, thermally cured fluoropolymer finish system.
   2. Color: As selected by Architect from manufacturer's standard colors.

2.02 ACCESSORIES

A. Fasteners: Same material and finish as flashing metal.

B. Primer: Zinc chromate type.

C. Protective Backing Paint: Zinc molybdate alkyd.

D. Sealant to be Concealed in Completed Work: Non-curing butyl sealant.

E. Sealant to be Exposed in Completed Work: ASTM C920; elastomeric sealant, 100 percent silicone with minimum movement capability of plus/minus 25 percent and recommended by manufacturer for substrates to be sealed; clear.

F. Sealant: Type as specified in Section 07 9005.

G. Plastic Cement: ASTM D4586/D4586M, Type I.

2.03 FABRICATION

A. Form sections true to shape, accurate in size, square, and free from distortion or defects.

B. Form pieces in longest possible lengths.

C. Hem exposed edges on underside 1/2 inch; miter and seam corners.

D. Form material with flat lock seams, except where otherwise indicated; at moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.

E. Fabricate corners from one piece with minimum 18 inch long legs; seam for rigidity, seal with sealant.

F. Fabricate flashings to allow toe to extend 2 inches over roofing gravel. Return and brake edges.

2.04 GUTTER AND DOWNSPOUT FABRICATION

A. Gutters: SMACNA (ASMM), Rectangular profile.

B. Downspouts: Profile as indicated.

C. Gutters and Downspouts: Size indicated.

D. Accessories: Profiled to suit gutters and downspouts.
   1. Anchorage Devices: In accordance with SMACNA (ASMM) requirements.
   2. Gutter Supports: Spikes and ferrules.
   3. Downspout Supports: Straps.
   4. Valley splash guards: Prefinished aluminum in same gage as gutters secured to outer edge of 90 degree inside corners at bottom of roof valleys. Scure to inside face of outer gutter edge to form a 90 degree 'L' approximately 6" in height with chamfered top corners.

E. Splash Pads: Precast concrete or solid plastic type, of size and profiles indicated; minimum 3000 psi at 28 days, with minimum 5 percent air entrainment.

F. Downspout Boots: Plastic.

G. Downspout Extenders: Same material and finish as downspouts.

H. Seal metal joints.

2.05 ACCESSORIES

A. Fasteners: Galvanized steel, with soft neoprene washers.

B. Primer: Zinc chromate type.

C. Concealed Sealants: Non-curing butyl sealant.

D. Exposed Sealants: ASTM C920; elastomeric sealant, with minimum movement capability as recommended by manufacturer for substrates to be sealed; color to match adjacent material.

E. Plastic Cement: ASTM D4586/D4586M, Type I.

2.06 VINYL SOFFITS

A. Profile: Board Style, Ventilating Triple 3-Inch; 3-1/3 inches wide, solid; 9 inch exposure; with hidden vents. Basis of design is Certainteed Vinyl Carpentry Triple 3-1/3" InvisiVent Super Ventilated Soffit providing 10.0 square inches of net free ventilation per square ft.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.

B. Verify roofing termination and base flashings are in place, sealed, and secure.

3.02 PREPARATION

A. Install starter and edge strips, and cleats before starting installation.

B. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil.

3.03 INSTALLATION

A. Conform to drawing details.

B. Secure flashings in place using concealed fasteners, and use exposed fasteners only where permitted..

C. Apply plastic cement compound between metal flashings and felt flashings.

D. Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.

E. Seal metal joints watertight.

F. Secure gutters and downspouts in place with concealed fasteners.

G. Connect downspouts to downspout boots, and grout connection watertight.

H. Set splash pads under downspouts, and set in place with _____.

3.04 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for field inspection requirements.

B. Inspection will involve surveillance of work during installation to ascertain compliance with specified requirements.

END OF SECTION

SECTION 07 8100

APPLIED FIREPROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fireproofing of interior structural steel not exposed to damage or moisture.

1.02 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

B. ASTM E736 - Standard Test Method for Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members; 2000 (Reapproved 2011).

C. ASTM E760/E760M - Standard Test Method for Effect of Impact on Bonding of Sprayed Fire-Resistive Material Applied to Structural Members; 1992 (Reapproved 2015)e1.

D. ASTM E937 - Standard Test Method for Corrosion of Steel by Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members; 1993 (Reapproved 2011).

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordinate with placement of ceiling hanger tabs, mechanical component hangers, and electrical components.

1.04 SUBMITTALS

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

B. Product Data: Provide data indicating product characteristics.

C. Test Reports: Reports from reputable independent testing agencies for proposed products, indicating compliance with specified criteria, conducted under conditions similar to those on project, for:
   1. Bond strength.
   2. Bond impact.
   3. Compressive strength.
   4. Fire tests using substrate materials similar those on project.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

1.06 FIELD CONDITIONS

A. Do not apply spray fireproofing when temperature of substrate material and surrounding air is below 40 degrees F or when temperature is predicted to be below said temperature for 24 hours after application.

B. Provide ventilation in areas to receive fireproofing during application and 24 hours afterward, to dry applied material.

C. Provide temporary enclosure to prevent spray from contaminating air.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.
   1. Include coverage for fireproofing to remain free from cracking, checking, dusting, flaking, spalling, separation, and blistering.
   2. Reinstall or repair failures that occur within warranty period.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Sprayed-On Fireproofing:
   1. Carboline Company; ____: www.carboline.com.
   2. GCP Applied Technologies; _____: www.gcpat.com/fireproofing/#sle.
   3. Isolatek International Inc: www.isolatek.com.
   4. Southwest Fireproofing Products Company; ____: www.sfrm.com.

2.02 FIREPROOFING ASSEMBLIES

A. Provide assemblies as indicated on the drawings.

2.03 MATERIALS

A. Sprayed Fire-Resistive Material for Interior Applications, Concealed: Manufacturer's standard factory mixed material, which when combined with water is capable of providing the indicated fire resistance, and conforming to the following requirements:
   1. Bond Strength: 150 pounds per square foot, minimum, when tested in accordance with ASTM E736 when set and dry.
   2. Dry Density: As required by fire resistance design.
   3. Compressive Strength: 8.33 pounds per square inch, minimum.
   4. Effect of Impact on Bonding: No cracking, spalling or delamination, when tested in accordance with ASTM E760/E760M.
   5. Corrosivity: No evidence of corrosion, when tested in accordance with ASTM E937.
   6. Surface Burning Characteristics: Maximum flame spread index of 0 (zero) and maximum smoke developed index of 0 (zero), when tested in accordance with ASTM E84.

2.04 ACCESSORIES

A. Primer Adhesive: Of type recommended by fireproofing manufacturer.

B. Water: Clean, potable.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are ready to receive fireproofing.

B. Verify that clips, hangers, supports, sleeves, and other items required to penetrate fireproofing are in place.

C. Verify that ducts, piping, equipment, or other items that would interfere with application of fireproofing have not been installed.

D. Verify that voids and cracks in substrate have been filled. Verify that projections have been removed where fireproofing will be exposed to view as a finish material.

3.02 PREPARATION

A. Perform tests as recommended by fireproofing manufacturer in situations where adhesion of fireproofing to substrate is in question.

B. Remove incompatible materials that could affect bond by scraping, brushing, scrubbing, or sandblasting.

C. Prepare substrates to receive fireproofing in strict accordance with instructions of fireproofing manufacturer.

D. Apply fireproofing manufacturer's recommended bonding agent on primed steel.

E. Protect surfaces not scheduled for fireproofing and equipment from damage by overspray, fall-out, and dusting.

F. Close off and seal duct work in areas where fireproofing is being applied.

3.03 APPLICATION

A. Apply primer adhesive in accordance with manufacturer's instructions.

B. Apply fireproofing in thickness and density necessary to achieve required ratings, with uniform density and texture.

3.04 CLEANING

A. Remove excess material, overspray, droppings, and debris.

B. Remove fireproofing from materials and surfaces not required to be fireproofed.

END OF SECTION

SECTION 07 8400
FIRESTOPPING

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

A. Section 07 8100 - Applied Fireproofing.

1.02 REFERENCE STANDARDS

A. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2015.

B. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Fire Stops; 2013a.

C. ASTM E1966 - Standard Test Method for Fire Resistive Joint Systems; 2007 (Reapproved 2011).

D. ASTM E2307 - Standard Test Method for Determining Fire Resistance of Perimeter Fire Barriers Using Intermediate-Scale, Multi-story Test Apparatus; 2015a.

E. ASTM E2837 - Standard Test Method for Determining the Fire Resistance of Continuity Head-of-Wall Joint Systems Installed Between Rated Wall Assemblies and Nonrated Horizontal Assemblies; 2013.

F. ITS (DIR) - Directory of Listed Products; current edition.

G. FM (AG) - FM Approval Guide; current edition.

H. SCAQMD 1168 - South Coast Air Quality Management District Rule No.1168; current edition.

I. UL 2079 - Standard for Tests for Fire Resistance of Building Joint Systems; Current Edition, Including All Revisions.

J. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

K. UL (FRD) - Fire Resistance Directory; current edition.

1.03 SUBMITTALS

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

B. Schedule of Firestopping: List each type of penetration, fire rating of the penetrated assembly, and firestopping test or design number.

C. Product Data: Provide data on product characteristics, performance ratings, and limitations.

D. Sustainable Design Submittal: Submit VOC content documentation for all non-preformed materials.

E. Manufacturer's Installation Instructions: Indicate preparation and installation instructions.

F. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

G. Certificate from authority having jurisdiction indicating approval of materials used.

H. Installer Qualification: Submit qualification statements for installing mechanics.

1.04 QUALITY ASSURANCE

A. Fire Testing: Provide firestopping assemblies of designs that provide the scheduled fire ratings when tested in accordance with methods indicated, ASTM E119, and ASTM E814.
   1. Listing in UL (FRD), FM (AG), or ITS (DIR) will be considered as constituting an acceptable test report.
   2. Valid evaluation report published by ICC Evaluation Service, Inc. (ICC-ES) at www.icc-es.org will be considered as constituting an acceptable test report.
   3. Submission of actual test reports is required for assemblies for which none of the above substantiation exists.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Installer Qualifications: Company specializing in performing the work of this section and:
   1. Verification of minimum three years documented experience installing work of this type.

D. Coordination: Cross-coordinate rated and structural assemblies with penetrating products shown on plans and shop drawings of work by other divisions.

1.05 FIELD CONDITIONS

A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation. Maintain minimum temperature before, during, and for 3 days after installation of materials.

B. Provide ventilation in areas where solvent-cured materials are being installed.

PART 2 PRODUCTS

2.01 MATERIALS

A. Manufacturers:
   1. A/D Fire Protection Systems Inc.: www.adfire.com.
   2. 3M Fire Protection Products: www.3m.com/firestop.
   3. Hilti, Inc: www.us.hilti.com/#sle.
   4. Nelson FireStop Products: www.nelsonfirestop.com.
   5. Specified Technologies, Inc.: www.stifirestop.com.

B. Materials: Use any material meeting requirements.

C. Volatile Organic Compound (VOC) Content: Provide products having VOC content lower than that required by SCAQMD 1168.

D. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Provide type of materials as required for tested firestopping assembly.

E. Fire Ratings: Refer to drawings for required systems and ratings.

2.02 FIRESTOPPING ASSEMBLY REQUIREMENTS

A. Through Penetration Firestopping: Use any system that has been tested according to ASTM E814 to have fire resistance F Rating equal to required fire rating of penetrated assembly.
   1. Listing by FM (AG), ITS (DIR), UL (DIR), or UL (FRD) in their certification directories will be considered evidence of successful testing.

B. Membrane Penetration Firestopping: For all membrane penetrations, provide firestopping systems that have been tested according to ASTM E814 to have a pressure differential of .01" of water, and with fire resistance, F and T Rating not less than the required fire rating of penetrated assembly.

C. Non-standard firestopping applications: for plumbing cleanouts, electrical panels, and other non-standard penetrations in rated and/or structural bearing wall membranes, provide listed systems with supporting fire engineering determination for modifications and submit for approval to local building and fire authorities.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify openings are ready to receive the work of this section.

3.02 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter that could adversely affect bond of firestopping material.

B. Remove incompatible materials that could adversely affect bond.

C. Install backing materials to arrest liquid material leakage.

3.03 INSTALLATION

A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.

B. Do not cover installed firestopping until inspected by authorities having jurisdiction.

C. Install labeling required by code.

3.04 FIELD QUALITY CONTROL

A. Repair or replace penetration firestopping and joints at locations where inspection results indicate firestopping or joints do not meet specified requirements.

3.05 CLEANING

A. Clean adjacent surfaces of firestopping materials.

3.06 PROTECTION

A. Protect adjacent surfaces from damage by material installation.

END OF SECTION

SECTION 07 9005

JOINT SEALERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Sealants and joint backing.

B. Precompressed foam sealers.

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 07 8400 - Firestopping: Firestopping sealants.

C. Section 08 8000 - Glazing: Glazing sealants and accessories.

D. Section 09 2116 - Gypsum Board Assemblies: Acoustic sealant.

1.03 REFERENCE STANDARDS

A. ASTM C834 - Standard Specification for Latex Sealants; 2014.

B. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications; 2012.

C. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2014.

D. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016.

1.04 SUBMITTALS

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

B. Product Data: Provide data indicating sealant chemical characteristics.

1.05 QUALITY ASSURANCE

1.06 FIELD CONDITIONS

A. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective work within a five year period after Date of Substantial Completion.

C. Warranty: Include coverage for installed sealants and accessories which fail to achieve airtight seal, exhibit loss of adhesion or cohesion, or do not cure.

PART 2 PRODUCTS

2.01 MANUFACTURERS

2.02 SEALANTS

A. Sealants and Primers - General: Provide products having volatile organic compound (VOC) content as specified in Section 01 6116.

B. General Purpose Exterior Sealant: Silane Modified Polymer (SMP); ASTM C920, Type S, Grade NS, Class 50, Uses Masonry, wood, metal, plastic; single component.
   1. Color: Match adjacent finished surfaces.
   2. Applications: Use for:
      a. Control, expansion, and soft joints in masonry.
      b. Joints between concrete and other materials.
      c. Joints between metal/wood frames and other materials.
      d. Joints at vinyl, cementitious or wood siding.
      e. Other exterior joints for which no other sealant is indicated.
   3. Silane Modified Polymer (SMP) Products:

a. OSI Quad Max: http://www.ositough.com.

C. General Purpose Interior Sealant: Acrylic emulsion latex; ASTM C834, Type OP, Grade NF single component, paintable.
   1. Color: Match adjacent finished surfaces.
   2. Applications: Use for:
      a. Interior wall and ceiling control joints.
      b. Joints between door and window frames and wall surfaces.
      c. Other interior joints for which no other type of sealant is indicated.
   3. Products:
      a. Bostik Inc: www.bostik-us.com.
      b. Pecora Corporation; AC-20 + Silicone Acrylic Latex Caulking Compound: www.pecora.com.
      c. BASF Construction Chemicals-Building Systems: www.buildingsystems.basf.com.
      d. Sherwin-Williams Company: www.sherwin-williams.com.
      e. Tremco Global Sealants: www.tremcosealants.com.

D. Bathtub/Tile Sealant: Silicone; ASTM C920, Uses I, M and A; single component, mildew resistant.
   1. Applications: Use for:
      a. Joints between plumbing fixtures and floor and wall surfaces.
      b. Joints between kitchen and bath countertops and wall surfaces.
   2. Color: Match adjacent finished surfaces except at plastic laminate countertops use clear.
   3. Products:
      a. Bostik Inc: www.bostik-us.com.
      b. BASF Construction Chemicals-Building Systems: www.buildingsystems.basf.com.
      c. Pecora Corporation; 898NST Sanitary Silicone Sealant - Class 50: www.pecora.com.
      d. Tremco Global Sealants: www.tremcosealants.com.
      e. Substitutions: See Section 01 6000 - Product Requirements.

E. Acoustical Sealant for Concealed Locations:
   1. Composition: Acrylic latex emulsion sealant.
   2. Applications: Use for concealed locations only:
      a. Sealant bead between top stud runner and structure and between bottom stud track and floor.
   3. Products:
      a. Bostik Inc: www.bostik-us.com.
      b. Pecora Corporation: www.pecora.com.
      c. BASF Construction Chemicals-Building Systems: www.buildingsystems.basf.com.
      d. Tremco Global Sealants: www.tremcosealants.com.
      e. Hilti, Inc.: www.us.hilti.com.
      f. Substitutions: See Section 01 6000 - Product Requirements.

F. Interior Floor Joint Sealant: Polyurethane, self-leveling; ASTM C920, Grade P, Class 25, Uses T, M and A; single component.
   1. Approved by manufacturer for wide joints up to 1-1/2 inches.
   2. Color: Match adjacent finished surfaces.
   3. Applications: Use for:
      a. Expansion joints in floors.
      b. Other floor joints.
   4. Products:
      a. Bostik Inc: www.bostik-us.com.
      b. Pecora Corporation: www.pecora.com.
      c. BASF Construction Chemicals-Building Systems: www.buildingsystems.basf.com.
      d. Sherwin-Williams Company: www.sherwin-williams.com.

e. Substitutions: See Section 01 6000 - Product Requirements.

G. Concrete Paving Joint Sealant: Polyurethane, self-leveling; ASTM C920, Class 25, Uses T, I, M and A; single component.
   1. Color: Gray.
   2. Applications: Use for:
      a. Joints in sidewalks and vehicular paving.
      b. Expansion joints abutting building..
   3. Products:
      a. Bostik Inc: www.bostik-us.com.
      b. Pecora Corporation: www.pecora.com.
      c. BASF Construction Chemicals-Building Systems: www.buildingsystems.basf.com.
      d. Sherwin-Williams Company: www.sherwin-williams.com.
      e. Substitutions: See Section 01 6000 - Product Requirements.

2.03 ACCESSORIES

A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.

B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.

C. Joint Backing: Round foam rod compatible with sealant; ASTM D 1667, closed cell PVC; oversized 30 to 50 percent larger than joint width..

D. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

B. Verify that joint backing and release tapes are compatible with sealant.

3.02 PREPARATION

A. Remove loose materials and foreign matter that could impair adhesion of sealant.

B. Clean and prime joints in accordance with manufacturer's instructions.

C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.

D. Protect elements surrounding the work of this section from damage or disfigurement.

3.03 INSTALLATION

A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.

B. Perform installation in accordance with ASTM C1193.

C. Perform acoustical sealant application work in accordance with ASTM C919.

D. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer, except where specific dimensions are indicated.

E. Install bond breaker where joint backing is not used.

F. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.

G. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

H. Tool joints concave.

3.04 CLEANING

A. Clean adjacent soiled surfaces.

3.05 PROTECTION

A. Protect sealants until cured.

END OF SECTION

SECTION 08 1113

HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Non-fire-rated hollow metal doors and frames.

B. Hollow metal frames for wood doors.

C. Fire-rated hollow metal doors and frames.

D. Thermally insulated hollow metal doors with frames.

E. Security resistant hollow metal doors and frames.

F. Accessories, including glazing, louvers, and matching panels.

1.02 RELATED REQUIREMENTS

A. Section 08 7100 - Door Hardware.

B. Section 08 8000 - Glazing: Glass for doors and borrowed lites.

1.03 ABBREVIATIONS AND ACRONYMS

A. ANSI - American National Standards Institute.

B. ASCE - American Society of Civil Engineers.

C. HMMA - Hollow Metal Manufacturers Association.

D. NAAMM - National Association of Architectural Metal Manufacturers.

E. NFPA - National Fire Protection Association.

F. SDI - Steel Door Institute.

G. UL - Underwriters Laboratories.

1.04 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

B. ANSI/ICC A117.1 - American National Standard for Accessible and Usable Buildings and Facilities; International Code Council; 2009.

C. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors; 2011.

D. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100); 2014.

E. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 2011.

F. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

G. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable; 2015.

H. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2014.

I. BHMA A156.115 - American National Standard for Hardware Preparation in Steel Doors and Steel Frames; 2014.

J. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2009.

K. NAAMM HMMA 830 - Hardware Selection for Hollow Metal Doors and Frames; 2002.

L. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames; 2011.

M. NAAMM HMMA 840 - Guide Specifications for Installation and Storage of Hollow Metal Doors and Frames; 2007.

N. NAAMM HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames; 2006.

O. SDI 117 - Manufacturing Tolerances for Standard Steel Doors and Frames; 2013.

1.05 SUBMITTALS

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

B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes; and one copy of referenced standards/guidelines.

C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.

D. Installation Instructions: Manufacturer's published instructions, including any special installation instructions relating to this project.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years documented experience.
   1. Provide hollow metal frames from SDI Certified manufacturer.

B. Maintain at project site copies of reference standards relating to installation of products specified.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.

B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Hollow Metal Doors and Frames:
   1. Therma Tru
   2. Ceco Door, an Assa Abloy Group company: www.assaabloydss.com.
   3. De La Fontaine Inc: www.delafontaine.com.
   4. De La Fontaine Inc: www.delafontaine.com.
   5. De La Fontaine Inc: www.delafontaine.com.
   6. Republic Doors: www.republicdoor.com.
   7. Steelcraft, an Allegion brand: www.allegion.com/us.
   8. Technical Glass Products; SteelBuilt Window & Door Systems: www.tgpamerica.com.
   9. Substitutions: See Section 01 6000 - Product Requirements.

2.02 DESIGN CRITERIA

A. Requirements for Hollow Metal Doors and Frames:
   1. Steel used for fabrication of doors and frames shall comply with one or more of the following requirements; Galvannealed steel conforming to ASTM A653/A653M, cold-rolled steel conforming to ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel conforming to ASTM A1011/A1011M, Commercial Steel (CS) Type B for each.
   2. Accessibility: Comply with ICC A117.1 and ADA Standards.
   3. Exterior Door Top Closures: Flush end closure channel, with top and door faces aligned.

4. Door Edge Profile: steel.
5. Typical Door Face Sheets: 2 panel.
6. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings. Style: Manufacturers standard.
7. Hardware Preparations, Selections and Locations: Comply with NAAMM HMMA 830 and NAAMM HMMA 831 or BHMA A156.115 and ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
8. Zinc Coating for Typical Interior and/or Exterior Locations: Provide metal components zinc-coated (galvanized) and/or zinc-iron alloy-coated (galvannealed) by the hot-dip process in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness, unless noted otherwise for specific hollow metal doors and frames.
    a. Based on SDI Standards: Provide at least A40/ZF120 (galvannealed) when necessary, coating not required for typical interior door applications, and at least A60/ZF180 (galvannealed) for corrosive locations.

B. Hollow Metal Panels: Same construction, performance, and finish as doors.

C. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

2.03 HOLLOW METAL DOORS

A. Exterior Doors: Thermally insulated.
1. Therma Tru SE969HD 90 minute thermally insulated steel door.
2. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
    a. Level heavy duty.
    b. Physical Performance Level C, 250,000 cycles; in accordance with ANSI/SDI A250.4.
    c. Model 2 panel.
    d. Door Face Metal Thickness: 24 gage, ___ inch, minimum.
3. Door Thickness: 1-3/4 inch, nominal.

2.04 HOLLOW METAL FRAMES

A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.

B. Exterior Door Frames: Face welded type.
1. Basis of Design: therma Tru adjust -a-fit steel frame.
2. Weatherstripping: Separate, see Section 08 7100.

C. Frames for Wood Doors: Comply with frame requirements in accordance with corresponding door.

2.05 FINISHES

A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.

2.06 ACCESSORIES

A. Louvers: Roll formed steel with overlapping frame; finish same as door components; factory-installed.

B. Glazing: As specified in Section 08 8000, factory installed.

C. Removable Stops: Formed sheet steel, shape as indicated on drawings, mitered or butted corners; prepared for countersink style tamper proof screws.

D. Silencers: Resilient rubber, fitted into drilled hole; 3 on strike side of single door, 3 on center mullion of pairs, and 2 on head of pairs without center mullions.

E. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.

F. hreshold: Therma Tru barrier free/ADA compliant.

2.07 FINISHES

A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.

B. Bituminous Coating: Asphalt emulsion or other high-build, water-resistant, resilient coating.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Verify that finished walls are in plane to ensure proper door alignment.

D. Verify necessary flashings are in place at exterior doors before installation.

3.02 PREPARATION

A. Coat inside of frames to be installed in masonry or to be grouted, with bituminous coating, prior to installation.

3.03 INSTALLATION

A. Install doors and frames in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.

B. Coordinate frame anchor placement with wall construction.

C. Install door hardware as specified in Section 08 7100.

D. Comply with glazing installation requirements of Section 08 8000.

E. At exterior doors install necessary flashing at head of door appropriate to the detail and adjacent materials.

F. Coordinate installation of electrical connections to electrical hardware items.

3.04 TOLERANCES

A. Clearances Between Door and Frame: Comply with related requirements of specified frame standards or custom guidelines indicated in accordance with SDI 117 or NAAMM HMMA 861

B. Maximum Diagonal Distortion: 1/16 in measured with straight edge, corner to corner.

3.05 ADJUSTING

A. Adjust for smooth and balanced door movement.

3.06 SCHEDULE

A. Refer to Door and Frame Schedule on the drawings.

END OF SECTION

SECTION 08 1416

FLUSH WOOD DOORS

A. Painted hardboard (factory finish - IE LEGACY).

PART 2 PRODUCTS

1.01 DOORS AND PANELS

A. Doors: Refer to drawings for locations and additional requirements.
   1. Quality Standard: Custom Grade, Heavy Duty performance, in accordance with WDMA I.S. 1A.

B. Interior Doors: 1-3/4 inches thick unless otherwise indicated; flush construction.
   1. Provide solid core doors at each location.
   2. Hardboard facing with factory opaque finish as indicated on drawings.

1.02 DOOR AND PANEL CORES

A. Hollow Core Doors: Type - Standard (FSHC); plies and faces as indicated above.

1.03 DOOR FACINGS

A. Hardboard Facing: Factory applied masonite legacy wood grain finish; color as selected by Architect.

1.04 DOOR CONSTRUCTION

A. Fabricate doors in accordance with door quality standard specified.

B. Cores Constructed with stiles and rails:
   1. Provide solid blocks at lock edge for hardware reinforcement.

C. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.

D. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.

E. Provide edge clearances in accordance with the quality standard specified.

1.05 FACTORY FINISHING - WOOD VENEER DOORS

A. Finish work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and as follows:
   1. Transparent:
      a. System - 1, Lacquer, Nitrocellulose.
      b. Sheen: Satin.

B. Finish work in accordance with WDMA I.S. 1A for grade specified and as follows:

C. Factory finish doors in accordance with approved sample.

END OF SECTION

SECTION 08 3100
ACCESS DOORS AND PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall access door and frame units.

B. Ceiling access door and frame units.

1.02 RELATED REQUIREMENTS

A. Section 23 3300 - Air Duct Accessories: Access doors in ductwork.

1.03 SUBMITTALS

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

B. Product Data: Provide sizes, types, finishes, hardware, scheduled locations, and details of adjoining work.

C. Manufacturer's Installation Instructions: Indicate installation requirements.

D. Project Record Documents: Record actual locations of each access unit.

PART 2 PRODUCTS

2.01 ACCESS DOORS AND PANELS ASSEMBLIES

A. Wall-Mounted Units:
   1. Material: Steel.
   2. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.
   3. Wall Mounting Criteria: Provide surface-mounted face frame and door surface flush with frame surface.

B. Wall-Mounted Units in Wet Areas:
   1. Material: Steel, hot-dipped zinc, or zinc-aluminum-alloy coated.
   2. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.
   3. Wall Mounting Criteria: Provide surface-mounted face frame and door surface flush with frame surface.

C. Fire-Rated Wall-Mounted Units:
   1. Wall Fire-Rating: As indicated on drawings.
   2. Material: Steel.
   3. Door/Panel: Insulated double-surface panel, with tool-operated spring or cam lock and no handle.

D. Ceiling-Mounted Units:
   1. Material: Steel.
   2. Size - Lay-In Grid Ceilings: To match module of ceiling grid.
   3. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.

E. Fire-Rated Ceiling-Mounted Units:
   1. Ceiling Fire-Rating: As indicated on drawings.
   2. Material: Steel.
   3. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.

F. Wall-Mounted Security Units:
   1. Material: Steel.
   2. Door/Panel and Frame: Heavy duty.
   3. Security type lock as indicated.

2.02 WALL AND CEILING MOUNTED UNITS

A. Manufacturers:

1. ACUDOR Products Inc: www.acudor.com/#sle.
2. Babcock-Davis; _____: www.babcockdavis.com/#sle.
3. Cendrex, Inc: www.cendrex.com/#sle.
4. Karp Associates, Inc: www.karpinc.com .
5. Milcor by Commercial Products Group of Hart & Cooley, Inc: www.milcorinc.com .
6. Substitutions: See Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that rough openings are correctly sized and located.

B. Begin installation only after substrates have been properly prepared, and if the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Prepare surfaces using methods recommended by manufacturer for applicable substrates in accordance with project conditions.

3.03 INSTALLATION

A. Install units in accordance with manufacturer's instructions.

B. Install frames plumb and level in openings, and secure units rigidly in place.

C. Position units to provide convenient access to concealed equipment when necessary.

END OF SECTION

SECTION 08 4229

AUTOMATIC SLIDING ENTRANCES

RELATED DOCUMENTS

1.01 DRAWINGS AND GENERAL PROVISIONS OF THE CONTRACT, INCLUDING GENERAL AND SUPPLEMENTARY CONDITIONS AND DIVISION 1 SPECIFICATION SECTIONS, APPLY TO THIS SECTION.

1.02 SUMMARY

A. This Section includes the following types of automatic entrances:
   1. Exterior and interior, bi-parting, sliding automatic entrances
   2. Interior entrances include access control locking.

B. Related Sections:
   1. Division 7 Sections for caulking to the extent not specified in this section.
   2. Division 8 Section "Aluminum-Framed Entrances and Storefronts" for entrances furnished and installed separately in Division 8 Section.
   3. Division 8 Section "Door Hardware" for hardware to the extent not specified in this Section.
   4. Division 8 Section Glazing for materials and installation requirements of glazing for automatic entrances.
   5. Division 26 Sections for electrical connections provided separately in Division 26 including conduit and wiring for power to, and monitoring of, and control of, sliding automatic entrances.
   6. Division 28 Section “Electronic Safety and Security” for systems not specified in this section.

1.03 REFERENCES

A. General: Standards listed by reference, including revisions by issuing authority, form a part of this specification section to extent indicated. Standards listed are identified by issuing authority, authority abbreviation, designation number, title or other designation established by issuing authority. Standards subsequently referenced herein are referred to by issuing authority abbreviation and standard designation.

B. Underwriters Laboratories (UL):
   1. UL 325 – Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems.

C. American National Standards Institute (ANSI) / Builders’ Hardware Manufacturers Association (BHMA):
   1. ANSI/BHMA A156.10: Standard for Power Operated Pedestrian Doors.
   2. ANSI/BHMA A156.5: Standard for Auxiliary Locks and Associated Products

D. American Society for Testing and Materials (ASTM):
   1. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
   2. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate

E. American Association of Automatic Door Manufacturers (AAADM):

F. National Fire Protection Association (NFPA):
   1. NFPA 101 – Life Safety Code.
   2. NFPA 70 – National Electric Code.

G. International Code Council (ICC):
   1. IBC: International Building Code

H. Building Officials and Code Administrators International (BOCA), 1999:

I. International Organization for Standardization (ISO):
   1. ISO 9001 - Quality Management Systems

J. National Association of Architectural Metal Manufacturers (NAAMM):
   1. Metal Finishes Manual for Architectural and Metal Products.

K. American Architectural Manufacturers Association (AAMA):
   1. AAMA 2605 – Superior Performing Organic Coatings on Aluminum Extrusions and Panels.
   2. AAMA 701 Voluntary Specification for Pile Weatherstripping and Replaceable Fenestration Weatherseals.

1.04 DEFINITIONS

A. Activation Device: Device that, when actuated, sends an electrical signal to the door operator to open the door.

B. Safety Device: Device that prevents a door from opening or closing, as appropriate.

1.05 PERFORMANCE REQUIREMENTS

A. General: Provide automatic entrance door assemblies capable of withstanding loads and thermal movements based on testing manufacturer's standard units in assemblies similar to those indicated for this Project.

B. Thermal Movements: Provide automatic entrances that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

C. Operating Range: Minus 30 deg F (Minus 34 deg C) to 130 deg F (54 deg C).

D. Opening-Force Requirements for Egress Doors: Not more than 50 lbf (222 N) required to manually set door in motion if power fails, and not more than 15 lbf (67 N) required to open door to minimum required width.

E. Closing-Force Requirements: Not more than 30 lbf (133 N) required to prevent door from closing.

F. Sliding automatic entrances specified with access control locking shall be designed to function as follows when set for secure operation:
   1. Entrances shall be normally closed and locked by access control locking system with exterior motion activation system disabled. Interior motion activation system to remain enabled; free egress.
   2. Upon signal from exterior secure activation device, sliding automatic entrances will unlock and open enabling motion activation system. Entrance will be held open as long as an object or pedestrian remains in the activation or safety zones.
   3. Once all activation and safety zones have cleared the entrance will close and re-lock, returning to normal state.
   4. At any time during the cycle emergency egress can be achieved by utilizing the emergency breakaway feature.

1.06 SUBMITTALS

A. General: Submit the following in accordance with Conditions of the Contract and Division 1 Specification Sections.

B. Shop Drawings: Include plans, elevations, sections, details, hardware mounting heights, and attachments to other work.

C. Color Samples for selection of factory-applied color finishes.

D. Closeout Submittals:
   1. Owner’s Manual.
   2. Warranties.

1.07 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative, with certificate issued by AAADM, who is trained for installation and maintenance of units required for this Project.

B. Manufacturer Qualifications: A qualified manufacturer with a manufacturing facility certified under ISO 9001.

C. Manufacturer shall have in place a national service dispatch center providing 24 hours a day, 7 days a week, emergency call back service.

D. Certifications: Automatic sliding door systems shall be certified by the manufacturer to meet performance design criteria in accordance with the following standards:
   1. ANSI/BHMA A156.10.
   2. NFPA 101.
   3. UL 325 listed.
   4. IBC 2009
   5. BOCA

E. Source Limitations: Obtain automatic entrance door assemblies through one source from a single manufacturer.

F. Product Options: Drawings indicate sizes, profiles, and dimensional requirements of automatic entrance door assemblies and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."

G. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

H. Emergency-Exit Door Requirements: Comply with requirements of authorities having jurisdiction for automatic entrances serving as a required means of egress.

1.08 PROJECT CONDITIONS

A. Field Measurements: General Contractor shall verify openings to receive automatic entrance door assemblies by field measurements before fabrication and indicate measurements on Shop Drawings.

B. Mounting Surfaces: General Contractor shall verify all surfaces to be plumb, straight and secure; substrates to be of proper dimension and material.

C. Other trades: General Contractor shall advise of any inadequate conditions or equipment.

1.09 COORDINATION

A. Templates: Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing automatic entrances to comply with indicated requirements.

B. Electrical System Roughing-in: Coordinate layout and installation of automatic entrance door assemblies with connections to power supplies, remote activation devices, remote monitoring systems, and security access control system. See Division 28 Section “Electronic Safety and Security” for systems not provided under this section.

C. System Integration: Integrate sliding automatic entrances with other systems as required for a complete working installation.
   1. Provide electrical interface control capability for activation of sliding automatic entrances by security access system on doors with electric locking.
   2. Provide electrical interface to allow for remote monitoring of automatic entrance door panel status.

1.10 WARRANTY

A. Automatic Entrances shall be free of defects in material and workmanship for a period of two (2) years from the date of substantial completion.

B. During the warranty period the Owner shall engage a factory-trained technician to perform service and affect repairs. A safety inspection shall be performed after each adjustment or repair and a completed inspection form shall be submitted to the Owner.

C. During the warranty period all warranty work, including but not limited to emergency service, shall be performed during normal working hours.

PART 2 PRODUCTS

2.01 AUTOMATIC ENTRANCES

A. Manufacturer: Basis of design is STanley Access Technologies; Dura-Glide 2000 Series sliding automatic entrances.

B. Substitutions: Subject to compliance with requirements of the contract documents, the following named products may be substituted on this project:
   1. Horton HD-Slide Series 2001 Belt Drive.
   2. Besam SL500 FSL.
   3. Record USA; 5100 series: www.record-usa.com

2.02 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
   1. Headers, stiles, rails, and frames: 6063-T6, 6063-T5.
   2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
   3. Sheet and Plate: ASTM B 209.

B. Sealants and Joint Fillers: Performed under Division 7 Section "Joint Sealants".

2.03 AUTOMATIC ENTRANCE DOOR ASSEMBLIES

A. General: Provide manufacturer's standard automatic entrance door assemblies including doors, sidelights, framing, headers, carrier assemblies, roller tracks, door operators, activation and safety devices, and accessories required for a complete installation.

B. Sliding Automatic Entrances:
   1. Configuration: Two sliding leaves and two full sidelights; bi-parting.
   2. Traffic Pattern: Two-way.
   3. Emergency Breakaway Capability: Sliding leaves only.
   4. Mounting: Between jambs.

2.04 COMPONENTS

A. Framing Members: Manufacturer's standard extruded aluminum reinforced as required to support imposed loads.
   1. Nominal Size: 1 3/4 inch by 4 1/2 inch (45 by 115 mm).
   2. Concealed Fastening: Framing shall incorporate a concealed fastening pocket, and continuous flush insert cover, extending full length of each framing member.

B. Stile and Rail Doors and Sidelights: Manufacturer's standard 1 ¾ inch (45 mm) thick glazed doors with extruded-aluminum tubular stile and rail members. Incorporate concealed tie-rods that span full length of top and bottom rails or mechanically fasten corners with reinforcing brackets that are welded.
   1. Glazing Stops and Gaskets: Snap-on, extruded-security aluminum stops and preformed gaskets.
   2. Stile Design: Medium stile; 3 ½ inch (95 mm) nominal width.
   3. Bottom Rail Design: Minimum 4 inch (102 mm) nominal height.
   4. Muntin Bars: Horizontal tubular rail member for each door; 4 1/4 inch (108 mm) to 6 inch (152 mm) nominal width.

C. Glazing: Furnished under Division 8 Section Glazing. All Glazing furnished under separate section shall be as follows:

1. Interior Entrances: 1/4 inch (6 mm) tempered.
2. Exterior Entrances: 1 inch (25 mm) insulated glazing units, hermetically sealed; except at vestibules the exterior entrance shall be 1/4" tempered.

D. Headers: Fabricated from extruded aluminum and extending full width of automatic entrance door units to conceal door operators, carrier assemblies, and roller tracks. Provide hinged or removable access panels for service and adjustment of door operators and controls. Secure panels to prevent unauthorized access.
1. Mounting: Concealed, with one side of header flush with framing.
2. Capacity: Capable of supporting up to 220 lb (100 kg) per panel, up to four panels, over spans up to 14 feet (4.3 m) without intermediate supports.

E. Carrier Assemblies and Overhead Roller Tracks: Manufacturer's standard carrier assembly that allows vertical adjustment of at least 1/8 inch (3 mm); consisting of urethane with precision steel lubricated ball-bearing wheels, operating on a continuous roller track. Support panels from carrier assembly by load wheels and anti-riser wheels with factory adjusted cantilever and pivot assembly. Minimum two ball-bearing load wheels and two anti-rise rollers for each active leaf.

F. Thresholds: Manufacturer's standard thresholds as indicated below:
1. Exterior Entrances: Continuous standard tapered extrusion square by bevel, with bevel to exterior.
2. Interior Entrances: Continuous extrusion with taper / square edge coordinated with proposed floor finishes.
3. All thresholds to conform to details and requirements for code compliance.

G. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, non-staining, non-bleeding fasteners and accessories compatible with adjacent materials.

H. Signage: Provide signage in accordance with ANSI/BHMA A156.10.

2.05 DOOR OPERATORS

A. General: Provide door operators of size recommended by manufacturer for door size, weight, and movement; for condition of exposure; and for long-term, operation under normal traffic load for type of occupancy indicated.

B. Electromechanical Operators: Self-contained overhead unit powered by a fractional horsepower, permanent-magnet DC motor with gear reduction drive, microprocessor controller; and encoder.
1. Operation: Power opening and power closing.
2. Features:
   a. Adjustable opening and closing speeds.
   b. Adjustable back-check and latching.
   c. Adjustable braking.
   d. Adjustable hold-open time between 0 and 30 seconds.
   e. Obstruction recycle.
   f. On/Off switch to control electric power to operator.
   g. Energy conservation switch that reduces door-opening width.
   h. Onboard sensor monitoring.
   i. Optional Switch to open/Switch to close operation.
3. Mounting: Concealed.
4. Drive System: Synchronous belt type.

C. Electrical service to door operators shall be provided under Division 16 Electrical. Minimum service to be 120 VAC, 5 amps.

2.06 ELECTRICAL CONTROLS

A. Electrical Control System: Electrical control system shall include a microprocessor controller and position encoder. The encoder shall monitor revolutions of the operator shaft and send

signals to microprocessor controller to define door position and speed. Systems utilizing external magnets and magnetic switches are not acceptable.

B. Performance Data: The microprocessor shall collect and store performance data as follows:
   1. Counter: A non-resettable counter to track operating cycles.
   2. Event Reporting: Unit shall include event and error recording including number of occurrences of events and errors, and cycle count of most recent events and errors.
   3. LED Display: Display presenting the current operating state of the controller.

C. Controller Protection: The microprocessor controller shall incorporate the following features to ensure trouble free operation:
   1. Automatic Reset Upon Power Up.
   2. Main Fuse Protection.
   3. Motor Protection, over-current protection.

D. Soft Start/Stop: A “soft-start” “soft-stop” motor driving circuit shall be provided for smooth normal opening and recycling.

E. Obstruction Recycle: Provide system to recycle the sliding panels when an obstruction is encountered during the closing cycle.

2.07 ACTIVATION AND SAFETY DEVICES

A. Push Plates: Where scheduled, provide 4 1/2 inch (114 mm) square push plates with UL recognized SPDT switch for primary activation of sliding automatic entrances. Face plates and mounting studs shall be stainless steel. Face plates shall be engraved with the international symbol for accessibility and “Push To Open”. Push plates shall be wall mounted in single or double gang electrical boxes and hardwired to door operator controls.
   1. Provide push plates at either side of the outer door.

B. Motion Sensors: Motion sensors shall be mounted on each side of door header to detect pedestrians in the activating zone, and to provide a signal to open doors in accordance with ANSI/BHMA A156.10. Units shall be programmable for bi-directional or uni-directional operation and shall incorporate K-band microwave frequency to detect all motion in both directions.

C. Presence Sensors: Presence sensors shall be provided to sense people or objects in the threshold safety zone in accordance with ANSI/BHMA A156.10. Units shall be self-contained, fully adjustable, and shall function accordingly with motion sensors provided. The sensor shall be enabled simultaneously with the door-opening signal and shall emit an elliptical shaped infrared presence zone, centered on the doorway threshold line. Presence sensors shall be capable of selectively retuning to adjust for objects which may enter the safety zone; tuning out, or disregarding, the presence of small nuisance objects and not tuning out large objects regardless of the time the object is present in the safety zone. The door shall close only after all sensors detect a clear surveillance field.

D. Photoelectric Beams: In addition to the threshold sensor include a minimum of two (2) doorway holding beams. Photoelectric beams shall be pulsed infrared type, including sender receiver assemblies for recessed mounting. Beams shall be monitored by electrical controls for faults and shall fail safe.

E. Door entrance intercom system: Where scheduled on the drawings provide interface with the door entrance intercom system coordinating access and security in accordance with the proposed use.

F. Security Card Swipe or Proximity Readers: Where scheduled on the drawings or hardware schedule provide interface with proposed security system entrance readers.
   1. Inner vestibule door shall have a proximity reader control each side of the door.

2.08 HARDWARE

A. General: Provide units in sizes and types recommended by automatic entrance door and hardware manufacturers for entrances and uses indicated.

B. Emergency Breakaway Feature: Provide release hardware that allows panel(s) to swing out in direction of egress to full 90 degrees from any position in sliding mode. Maximum force to open panel shall be 50 lbf (222 N) according to ANSI/BHMA A156.10. Interrupt powered operation of panel operator while in breakaway mode.
   1. Emergency breakaway feature shall include at least one adjustable detent device mounted in the top of each breakaway panel to control panel breakaway force.
   2. Limit Arms: Limit arms shall be provided to control swing of sliding panels on break-out; swing shall not exceed 90 degrees. Limit arms shall be spring loaded to prevent shock, and include adjustable friction damping.

C. Access Control Locking System: Provide access control locking hardware on sliding automatic entrances as follows:
   1. System shall include:
      a. A fail-secure electric solenoid locking device with a self contained solid state electronic control factory mounted inside the header.
      b. Vertical rod exit devices incorporated into the sliding door panels that prevent breakout until rod is released.
   2. When set for secure operation, the automatic sliding entrance(s) shall electrically latch in the closed position preventing door panels from sliding manually, returning the system to its locked status.
   3. During a power interruption:
      a. The solenoid lock shall be engaged, preventing the doors from sliding manually.
      b. Means of egress shall be accomplished by exit device. Exit device shall be concealed vertical rod tamper proof exit device with recessed flush mounted interior release hardware that shall prohibit manual breakout of door(s) from exterior. Flush mounted release hardware shall be concealed within the horizontal muntin bar.
   4. Provide access control locking system on interior entrances; exterior entrances exclude locking.

D. Alarm Contacts: Sliding automatic entrances shall include factory installed integrated alarm contacts which shall provide a closed circuit dry contact for remote monitoring of sliding panel security. Alarm contacts shall be configured to signal forced entry, normal sliding, and emergency breakout conditions.

E. Control Switch: Provide manufacturer’s standard header mounted rocker switches and door position switch to allow for full control of the automatic entrance door. Controls to include, but are not limited to:
   1. One-way traffic; secure on entrances with access control locking.
   2. Reduced Opening
   3. Open/Closed/Automatic

F. Power Switch: Sliding automatic entrances shall be equipped with a two position “On/Off” illuminated rocker switch to control power to the door.

G. Sliding Weather Stripping: Manufacturer's standard replaceable components complying with AAMA 701; made of wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing.

H. Weather Sweeps: Manufacturer's standard adjustable nylon brush sweep mounted to underside of door bottom.

2.09 FABRICATION

A. General: Factory fabricates automatic entrance door assembly components to designs, sizes, and thickness indicated and to comply with indicated standards.
   1. Form aluminum shapes before finishing.
   2. Use concealed fasteners to greatest extent possible.

a. Where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration, use self-locking devices.
b. Reinforce members as required to receive fastener threads.

B. Framing: Provide automatic entrances as prefabricated assemblies.
1. Fabricate tubular and channel frame assemblies with manufacturer's standard mechanical or welded joints. Provide sub-frames and reinforcement as required for a complete system to support required loads.
2. Perform fabrication operations in manner that prevents damage to exposed finish surfaces.
3. Form profiles that are sharp, straight, and free of defects or deformations.
4. Prepare components to receive concealed fasteners and anchor and connection devices.
5. Fabricate components with accurately fitted joints with ends coped or mitered to produce hairline joints free of burrs and distortion.

C. Doors: Factory fabricated and assembled in profiles indicated. Reinforce as required to support imposed loads and for installing hardware.

D. Door Operators: Factory fabricated and installed in headers, including adjusting and testing.

E. Glazing: Fabricate framing with minimum glazing edge clearances for thickness and type of glazing indicated.

F. Hardware: Factory install hardware to the greatest extent possible; remove only as required for final finishing operation and for delivery to and installation at Project site.

2.10 ALUMINUM FINISHES

A. General: Comply with NAAMM Metal Finishes Manual for Architectural and Metal Products for recommendations for applying and designing finishes. Finish designations prefixed by AA comply with system established by Aluminum Association for designing finishes.

B. Superior-Performance Organic Finish: AA-C12C40R1x Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating.
1. Fluoropolymer Three-Coat System: Manufacturer’s standard three-coat, thermocured system; including but not limited to mica, metallic, and bright white; consisting of inhibitive primer and fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight.
2. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2605 and with coating and resin manufacturers' written instructions.
3. Minimum dry film thickness shall be 1.2 mils.
4. Color and Gloss: As selected by Architect from manufacturer’s standard colors and gloss for paint system specified.

PART 3 EXECUTION

3.01 INSPECTION

A. Examine conditions for compliance with requirements for installation tolerances, header support, and other conditions affecting performance of automatic entrances. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. General: Do not install damaged components. Fit frame joints to produce joints free of burrs and distortion. Rigidly secure non-movement joints.

B. Entrances: Install automatic entrances plumb and true in alignment with established lines and grades without warp or rack of framing members and doors. Anchor securely in place.
1. Install surface-mounted hardware using concealed fasteners to greatest extent possible.

2. Set headers, carrier assemblies, tracks, operating brackets, and guides level and true to location with anchorage for permanent support.

C. Door Operators: Connect door operators to electrical power distribution system as specified in Division 16 Sections.

D. Glazing: Performed under Division 8 Section "Glazing" in accordance with sliding automatic entrance manufacturer's instructions.

E. Sealants: Comply with requirements specified in Division7 Section "Joint Sealants" to provide weather tight installation.

3.03 FIELD QUALITY CONTROL

A. Testing Services: Factory Trained Installer shall test and inspect each automatic entrance door to determine compliance of installed systems with applicable ANSI standards.

3.04 ADJUSTING

A. Adjust door operators, controls, and hardware for smooth and safe operation, for tight closure, and complying with requirements in ANSI/BHMA A156.10.

3.05 CLEANING AND PROTECTION

A. Clean glass and aluminum surfaces promptly after installation. Remove excess glazing and sealant compounds, dirt, and other substances. Repair damaged finish to match original finish. Comply with requirements in Division 8 Section "Glazing", for cleaning and maintaining glass.

END OF SECTION

SECTION 08 4523

2-3/4" INSULATED TRANSLUCENT FIBERGLASS SANDWICH PANEL SKYLIGHT SYSTEM

P1 - GENERAL

1.01 SUMMARY

A. Section includes the insulated translucent sandwich panel skylight system and accessories as shown and specified. Work includes providing and installing:
   1. Flat, factory prefabricated structural insulated translucent sandwich panels
   2. Aluminum flashing factory-attached to skylight

B. Related Sections:
   1. Structural Steel/Concrete/Rough Carpentry: Section _____
   2. Roofing: Section _____

1.02 SUBMITTALS

A. Submit manufacturer's product data. Include construction details, material descriptions, profiles and finishes of skylight components.

B. Submit shop drawings. Include elevations and details.

C. Submit manufacturer's color charts showing the full range of colors available for factory-finished aluminum.

D. Submit product reports from a qualified independent testing agency indicating each type and class of panel system complies with the project performance requirements, based on comprehensive testing of current products. Previously completed reports will be acceptable if for current manufacturer and indicative of products used on this project.
   1. Reports required are:
      a. International Building Code Evaluation Report
      b. Flame Spread and Smoke Developed (UL 723) - Submit UL Card
      c. Burn Extent (ASTM D 635)
      d. Color Difference (ASTM D 2244)
      e. Impact Strength (UL 972)
      f. Beam Bending Strength (ASTM E 72)
      g. Fall Through Resistance (ASTM E 661)
      h. Insulation U-Factor (NFRC 100)
      i. Solar Heat Gain Coefficient (NFRC)
      j. Structural Performance (ASTM E 330)
      k. Class A Roof Covering Burning Brand (ASTM E 108)

1.03 QUALITY ASSURANCE

A. Manufacturer's Qualifications
   1. Panel system must be listed by an ANSI accredited Evaluation Service, which requires quality control inspections and fire, structural and water infiltration testing of sandwich panel systems by an accredited agency.
   2. Quality control inspections shall be conducted at least once each year and shall include manufacturing facilities, sandwich panel components and production sandwich panels for conformance with AC177 "Translucent Fiberglass Reinforced Plastic (FRP) Faced Panel Wall, Roof and Skylight Systems" as issued by the ICC-ES.

1.04 PERFORMANCE REQUIREMENTS

A. The manufacturer shall be responsible for the configuration and fabrication of the complete skylight panel system.
   1. Structural Loads; Provide skylight system capable of handling the following loads:
      a. Live Load: _____ PSF

b. Snow Load: _____ PSF; Drift Load: _____ PSF
c. Wind Load: _____ PSF

1.05 WARRANTY

A. Submit manufacturer's and installer's written warranty agreeing to repair or replace panel system work, which fails in materials or workmanship within two years of the date of delivery. Failure of materials or workmanship shall include leakage, excessive deflection, deterioration of finish on metal in excess of normal weathering, insulated translucent sandwich panels and other components of the work.

1.06 P2 - PRODUCTS

1.07 MANUFACTURER

A. The basis for this specification is for products manufactured by Kalwall Corporation. Other manufacturers may bid this project provided they comply with all of the performance requirements of this specification and submit evidence thereof.

1.08 PANEL COMPONENTS

A. Face Sheets
1. Translucent faces: Manufactured from glass fiber reinforced thermoset resins, formulated specifically for architectural use.
a. Thermoplastic (e.g. polycarbonate, acrylic) faces are not acceptable.
b. Interior face sheets:
1) Flame spread: Underwriters Laboratories (UL) listed, which requires periodic unannounced retesting, with flame spread rating no greater than 50 and smoke developed no greater than 250 when tested in accordance with UL 723.
2) Burn extent by ASTM D 635 shall be no greater than 1”.
c. Exterior face sheets:
1) Color stability: Full thickness of the exterior face sheet shall not change color more than 3 CIE Units DELTA E by ASTM D 2244 after five years outdoor South Florida weathering at 5° facing south, determined by the average of at least three white samples with and without a protective film or coating to ensure long-term color stability. Color stability shall be unaffected by abrasion or scratching.
2) Strength: Exterior face sheet shall be uniform in strength, impenetrable by hand held pencil and repel an impact minimum of 70 ft. lbs. without fracture or tear when impacted by a 3-1/4” diameter, 5 lb. free-falling ball per UL 972.
d. Appearance:
1) Exterior face sheets: Smooth, .070 thick and Crystal in color.
2) Interior face sheets: Smooth, .045 thick and White in color.

1.09 \PARA. Grid Core
1. Thermally-broken I-beam grid core shall be of 6063-T6 or 6005-T5 alloy and temper with provisions for mechanical interlocking of muntin-mullion and perimeter. Width of I-beam shall be no less than 7/16”.
2. I-beam Thermal break: Minimum 1”, thermoset fiberglass composite.

B. Laminate Adhesive
1. Minimum tensile strength of 750 PSI when the panel assembly is tested by ASTM C 297 after two exposures to six cycles each of the aging conditions prescribed by ASTM D 1037.
2. Minimum shear strength of the panel adhesive by ASTM D 1002 after exposure to four separate conditions.

1.10 PANEL CONSTRUCTION

A. Provide sandwich panels of flat fiberglass reinforced translucent face sheets laminated to a grid core of mechanically interlocking I-beams. The adhesive bonding line shall be straight, cover the entire width of the I-beam and have a neat, sharp edge.
   1. Thickness: 2-3/4”
   2. Light transmission: 20%
   3. Solar heat gain coefficient: 0.28
   4. Panel U-factor by NFRC certified laboratory: 0.23
   5. Grid pattern: Nominal size: 12” x 24”. Pattern: Shoji

B. Standard panels shall deflect no more than 1.9” at 30 PSF in 10’ 0” span without a supporting frame by ASTM E 72.

C. Thermally broken panels: Minimum Condensation Resistance Factor of 80 by AAMA 1503 measured on the bond line.

D. Skylight System:
   1. Skylight system shall pass Class A Roof Burning Brand Test By ASTM E 108.

E. Skylight System shall meet the fall through requirements of OSHA 1910.23 as demonstrated by testing in accordance with ASTM E661, thereby not requiring supplemental screens or railings.

1.11 BATTENS AND PERIMETER CLOSURE SYSTEM

A. Closure system:
   1. Extruded aluminum 6063-T6 and 6063-T5 alloy and temper clamp-tite screw type closure system.
   2. Skylight perimeter closures at curbs shall be factory sealed to panels.

B. Sealing tape: Manufacturer's standard, pre-applied to closure system at the factory under controlled conditions.

C. Fasteners: 300 series stainless steel screws for aluminum closures, excluding final fasteners to the building.

D. Finish:
   1. Manufacturer's factory applied finish, which meets the performance requirements of AAMA 2604. Color to be selected from manufacturer's standards.

1.12 P1 - EXECUTION

1.13 EXAMINATION

A. Installer shall examine substrates, supporting structure and installation conditions.

B. Do not proceed with panel installation until unsatisfactory conditions have been corrected.

1.14 PREPARATION

A. Metal Protection:
   1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose.
   2. Where aluminum will contact concrete, masonry or pressure treated wood, protect against corrosion by painting contact surfaces with bituminous paint or method recommended by manufacturer.

1.15 INSTALLATION

A. Install the skylight system in accordance with the manufacturer's suggested installation recommendations and approved shop drawings.
   1. Anchor component parts securely in place by perma-nent mechanical attachment system.
   2. Accommodate thermal and mechanical movements.

3. Set perimeter framing in a full bed of sealant compound, or with joint fillers or gaskets to provide weather-tight construction.

B. Install joint sealants at perimeter joints and within the panel system in accordance with manufacturer's installation instructions.

1.16 FIELD QUALITY CONTROL

A. Water Test: Installer to test skylights according to procedures in AAMA 501.2.

B. Repair or replace work that does not pass testing or that is damaged by testing and retest work.

END OF SECTION

SECTION 08 5313

VINYL WINDOWS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Vinyl-framed, factory-glazed windows.

B. Operating hardware.

C. Insect screens.

D. Perimeter sealant.

1.02 RELATED REQUIREMENTS

A. Section 07 9005 - Joint Sealers: Perimeter sealant and back-up materials.

B. Section 08 8000 - Glazing.

1.03 REFERENCE STANDARDS

A. AAMA/WDMA/CSA 101/I.S.2/A440 - North American Fenestration Standard/Specification for windows, doors, and skylights; 2011.

B. AAMA 701/702 - Combined Voluntary Specifications for Pile Weatherstrip and Replaceable Fenestration Weatherseals; 2011.

C. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections; 2009.

D. AAMA 1801 - Voluntary Specification for the Acoustical Rating of Exterior Windows, Doors, Skylights and Glazed Wall Sections; 2013.

E. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009.

F. ASTM E413 - Classification for Rating Sound Insulation; 2010.

G. ASTM E1332 - Standard Classification for Rating Outdoor-Indoor Sound Attenuation; 2010a.

H. ASTM E1423 - Standard Practice for Determining the Steady State Thermal Transmittance of Fenestration Systems; 2014.

I. ASTM E1425 - Standard Practice for Determining the Acoustical Performance of Windows, Doors, Skylight, and Glazed Wall Systems; 2014.

J. ASTM E2112 - Standard Practice for Installation of Exterior Windows, Doors and Skylights; 2007.

K. ASTM F588 - Standard Test Methods for Measuring the Forced Entry Resistance of Window Assemblies, Excluding Glazing Impact; 2014.

L. NFRC 100 - Procedure for Determining Fenestration Product U-factors; 2014.

1.04 SUBMITTALS

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

B. Product Data: Provide component dimensions, anchors, fasteners, glass, internal drainage, and _____.

C. Shop Drawings: Indicate opening dimensions, framed opening tolerances, affected related work, installation requirements, and _____.

D. Grade Substantiation: Prior to submitting shop drawings or starting fabrication, submit one of the following showing compliance with specified grade:
   1. Evidence of AAMA Certification.
   2. Evidence of WDMA Certification.
   3. Evidence of CSA Certification.

4. Test report(s) by independent testing agency itemizing compliance and acceptable to authorities having jurisdiction.

E. Test Reports: Prior to submitting shop drawings or starting fabrication, submit test report(s) by independent testing agency showing compliance with performance requirements in excess of those prescribed by specified grade.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect finished surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond when exposed to sunlight or weather.

B. Jig, brace, and box the window frame assemblies for transport to minimize flexing of members or joints.

1.07 FIELD CONDITIONS

A. Do not install sealants when ambient temperature is less than 40 degrees F.

B. Maintain this minimum temperature during and after installation of sealants.

1.08 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a one year period after Date of Substantial Completion.

C. Provide 20 year manufacturer warranty for insulated glass units from seal failure, interpane dusting or misting, and replacement of same. Include coverage for degradation of color finish.

D. Provide Lilfetime manufacturers warranty on frames and fabrication.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Vinyl Windows:
1. Alside, Inc: www.alside.com.
2. Atrium Windows and Doors; Series 7000 - Silent Guard: www.atrium.com.
3. Pella Corporation; 350 Series: www.pellacommercial.com/sle.
4. Capitol
5. Certainteed
6. JeldWen
7. Simonton
8. Vinyl Max

2.02 DESCRIPTION

A. Vinyl Windows: Factory fabricated frame and sash members of extruded, hollow, ultra-violet-resistant, polyvinyl chloride (PVC) with integral color; with factory-installed glazing, hardware, related flashings, anchorage and attachment devices.
1. Configuration: As indicated on drawings.
2. Color: Tan.
3. Size to fit openings with minimum clearance around perimeter of assembly providing necessary space for perimeter seals.
4. Operable Units: Double weatherstripped.
5. Framing Members: Fusion welded corners and joints, with internal reinforcement where required for structural rigidity; concealed fasteners.
6. System Internal Drainage: Drain to exterior side by means of weep drainage network any water entering joints, condensation within glazing channel, or other migrating moisture within system.

7. Glazing Stops, Trim, Flashings, and Accessory Pieces: Formed of rigid PVC, fitting tightly into frame assembly.
8. Mounting Flange: Integral to frame assembly, providing weather stop at entire perimeter of frame.
9. Insect Screens: Tight fitting for operating sash location.

B. Performance Requirements: Provide products that comply with the following:
1. Grade: AAMA/WDMA/CSA 101/I.S.2/A440 requirements for specific window type:
   a. Performance Class (PC): LC.
   b. Performance Grade (PG): 25.
2. Design Pressure: In accordance with applicable codes.
3. Condensation Resistance Factor: CRF of 50, minimum, the lower value of the glass and frame window components and determined in accordance with AAMA 1503.
4. Thermal Transmittance: Windows to be Energy Star Labeled. U-factor of 0.30, maximum, that includes window glazing and frame system based on average window size required for project and determined in accordance with AAMA 1503, ASTM E1423, or NFRC 100.
5. Forced Entry Resistance (FER): Tested to comply with ASTM F588 requirements having at least Grade 10 performance for each required window assembly.
6. Acoustical Performance: STC rating of 30, OITC rating of ___, when tested in accordance with ASTM E90, ASTM E1425, or AAMA 1801 and ratings derived from ASTM E413 and ASTM E1332, respectively.
7. Single and double hung windows shall have tilt sash feature for easy cleaning.
8. Counterbalance system shall be such so the required force to open and close windows is no more than 5 pounds of pressure.

2.03 COMPONENTS

A. Glazing: Double glazed, clear, low-E coated, argon filled, with glass thicknesses as recommended by manufacturer for specified wind conditions with SHGC of .30 or better.
1. Provide tempered glazing for any glass withing 18" of finish floor or within 12" of the handle side of a passage door; bearing the tempered glass label; or otherwise comply with the latest requirements of the applicable building code.

B. Frames: Manufacturer's standard profile; flush glass stops of screw fastened type .

C. Sills: Manufacturer's standard thickness, extruded aluminum; sloped for positive wash; fit under sash to 1/2 inch beyond wall face; one piece full width of opening .

D. Divided Lite Grid: Installed between panes of insulating glass, 5/8 inch wide flat metal bars, color to match frame and sash.
1. Pattern: Manufacturer's standard layout.
2. Bar Width: 3/4 inch.
3. Color: Match interior and exterior of frame.

E. Insect Screens: Aluminum, extruded or roll-formed frame with mitered and reinforced corners; apply screen mesh taut to frame; secure to window with hardware to allow easy removal.
1. Hardware: Manufacturer's standard; quantity as required per screen.
2. Screen Mesh: Vinyl-coated fiberglass, window manufacturer's 18 x 16 mesh.
3. Frame Finish: Manufacturer's standard, color to match window frame and sash color.

F. Operable Sash Weatherstripping: Wool pile; permanently resilient, profiled to maintain weather seal in accordance with AAMA 701/702.

G. Fasteners: Stainless steel.

H. Accessories: Provide related flashings, anchorage and attachment devices as necessary for full assembly.

I. Sealants for Setting Window Sill Pan Flashing: Provide butyl tape, non-hardening butyl, polyurethane, or silicone sealant; in compliance with ASTM E2112 installation practices.

2.04 SEALANT MATERIALS

A. Perimeter Sealant and Backing Materials: As specified in Section 07 9005, OSI Quad Max.

B. Glazing Sealant: Type as specified in Section 08 8000.

2.05 HARDWARE

A. Horizontal Sliding Sash: Rigid PVC interfacing tracks with dual brass wheel and stainless steel axle assembly housing, provide two sets for each operating sash and opening stops in head and sill track as required.

B. Double or single Hung Sash: Metal and nylon spiral friction slide cylinder, each sash, each jamb.

C. Sash lock: Lever handle and keeper with cam lock, provide at least one for each operating sash.

D. Finish of Exposed Hardware: Baked enamel, match interior sash and frame color.

2.06 ATTIC STOCK

A. Provide the following “attic stock” additional product materials at the conclusion of construction for storage on site by the owner:

1. One (1) box of window screens - must provide a minimum of 3 screens for each window type.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify wall openings and adjoining air and vapor seal materials are ready to receive this work.

3.02 INSTALLATION

A. Install window unit assemblies in accordance with manufacturers instructions and applicable building codes.

B. Attach window frame and shims to perimeter opening to accommodate construction tolerances and other irregularities as necessary.

C. Align window plumb and level, free of warp or twist, and maintain dimensional tolerances and alignment with adjacent work.

D. Provide thermal isolation where components penetrate or disrupt building insulation. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

E. Coordinate attachment and seal of perimeter air, vapor barrier and flashing materials.

F. Install perimeter sealant and backing materials in accordance with Section 07 9005. Apply continuous bead of sealant on backside of nailing flange before setting window.

G. Apply flexible window perimeter flashing in accordance with details on the drawings and the manufacturer's instructions adhering to whichever is more stringent.

3.03 TOLERANCES

A. Maximum Variation from Level or Plumb: 0.06 inches every 3 ft non-cumulative or 0.5 inches per 100 ft, whichever is less.

3.04 ADJUSTING

A. Adjust hardware for smooth operation and secure weathertight closure.

3.05 CLEANING

A. Remove protective material from pre-finished surfaces.

B. Wash surfaces by method recommended and acceptable to window manufacturer; rinse and wipe surfaces clean.

C. Remove excess glazing sealant by moderate use of mineral spirits or other solvent acceptable to sealant manufacturer and appropriate for application indicated.

END OF SECTION

SECTION 08 8000
GLAZING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Insulating glass units.

B. Glazing units.

C. Glazing compounds and accessories.

1.02 RELATED REQUIREMENTS

A. Section 08 1113 - Hollow Metal Doors and Frames: Glazed lites in doors and borrowed lites.

B. Section 08 1433 - Stile and Rail Wood Doors: Glazed lites in doors.

C. Section 08 4126 - All-Glass Entrances and Storefronts: Glazing furnished as part of entrance assembly.

D. Section 08 4229 - Automatic Entrances: Glazing furnished as part of door assembly.

E. Section 08 4313 - Aluminum-Framed Storefronts: Glazing furnished as part of storefront assembly.

F. Section 08 5113 - Aluminum Windows: Glazing furnished by window manufacturer.

G. Section 08 5123 - Steel Windows: Glazing furnished by window manufacturer.

H. Section 08 5200 - Wood Windows: Glazing furnished by window manufacturer.

I. Section 08 5313 - Vinyl Windows: Glazing furnished by window manufacturer.

1.03 REFERENCE STANDARDS

A. ASCE 7 - Minimum Design Loads for Buildings and Other Structures; 2010, with 2013 Supplements and Errata.

B. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers; 2005 (Reapproved 2011).

C. ASTM C1036 - Standard Specification for Flat Glass; 2011.

D. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2012.

E. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016.

F. ASTM C1376 - Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass; 2015.

G. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings; 2012a.

H. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation; 2010.

I. GANA (SM) - GANA Sealant Manual; 2008.

J. ICC (IBC) - International Building Code; 2015.

K. NFRC 100 - Procedure for Determining Fenestration Product U-factors; 2014.

L. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence; 2014.

M. NFRC 300 - Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems; 2014.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by each of the affected installers.

1.05 SUBMITTALS

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

B. Product Data on Insulating Glass Unit, Glazing Unit, Plastic Sheet Glazing Unit, and Plastic Film Glazing Types: Provide structural, physical and environmental characteristics, size limitations, special handling and installation requirements.

C. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements. Identify available colors.

D. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

A. Perform Work in accordance with for glazing installation methods. Maintain one copy on site.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years documented experience.

1.07 FIELD CONDITIONS

A. Do not install glazing when ambient temperature is less than 40 degrees F.

B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.08 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design glass, including comprehensive engineering analysis according to ASTM E 1300 and ICC's 2009 International Building Code by a qualified professional engineer, using the following design criteria:
   1. Design Wind Pressures: As indicated on structural Drawings.

1.09 DESIGN SNOW LOADS: [AS INDICATED ON DRAWINGS].

A. If referencing ASTM E 1300, retain applicable subparagraphs from first three below, which are based on requirements in the 2006 IBC.
   1. Vertical Glazing: For glass surfaces sloped 15 degrees or less from vertical, design glass to resist design wind pressure based on glass type factors for short-duration load.
   2. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.

B. Safety Glazing: Provide safety glazing in the following applications.
   1. Glazing in swinging doors except jalousies.
   2. Glazing in fixed and sliding panels of sliding door assemblies and panels in sliding and bifold closet door assemblies.
   3. Glazing in storm doors.
   4. Glazing in unframed swinging doors.
   5. Glazing in doors and enclosures for hot tubs, whirlpools, saunas, steam rooms, bathtubs and showers. Glazing in any portion of a building wall enclosing these compartments where the bottom exposed edge of the glazing is less than 60 inches (1524 mm)above a standing surface.
   6. Glazing in an individual fixed or operable panel adjacent to a door where the nearest exposed edge of the glazing is within a 24-inch (610 mm) arc of either vertical edge of the door in a closed position and where the bottom exposed edge of the glazing is less than 60 inches (1524 mm) above the walking surface.

7. Glazing in an individual fixed or operable panel, other than in those locations described in preceding Items 5 and 6, which meets all of the following conditions:
    a. Exposed area of an individual pane greater than 9 square feet (0.84 m2);
    b. Exposed bottom edge less than 18 inches (457 mm) above the floor;
    c. Exposed top edge greater than 36 inches (914 mm) above the floor; and
    d. One or more walking surface(s) within 36 inches (914 mm) horizontally of the plane of the glazing.
8. Glazing in guards and railings, including structural baluster panels and nonstructural in-fill panels, regardless of area or height above a walking surface.
9. Glazing adjacent to stairways, landings and ramps within 36 inches (914 mm) horizontally of a walking surface; when the exposed surface of the glass is less than 60 inches (1524 mm) above the plane of the adjacent walking surface.
10. Glazing adjacent to stairways within 60 inches (1524 mm) horizontally of the bottom tread of a stairway in any direction when the exposed surface of the glass is less than 60 inches (1524 mm) above the nose of the tread.
11. Provide safety glazing in any other location as may be designated on the drawings.

1.10 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Insulating Glass Units: Provide a five (5) year manufacturer warranty to include coverage for seal failure, interpane dusting or misting, including replacement of failed units.

C. Laminated Glass: Provide a five (5) year manufacturer warranty to include coverage for delamination, including replacement of failed units.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Glass Fabricators:
    1. JE Berkowitz, LP: www.jeberkowitz.com.
    2. Trulite Glass & Aluminum Solutions, LLC: www.trulite.com.
    3. Viracon, Inc: www.viracon.com.

B. Float Glass Manufacturers:
    1. AGC Glass Company North America, Inc: www.us.agc.com.
    2. Cardinal Glass Industries: www.cardinalcorp.com.
    3. Guardian Industries Corp: www.sunguardglass.com.
    4. Pilkington North America Inc: www.pilkington.com/na.
    5. PPG Industries, Inc: www.ppgideascapes.com.
    6. Substitutions: Refer to Section 01 6000 - Product Requirements.

C. Fire-Resistance-Rated Glass Manufacturers: Provide products as required to achieve indicated fire-rating period.
    1. SAFTIFIRST, a division of O'Keeffe's Inc; SuperLite II-XL: www.safti.com/#sle.
    2. Technical Glass Products; Pilkington Pyrostop: www.fireglass.com/#sle.
    3. Vetrotech Saint-Gobain North America; Contraflam: www.vetrotechusa.com/#sle.
    4. Substitutions: Refer to Section 01 6000 - Product Requirements.

D. Fire-Protection-Rated Glass Manufacturers: Provide products as required to achieve indicated fire-rating period.
    1. SAFTIFIRST, a division of O'Keeffe's Inc; SuperLite I-XL: www.safti.com/#sle.
    2. SCHOTT North America Inc; PYRAN Platinum 20: www.us.schott.com/#sle.
    3. Technical Glass Products: www.fireglass.com.
    4. Vetrotech Saint-Gobain North America; Contraflam 45: www.vetrotechusa.com/#sle.
    5. Substitutions: Refer to Section 01 6000 - Product Requirements.

2.02 PERFORMANCE REQUIREMENTS - EXTERIOR GLAZING ASSEMBLIES

A. Provide type and thickness of exterior glazing assemblies to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of glass.
   1. Design Pressure: Calculated in accordance with ASCE 7.
   2. Comply with ASTM E1300 for design load resistance of glass type, thickness, dimensions, and maximum lateral deflection of supported glass.
   3. Provide glass edge support system sufficiently stiff to limit the lateral deflection of supported glass edges to less than 1/175 of their lengths under specified design load.
   4. Glass thicknesses listed are minimum.

B. Vapor Retarder and Air Barrier Seals: Provide completed assemblies that maintain continuity of building enclosure vapor retarder and air barrier.
   1. In conjunction with vapor retarder and joint sealer materials described in other sections.

C. Thermal and Optical Performance: Provide glass products with performance properties as indicated. Performance properties are in accordance with manufacturer's published data as determined with the following procedures and/or test methods:
   1. Center of Glass U-Value: Comply with NFRC 100 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
   2. Center of Glass Solar Heat Gain Coefficient (SHGC): Comply with NFRC 200 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
   3. Solar Optical Properties: Comply with NFRC 300 test method.

2.03 GLASS MATERIALS

A. Float Glass: Provide float glass based glazing unless noted otherwise.
   1. Annealed Type: ASTM C1036, Type I - Transparent Flat, Class 1 - Clear, Quality-Q3.
   2. Heat-Strengthened and Fully Tempered Types: ASTM C1048, Kind HS and FT.
   3. Tinted Type: ASTM C1036, Class 2 - Tinted, Quality-Q3, color and performance characteristics as indicated.
   4. Thicknesses: As indicated; provide greater thickness as required for exterior glazing wind load design.

2.04 INSULATING GLASS UNITS

A. Manufacturers:
   1. Any of the manufacturers specified for float glass.
   2. Fabricator certified by glass manufacturer for type of glass, coating, and treatment involved and capable of providing specified warranty.

B. Insulating Glass Units: Types as indicated.
   1. Durability: Certified by an independent testing agency to comply with ASTM E2190.
   2. Coated Glass: Comply with requirements of ASTM C1376 for pyrolytic (hard-coat) or magnetic sputter vapor deposition (soft-coat) type coatings on flat glass; coated vision glass, Kind CV; coated overhead glass, Kind CO; or coated spandrel glass, Kind CS.
   3. Metal Edge Spacers: Aluminum, bent and soldered corners.
   4. Spacer Color: Black.
   5. Edge Seal:
   6. Purge interpane space with dry air, hermetically sealed.

C. Type IG-1 - Insulating Glass Units: Vision glass, double glazed.
   1. Applications: Exterior glazing unless otherwise indicated.
   2. Space between lites filled with air.
   3. Outboard Lite: Annealed float glass, 1/4 inch thick, minimum.
      a. Tint: Clear.
   4. Inboard Lite: Annealed float glass, 1/4 inch thick, minimum.
      a. Tint: Clear.

5. Total Thickness: 1 inch.
6. Thermal Transmittance (U-Value), Summer - Center of Glass:.30, nominal.

2.05 GLAZING COMPOUNDS

2.06 ACCESSORIES

A. Setting Blocks: Silicone, with 80 to 90 Shore A durometer hardness; ASTM C864 Option II. Length of 0.1 inch for each square foot of glazing or minimum 4 inch x width of glazing rabbet space minus 1/16 inch x height to suit glazing method and pane weight and area.

B. Spacer Shims: Neoprene, 50 to 60 Shore A durometer hardness; ASTM C864 Option II. Minimum 3 inch long x one half the height of the glazing stop x thickness to suit application, self adhesive on one face.

C. Glazing Tape, Back Bedding Mastic Type: Preformed, butyl-based, 100 percent solids compound with integral resilient spacer rod applicable to application indicated; 5 to 30 cured Shore A durometer hardness; coiled on release paper; black color.
   1. Width: As required for application.
   2. Thickness: As required for application.
   3. Spacer Rod Diameter: As required for application.
   4. Manufacturers:
      a. Pecora Corporation: www.pecora.com.
      b. Tremco Global Sealants: www.tremcosealants.com.
      c. Substitutions: Refer to Section 01 6000 - Product Requirements.

D. Glazing Splines: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C864 Option II; color black.

E. Glazing Clips: Manufacturer's standard type.

F. Smoke Removal Window/Glazing Unit Markings: Adhesive backed markings affixed to manually operable or fixed windows of high-rise buildings to identify units intended for post-fire smoke removal in compliance with ICC (IBC) and local building officials.

2.07 SOURCE QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

PART 3 EXECUTION

3.01 VERIFICATION OF CONDITIONS

A. Verify that openings for glazing are correctly sized and within tolerances, including those for size, squareness, and offsets at corners.

B. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and support framing is ready to receive glazing system.

3.02 PREPARATION

A. Clean contact surfaces with appropriate solvent and wipe dry within maximum of 24 hours before glazing. Remove coatings that are not tightly bonded to substrates.

B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.

C. Prime surfaces scheduled to receive sealant where required for proper sealant adhesion.

3.03 INSTALLATION, GENERAL

A. Install glazing sealants in accordance with ASTM C1193, GANA (SM), and manufacturer's instructions.

3.04 FIELD QUALITY CONTROL

A. Glass and Glazing product manufacturers to provide field surveillance of the installation of their products.

B. Monitor and report installation procedures and unacceptable conditions.

3.05 CLEANING

A. Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.

B. Remove non-permanent labels immediately after glazing installation is complete.

C. Clean glass and adjacent surfaces after sealants are fully cured.

D. Clean glass on both exposed surfaces not more than 4 days prior to Date of Substantial Completion in accordance with glass manufacturer's written recommendations.

3.06 PROTECTION

A. After installation, mark pane with an 'X' by using removable plastic tape or paste; do not mark heat absorbing or reflective glass units.

B. Remove and replace glass that is damaged during construction period prior to Date of Substantial Completion.

END OF SECTION

SECTION 08 8300
MIRRORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Glass mirrors.
   1. Annealed float glass.

1.02 REFERENCE STANDARDS

A. ASTM C1036 - Standard Specification for Flat Glass; 2011.

B. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016.

C. ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror; 2008 (Reapproved 2013).

D. GANA (GM) - GANA Glazing Manual; 2009.

E. GANA (SM) - GANA Sealant Manual; 2008.

F. GANA (TIPS) - Mirrors: Handle with Extreme Care (Tips for the Professional on the Care and Handling of Mirrors); 2011.

1.03 SUBMITTALS

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

B. Product Data on Mirror Types: Submit structural, physical and environmental characteristics, size limitations, special handling and installation requirements.

C. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.04 QUALITY ASSURANCE

A. Perform Work in accordance with GANA (GM) and GANA (SM) for glazing installation methods.

B. Fabricate, store, transport, receive, install, and clean mirrors in accordance with recommendations of GANA (TIPS).

1.05 FIELD CONDITIONS

A. Do not install mirrors when ambient temperature is less than 50 degrees F.

B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.06 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide five year manufacturer warranty for reflective coating on mirrors and replacement of same.

PART 2 PRODUCTS

2.01 MATERIALS

A. Mirror Design Criteria: Select materials and/or provide supports as required to limit mirror material deflection to 1/200, or to the flexure limit of glass, with full recovery of glazing materials, whichever is less.

B. Mirror Glass: Clear, annealed float glass; ASTM C1036, with copper and silver coatings, and protective overcoating.
   1. Size: As noted on drawings.

2.02 ACCESSORIES

A. Setting Blocks: Neoprene, 80 to 90 Shore A durometer hardness.

B. Spacer Shims: Neoprene, 50 to 60 Shore A durometer hardness.

C. Glazing Tape: Preformed butyl compound; 10 to 15 Shore A durometer hardness; on release paper.

D. Glazing Clips: Manufacturer's standard type.

E. Mirror Attachment Accessories: Stainless steel clips.

F. Mirror Adhesive: Chemically compatible with mirror coating and wall substrate.

G. Channel Frame where indicated: One piece, channel frame, stainless steel, Type 430, satin finish, 1/2 inch by 1/2 inch by 3/8 inch deep with 90 degree mitered corners.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that openings for mirrored glazing are correctly sized and within tolerance.

B. Verify that surfaces of mirror frames or recesses are clean, free of obstructions, and ready for installation of mirrors.

3.02 PREPARATION

A. Clean contact surfaces with solvent and wipe dry.

B. Seal porous mirror frames or recesses with substrate compatible primer or sealer. Prime surfaces scheduled to receive sealant.

C. Prepare installation in accordance with ASTM C1193 for solvent release sealants, and install sealant in accordance with manufacturer's instructions.

3.03 INSTALLATION

A. Install mirrors in accordance with GANA (TIPS) and manufacturers recommendations.

B. Set mirrors plumb and level, and free of optical distortion.

C. Set mirrors with edge clearance free of surrounding construction including countertops or backsplashes.

3.04 CLEANING

A. Remove wet glazing materials from finish surfaces.

B. Remove labels after work is complete.

C. Clean mirrors and adjacent surfaces.

3.05 PROTECTION

END OF SECTION

SECTION 09 2116
GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Performance criteria for gypsum board assemblies.

B. Acoustic insulation.

C. Gypsum sheathing.

D. Cementitious backing board.

E. Gypsum wallboard.

F. Joint treatment and accessories.

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 06 1000 - Rough Carpentry: Building framing and sheathing.

C. Section 06 1000 - Rough Carpentry: Wood blocking product and execution requirements.

D. Section 07 2500 - WEATHER BARRIERS: Water-resistive barrier over sheathing.

E. Section 07 8400 - Firestopping: Top-of-wall assemblies at fire rated walls.

F. Section 07 9200 - Joint Sealants: Sealing acoustical gaps in construction other than gypsum board or plaster work.

G. Section 09 3000 - Tiling: Tile backing board.

1.03 REFERENCE STANDARDS

A. ANSI A108.11 - American National Standard for Interior Installation of Cementitious Backer Units; 2010 (Revised).

B. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units; 1999 (Reaffirmed 2010).

C. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2015.

D. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2012.

E. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2013.

F. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2014.

G. ASTM C1047 - Standard Specification for Accessories For Gypsum Wallboard and Gypsum Veneer Base; 2014a.

H. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2013.

I. ASTM C1178/C1178M - Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel; 2013.

J. ASTM C1278/C1278M - Standard Specification for Fiber-Reinforced Gypsum Panel; 2007a (Reapproved 2011).

K. ASTM C1280 - Standard Specification for Application of Gypsum Sheathing Board; 2013.

L. ASTM C1288 - Standard Specification for Discrete Non-Asbestos Fiber-Cement Interior Substrate Sheets; 2014.

M. ASTM C1325 - Specification for Non-Asbestos Fiber-Mat Reinforced Cementitious Backer Units; 2014.

N. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2014.

O. ASTM C1658/C1658M - Standard Specification for Glass Mat Gypsum Panels; 2013.

P. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2012.

Q. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009.

R. ASTM E413 - Classification for Rating Sound Insulation; 2010.

S. GA-216 - Application and Finishing of Gypsum Board; 2013.

T. GA-226 - Application of Gypsum Board to Form Curved Surfaces; Gypsum Association; 2008.

U. UL (FRD) - Fire Resistance Directory; current edition.

1.04 SUBMITTALS

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

B. Shop Drawings: Indicate special details associated with fireproofing and acoustic seals.

C. Product Data: Provide data on metal framing, gypsum board, accessories, and joint finishing system.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing gypsum board installation and finishing, with minimum five (5) years of experience.

B. Copies of Documents at Site: Maintain at the project site a copy of each referenced document that prescribes execution requirements.

PART 2 PRODUCTS

2.01 GYPSUM BOARD ASSEMBLIES

A. Provide completed assemblies complying with ASTM C840 and GA-216.

B. Interior Partitions, Indicated as Acoustic: Provide completed assemblies with the following characteristics:
   1. Acoustic Attenuation: STC of 45-49 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.

C. Shaft Walls at HVAC Shafts: Provide completed assemblies with the following characteristics:
   1. Air Pressure Within Shaft: Sustained loads of 5 lbf/sq ft with maximum mid-span deflection of L/240.
   2. Acoustic Attenuation: STC of 35-39 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.

D. Shaft Walls at Elevator Shafts: Provide completed assemblies with the following characteristics:
   1. Air Pressure Within Shaft: Intermittent loads of 5 lbf/sq ft with maximum mid-span deflection of L/240.
   2. Acoustic Attenuation: STC of 35-39 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.

E. Fire Rated Assemblies: Provide completed assemblies with the following characteristics:
   1. UL Assembly Numbers: Provide construction equivalent to that listed for the particular assembly in the current UL (FRD).

2.02 METAL FRAMING MATERIALS

A. Resilient channels: Dietrich deluxe resilient channel (RCSD); 22 mil steel with 1 1/2" nailing flange.

2.03 BOARD MATERIALS

A. Manufacturers - Gypsum-Based Board:
   1. American Gypsum Company; ____: www.americangypsum.com.
   2. CertainTeed Corporation; ____: www.certainteed.com.
   3. Georgia-Pacific Gypsum; ____: www.gpgypsum.com.
   4. Lafarge North America Inc: www.lafargenorthamerica.com.
   5. National Gypsum Company; ____: www.nationalgypsum.com/#sle.
   6. PABCO Gypsum; ____: www.pabcogypsum.com.
   7. Temple-Inland Building Product by Georgia-Pacific, LLC: www.temple.com.
   8. USG Corporation; ____: www.usg.com.

B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
   1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
   2. Glass mat faced gypsum panels as defined in ASTM C1658/C1658M, suitable for paint finish, of the same core type and thickness may be substituted for paper-faced board.
      a. Use Glass-mat faced gypsum panels above shower surrounds from top of surround to ceiling.
   3. Unfaced fiber-reinforced gypsum panels as defined in ASTM C1278/C1278M, suitable for paint finish, of the same core type and thickness may be substituted for paper-faced board.
   4. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
      a. Mold-resistant board is required whenever board is being installed before the building is enclosed and conditioned.
   5. At Assemblies Indicated with Fire-Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.
   6. Glass-Mat-Faced Products (non paper faced):
      a. Georgia-Pacific Gypsum; DensArmor Plus.
      b. Temple-Inland Building Product by Georgia-Pacific, LLC; GreenGlass Interior Gypsum Board.
      c. National Gypsum Company; Gold Bond eXP Fire-Shield Interior Extreme Gypsum Panel.
      d. La Farge Weather Defense Platinum Interior Panels..

C. Backing Board For Wet Areas: One of the following products:
   1. Application: Surfaces behind tile in wet areas including bathrooms without showers..
   2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
   3. ANSI Cement-Based Board: Non-gypsum-based; aggregated Portland cement panels with glass fiber mesh embedded in front and back surfaces complying with ANSI A118.9 or ASTM C1325.
      a. Thickness: 1/2 inch.
      b. Products:
         1) Custom Building Products; _____: www.custombuildingproducts.com.
         2) National Gypsum Company; PermaBase Brand Cement Board.
         3) National Gypsum Company; PermaBase Flex Brand Cement Board.
         4) USG Corporation; _____: www.usg.com.
   4. ASTM Cement-Based Board: Non-gypsum-based, cementitious board complying with ASTM C1288.
      a. Thickness: 1/2 inch.
      b. Products:

1) James Hardie Building Products, Inc; _____: www.jameshardie.com.

5. Glass Mat Faced Board: Coated glass mat water-resistant gypsum backing panel as defined in ASTM C1178/C1178M.
   a. Standard Type: Thickness 1/2 inch.
   b. Fire Resistant Type: Type X core, thickness 5/8 inch.
   c. Products:
      1) Georgia-Pacific Gypsum; DensShield Tile Backer.
      2) National Gypsum Company; Gold Bond eXP Tile Backer.
      3) Temple-Inland Building Product by Georgia-Pacific, LLC; GreenGlass Tile Backer.

D. Backing Board For Non-Wet Areas: Water-resistant gypsum backing board as defined in ASTM C1396/C1396M; sizes to minimum joints in place; ends square cut.
   1. Application: Vertical surfaces behind thinset tile, except in wet areas.
   2. Edges: Tapered.
   3. Products:
      a. American Gypsum Company; M-Bloc.
      b. Georgia-Pacific Gypsum; ToughRock Mold-Guard Gypsum Board.
      c. Georgia-Pacific Gypsum; DensArmor Plus.
      d. National Gypsum Company; Gold Bond XP Gypsum Board.

E. Ceiling Board: Special sag resistant gypsum ceiling board as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
   1. Application: Ceilings, unless otherwise indicated.
   2. Thickness: as indicated on drawings .
   3. Edges: Tapered.

F. Exterior Sheathing Board **and board at shower enclosure walls and ceilings for a distance of 4' from back wall:** Sizes to minimize joints in place; ends square cut.
   1. Application: Exterior sheathing, unless otherwise indicated.
   2. Glass Mat Faced Sheathing: Glass mat faced gypsum substrate as defined in ASTM C1177/C1177M.
   3. Core Type: Type X, as indicated.
   4. Type X Thickness: 5/8 inch.
   5. Edges: Square.
   6. Glass Mat Faced Products:
      a. CertainTeed Corporation; GlasRoc Brand.
      b. Georgia-Pacific Gypsum; DensGlass Sheathing.
      c. National Gypsum Company; Gold Bond eXP Sheathing.

2.04 ACCESSORIES

A. Acoustic Insulation: ASTM C665; preformed glass fiber, friction fit type, unfaced. Thickness: 3 1/2" inch.

B. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.

C. Water-Resistive Barrier: As specified in Section 07 2500.

D. Beads, Joint Accessories, and Other Trim: ASTM C1047, rigid plastic, galvanized steel, or rolled zinc, unless noted otherwise.

E. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
   1. Tape: 2 inch wide, coated glass fiber tape for joints and corners, except as otherwise indicated.
   2. Tape: 2 inch wide, creased paper tape for joints and corners, except as otherwise indicated.

3. Ready-mixed vinyl-based joint compound.
4. Powder-type vinyl-based joint compound.
5. Chemical hardening type compound.

F. High Build Drywall Surfacer: Vinyl acrylic latex-based coating for spray application, designed to take the place of skim coating and separate paint primer in achieving Level 5 finish.

G. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inch in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion resistant.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that project conditions are appropriate for work of this section to commence.

3.02 ACOUSTIC ACCESSORIES INSTALLATION

A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.

B. Acoustic Sealant: Install in accordance with manufacturer's instructions.

3.03 BOARD INSTALLATION

A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.

B. Single-Layer Non-Rated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.
   1. Exception: Tapered edges to receive joint treatment at right angles to framing.

C. Double-Layer Non-Rated: Use gypsum board for first layer, placed parallel to framing or furring members, with ends and edges occurring over firm bearing. Use glass mat faced gypsum board at exterior walls and at other locations as indicated. Place second layer perpendicular to framing or furring members. Offset joints of second layer from joints of first layer.

D. Fire-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.

E. Exterior Sheathing: Comply with ASTM C1280. Install sheathing vertically, with edges butted tight and ends occurring over firm bearing.
   1. Paper-Faced Sheathing: Immediately after installation, protect from weather by application of water-resistive barrier.

F. Cementitious Backing Board: Install over steel framing members and plywood substrate where indicated, in accordance with ANSI A108.11 and manufacturer's instructions.

G. Installation on Metal Framing: Use screws for attachment of gypsum board except face layer of non-rated double-layer assemblies, which may be installed by means of adhesive lamination.

H. Installation on Wood Framing: For rated assemblies, comply with requirements of listing authority. For non-rated assemblies, install as follows:
   1. Single-Layer Applications: Screw attachment.
   2. Double-Layer Application: Install base layer using screws. Install face layer using adhesive.

I. Curved Surfaces: Apply gypsum board to curved substrates in accordance with GA-226.

3.04 INSTALLATION OF TRIM AND ACCESSORIES

A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.

B. Corner Beads: Install at external corners, using longest practical lengths.

C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

3.05 JOINT TREATMENT

A. Glass Mat Faced Gypsum Board and Exterior Glass Mat Faced Sheathing: Use fiberglass joint tape, bedded and finished with chemical hardening type joint compound.

B. Paper Faced Gypsum Board: Use paper joint tape, bedded with ready-mixed vinyl-based joint compound and finished with ready-mixed vinyl-based joint compound.

C. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
   1. Level 1: Fire rated wall areas above finished ceilings, whether or not accessible in the completed construction.

D. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
   1. Feather coats of joint compound so that camber is maximum 1/32 inch.

E. Levels of Gypsum Board Finish: Provide the following levels of gypsum board finish per GA-216.
   1. Level 1 for ceiling plenum areas, concealed areas, and where indicated, unless a higher level of finish is required for fire-resistive-rated assemblies and sound-rated assemblies.
   2. Level 2 where water-resistant gypsum backing board panels form substrates for tile, and where indicated.
   3. Level 3 for gypsum board surfaces to receive medium texture.
   4. Level 4 for gypsum board surfaces to be painted flat or to receive wallcoverings.
   5. Level 5 for gypsum board surfaces to be painted gloss or semi-gloss.

F. Where Level 5 finish is indicated, spray apply high build drywall surfacer over entire surface after joints have been properly treated; achieve a flat and tool mark-free finish.

G. Fill and finish joints and corners of cementitious backing board as recommended by manufacturer.

3.06 PENETRATIONS

A. Fill openings created by penetrating items in unrated assemblies and draftstopping. Where exposed, finish to match level of remaining wall.

3.07 TOLERANCES

A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

END OF SECTION

SECTION 09 3000

TILING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Tile for floor applications.

B. Tile for wall applications.

C. Cementitious backer board as tile substrate.

D. Ceramic trim.

E. Non-ceramic trim.

1.02 RELATED REQUIREMENTS

A. Section 07 9005 - Joint Sealers.

1.03 REFERENCE STANDARDS

A. ANSI A108.1a - American National Standard Specifications for Installation of Ceramic Tile in the Wet-Set Method, with Portland Cement Mortar; 2014.

B. ANSI A108.1b - American National Standard Specifications for Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex-Portland Cement Mortar; 1999 (Reaffirmed 2010).

C. ANSI A108.1c - Specifications for Contractors Option: Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar or Installation of Ceramic Tile on a Cured Portland Cement Mortar Bed with Dry-Set or Latex-Portland Cement; 1999 (Reaffirmed 2010).

D. ANSI A108.4 - American National Standard Specifications for Installation of Ceramic Tile with Organic Adhesives or Water Cleanable Tile-Setting Epoxy Adhesive; 2009 (Revised).

E. ANSI A108.5 - American National Standard Specifications for Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar; 1999 (Reaffirmed 2010).

F. ANSI A108.6 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy; 1999 (Reaffirmed 2010).

G. ANSI A108.8 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant Furan Resin Mortar and Grout; 1999 (Reaffirmed 2010).

H. ANSI A108.9 - American National Standard Specifications for Installation of Ceramic Tile with Modified Epoxy Emulsion Mortar/Grout; 1999 (Reaffirmed 2010).

I. ANSI A108.10 - American National Standard Specifications for Installation of Grout in Tilework; 1999 (Reaffirmed 2010).

J. ANSI A108.11 - American National Standard for Interior Installation of Cementitious Backer Units; 2010 (Revised).

K. ANSI A108.12 - American National Standard for Installation of Ceramic Tile with EGP (Exterior glue plywood) Latex-Portland Cement Mortar; 1999 (Reaffirmed 2010).

L. ANSI A108.13 - American National Standard for Installation of Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone; 2005 (Reaffirmed 2010).

M. ANSI A118.3 - American National Standard Specifications for Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy and Water Cleanable Tile-Setting Epoxy Adhesive; 2013 (Revised).

N. ANSI A118.4 - American National Standard Specifications for Modified Dry-Set Cement Mortar; 2012 (Revised).

O. ANSI A118.7 - American National Standard Specifications for High Performance Cement Grouts for Tile Installation; 2010 (Revised).

P. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units; 1999 (Reaffirmed 2010).

Q. ANSI A118.10 - American National Standard Specifications for Load Bearing, Bonded, Waterproof Membranes For Thin-Set Ceramic Tile And Dimension Stone Installation; 2014.

R. ANSI A118.12 - American National Standard Specifications for Crack Isolation Membranes for Thin-set Ceramic Tile and Dimension Stone Installation; 2014.

S. ANSI A118.15 - American National Standard Specifications for Improved Modified Dry-Set Cement Mortar; 2012.

T. ANSI A118.15 - American National Standard Specifications for Improved Modified Dry-Set Cement Mortar; 2012.

U. ASTM C1178/C1178M - Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel; 2013.

V. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation; 2015.

1.04 SUBMITTALS

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

B. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.

C. Shop Drawings: Indicate tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, control and expansion joints, thresholds, ceramic accessories, and setting details.

D. Samples: submit two samples of each color as selected by architect

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. Maintenance Data: Include recommended cleaning methods, cleaning materials, stain removal methods, and polishes and waxes.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

1.06 FIELD CONDITIONS

A. Do not install solvent-based products in an unventilated environment.

B. Maintain ambient and substrate temperature of 50 degrees F during installation of mortar materials.

PART 2 PRODUCTS

2.01 TILE

A. Common Areas & Resident Units: American Olean, Laurel Heights. Color TBD. Field tile sizes: 12x12", 18x18" floor tile; Bullnose 3"X12" trim to match.
   1. Ceramic Mosaic Tile, Type GLASS:

2.02 TRIM AND ACCESSORIES

A. Ceramic Trim: Matching bullnose, double bullnose, cove base, and cove ceramic shapes in sizes coordinated with field tile.
   1. Manufacturers: Same as for tile.

B. Non-Ceramic Trim: Satin brass anodized extruded aluminum, style and dimensions to suit application, for setting using tile mortar or adhesive.
   1. Applications:

a. Open edges of wall tile.
b. Open edges of floor tile.
c. Wall corners, outside and inside.
d. Transition between floor finishes of different heights.
e. Thresholds at door openings.
f. Borders and other trim as indicated on drawings.

2. Manufacturers:
   a. Schluter-Systems: www.schluter.com.
   b. Substitutions: See Section 01 6000 - Product Requirements.

2.03 SETTING MATERIALS

A. Provide setting materials made by the same manufacturer as grout.

B. Latex-Portland Cement Mortar Bond Coat: 1, 1, or _____.
   1. Applications: Use this type of bond coat where indicated and where no other type of bond coat is indicated.
   2. Products:
      a. ARDEX Engineered Cements; ARDEX X 77 MICROTEC: www.ardexamericas.com.
      b. AVM Industries, Inc; Thin-Set 780: www.avmindustries.com.
      c. LATICRETE International, Inc; LATICRETE 254 Platinum: www.laticrete.com.
      d. Merkrete, by Parex USA, Inc; Merkrete 735 Premium Flex: www.merkrete.com/sle.
      e. ProSpec, an Oldcastle brand; Permalastic System: www.prospec.com.

2.04 GROUTS

A. Manufacturers:
   1. ARDEX Engineered Cements; _____: www.ardexamericas.com.
   2. ProSpec, an Oldcastle brand; ProColor Sanded Tile Grout: www.prospec.com.
   3. Bostik Inc; ____: www.bostik-us.com.
   4. LATICRETE International, Inc; LATICRETE PERMACOLOR Grout: www.laticrete.com/#sle.
   5. Merkrete, by Parex USA, Inc; Merkrete Duracolor Non-Sanded Color Grout: www.merkrete.com/sle.
   6. Substitutions: See Section 01 6000 - Product Requirements.

B. High Performance Polymer Modified Grout: ANSI A118.7 polymer modified cement grout.
   1. Applications: Use this type of grout where indicated and where no other type of grout is indicated.
   2. Use sanded grout for joints 1/8 inch wide and larger; use unsanded grout for joints less than 1/8 inch wide.
   3. Color(s): As selected by Architect from manufacturer's full line.
   4. Products:
      a. ARDEX Engineered Cements; ARDEX FG-C MICROTEC: www.ardexamericas.com.
      b. Bostik Inc; ____: www.bostik-us.com.
      c. LATICRETE International, Inc; LATICRETE PERMACOLOR Grout: www.laticrete.com/#sle.
      d. Merkrete, by Parex USA, Inc; Merkrete Pro Grout: www.merkrete.com/sle.
      e. ProSpec, an Oldcastle brand; ProColor Sanded Tile Grout: www.prospec.com.
      f. Substitutions: See Section 01 6000 - Product Requirements.

C. Epoxy Grout: ANSI A118.3 chemical resistant and water-cleanable epoxy grout.
   1. Applications: Where indicated.
   2. Color(s): As selected by Architect from manufacturer's full line.
   3. Products:
      a. Bostik Inc; ____: www.bostik-us.com.

b. LATICRETE International, Inc; LATICRETE SPECTRALOCK PRO Premium Grout: www.laticrete.com/#sle.
c. Merkrete, by Parex USA, Inc; Merkrete Pro Epoxy: www.merkrete.com/sle.
d. ProSpec, an Oldcastle brand; B-7000 Epoxy Mortar and Grout: www.prospec.com.
e. Stuart Dean Company, Inc; Marcoat GS: www.stuartdean.com.
f. Substitutions: See Section 01 6000 - Product Requirements.

D. Stain Resistant Grout Additive: Liquid admixture for sanded and unsanded cement-based grouts; mix with dry grout material in place of water.
1. Applications: throughout.
2. Products:
a. ProSpec, an Oldcastle brand; ProColor Stain Guard Grout Additive: www.prospec.com.
b. H.B. Fuller Construction Products Inc., Grout Boost Advanced Pro; www.groutboost.com.
c. Substitutions: See Section 01 6000 - Product Requirements.

E. Tile Sealant: Gunnable, silicone, siliconized acrylic, or urethane sealant; moisture and mildew resistant type.
1. Applications: Between tile and plumbing fixtures.
2. Color(s): As selected by Architect from manufacturer's full line.
3. Products:
a. ARDEX Engineered Cements; ARDEX SX: www.ardexamericas.com.
b. LATICRETE International, Inc; LATICRETE LATASIL: www.laticrete.com.
c. Merkrete, by Parex USA, Inc; Merkrete Colored Caulking: www.merkrete.com.
d. ProSpec, an Oldcastle brand; ProColor Advantage Caulk: www.prospec.com.
e. Substitutions: See Section 01 6000 - Product Requirements.

F. Grout Sealer: Liquid-applied, moisture and stain protection for existing or new Portland cement grout.
1. Composition: Water-based colorless silicone.
2. Color(s): As selected by Architect from manufacturer's full line.

2.05 ACCESSORY MATERIALS

A. Concrete Floor Slab Crack Isolation Membrane: Material complying with ANSI A118.12; not intended as waterproofing.
1. Thickness: 20 mils, maximum.
2. Crack Resistance: No failure at 1/16 inch gap, minimum.
3. Products:
a. LATICRETE International, Inc; LATICRETE Blue 92 Anti-Fracture Membrane: www.laticrete.com/#sle.
b. Merkrete, by Parex USA, Inc; Merkrete Fracture Guard: www.merkrete.com/sle.
c. Substitutions: See Section 01 6000 - Product Requirements.

B. Waterproofing Membrane at Floors: Specifically designed for bonding to cementitious substrate under thick mortar bed or thin-set tile; complying with ANSI A118.10.
1. Type: Bonded Sheet Membrane.

C. Cementitious Backer Board: ANSI A118.9; High density, cementitious, glass fiber reinforced, 1/2 inch thick; 2 inch wide coated glass fiber tape for joints and corners. See Section 092116.

D. Coated Glass Mat Backer Board: ASTM C1178/C1178M, with coated inorganic fiberglass mat on both surfaces and integral acrylic coating vapor retarder. See Section 092116.

E. Mesh Tape: 2 inch wide self-adhesive fiberglass mesh tape.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that sub-floor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive tile.

B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive tile.

C. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of setting materials to sub-floor surfaces.

D. Verify that concrete sub-floor surfaces are ready for tile installation by testing for moisture emission rate and alkalinity; obtain instructions if test results are not within limits recommended by tile manufacturer and setting materials manufacturer.

3.02 PREPARATION

A. Protect surrounding work from damage.

B. Vacuum clean surfaces and damp clean.

C. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.

D. Install backer board in accordance with ANSI A108.11 and board manufacturer's instructions. Tape joints and corners, cover with skim coat of setting material to a feather edge.

E. Prepare substrate surfaces for adhesive installation in accordance with adhesive manufacturer's instructions.

3.03 INSTALLATION - GENERAL

A. Install tile, thresholds, and stair treads and grout in accordance with applicable requirements of ANSI A108.1a through ANSI A108.13, manufacturer's instructions, and TCNA (HB) recommendations.

B. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.

C. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor joints.

D. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make grout joints without voids, cracks, excess mortar or excess grout, or too little grout.

E. Form internal angles square and external angles bullnosed.

F. Install non-ceramic trim in accordance with manufacturer's instructions.

G. Sound tile after setting. Replace hollow sounding units.

H. Keep control and expansion joints free of mortar, grout, and adhesive.

I. Keep expansion joints free of adhesive or grout. Apply sealant to joints.

J. Prior to grouting, allow installation to completely cure; minimum of 48 hours.

K. Grout tile joints unless otherwise indicated. Use standard grout unless otherwise indicated.

L. At changes in plane and tile-to-tile control joints, use tile sealant instead of grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding.

M. Apply sealant to junction of tile and dissimilar materials and junction of dissimilar planes.

3.04 INSTALLATION - FLOORS - THIN-SET METHODS

A. Over exterior concrete substrates, install in accordance with TCNA (HB) Method F102, with standard grout.

B. Over interior concrete substrates, install in accordance with TCNA (HB) Method F113, dry-set or latex-Portland cement bond coat, with standard grout, unless otherwise indicated.

1. Use uncoupling membrane under all tile unless other underlayment is indicated.
2. Where waterproofing membrane is indicated, install in accordance with TCNA (HB) Method F122, with latex-Portland cement grout.

C. Over wood substrates, install in accordance with TCNA (HB) Method F142, with standard grout, unless otherwise indicated.

D. Over wood substrate with backer board underlayment, install in accordance with TCNA (HB) Method F144, for cementitious backer boards, with standard grout.

3.05 INSTALLATION - SHOWERS AND BATHTUB WALLS

A. At tiled shower receptors install in accordance with TCNA (HB) Method B415, mortar bed floor, and W244, thin-set over cementitious backer unit walls.

B. At bathtub walls install in accordance with TCNA (HB) Method B412, over cementitious backer units with waterproofing membrane.

C. Grout with standard grout as specified above.

D. Seal joints between tile work and other work with silicone type sealant specified in Section 07 9005.

3.06 INSTALLATION - WALL TILE

A. Over cementitious backer units on studs, install in accordance with TCNA (HB) Method W244, using membrane at toilet rooms.

B. Over coated glass mat backer board on studs, install in accordance with TCNA (HB) Method W245.

C. Over gypsum wallboard on wood or metal studs install in accordance with TCNA (HB) Method W243, thin-set with dry-set or latex-Portland cement bond coat, unless otherwise indicated.

D. Over wood studs without backer install in accordance with TCNA (HB) Method W231, mortar bed, with membrane where indicated.

3.07 CLEANING

A. Clean tile and grout surfaces.

3.08 PROTECTION

A. Do not permit traffic over finished floor surface for 4 days after installation.

3.09 SCHEDULE

A. Common Areas: Restroom, laundry room, entry lobby through to elevator and any necesary adjacenscies. See finish floor plans for exact locations.

B. Resident units: Entry, kitchen, bathroom. See interior finish schedule to confirm locations.

END OF SECTION

SECTION 09 5100
ACOUSTICAL CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Suspended metal grid ceiling system.

B. Acoustical units.

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 07 2100 - Thermal Insulation: Acoustical insulation.

C. Section 08 3100 - Access Doors and Panels: Access panels.

D. Section 21 1300 - Fire-Suppression Sprinkler Systems: Sprinkler heads in ceiling system.

E. Section 23 3700 - Air Outlets and Inlets: Air diffusion devices in ceiling.

F. Section 26 5100 - Interior Lighting: Light fixtures in ceiling system.

G. Section 27 5116 - Public Address Systems: Speakers in ceiling system.

H. Section 28 4600 - Fire Detection and Alarm: Fire alarm components in ceiling system.

1.03 REFERENCE STANDARDS

A. ASTM C635/C635M - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2013a.

B. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels; 2013.

C. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions; 2014.

D. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2014.

E. CAL (CHPS LEM) - Low-Emitting Materials Product List; California Collaborative for High Performance Schools (CHPS); current edition at www.chps.net/.

F. GEI (SCH) - GREENGUARD "Children and Schools" Certified Products; GREENGUARD Environmental Institute; current listings at www.greenguard.org.

1.04 SUBMITTALS

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

B. Shop Drawings: Indicate grid layout and related dimensioning.

C. Product Data: Provide data on suspension system components.

D. Samples: Submit two samples ___6_by___6_ inch in size illustrating material and finish of acoustical units.

1.05 QUALITY ASSURANCE

A. Suspension System Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

B. Acoustical Unit Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acoustic Tiles/Panels:
   1. Armstrong World Industries, Inc: www.armstrong.com.
   2. Acoustic Ceiling Products, Inc: www.acpideas.com.

3. CertainTeed Corporation: www.certainteed.com.
4. USG: www.usg.com.
5. Substitutions: See Section 01 6000 - Product Requirements.

B. Suspension Systems:
1. Same as for acoustical units.

2.02 ACOUSTICAL UNITS

A. Manufacturers:
1. Acoustical Tile: Basis-of-Design Product: Subject to compliance with requirements, provide Suprafine by Armstrong with DUNE Second Look II 24" x 48", white, or comparable product by one of the following
2. Acoustical Tile: Basis-of-Design Product: Subject to compliance with requirements, provide USG Olympia Micro Illusion two/24 Acoustical Panels 4742, Climaplus Performance, flat white, fine texture or comparable product by one of the following:
3.
a. Armstrong World Industries, Inc: www.armstrong.com.
b. Acoustic Ceiling Products, Inc.: www.acpideas.com.
c. CertainTeed Corporation: www.certainteed.com.
d. USG: www.usg.com.
e. Substitutions: See Section 01 6000 - Product Requirements.

B. Acoustical Units - General: ASTM E1264,type III Class A.
1. Flame Spread Rating: 25 or less (ASTM E84). To meet Federal Spec. SS-S-118a, Class 25.
2. Comply with "Acoustical and Insulating Materials Association" (AIMA) "Performance Data Bulletin".
3. Provide panels that are sag resistant and manufactured for environment with humidity levels up to 100%.
4. Edge: Beveled tegular.
5. Surface Color: White.
6. VOC Content: Certified as Low Emission by one of the following :
a. GreenGuard Children and Schools; www.greenguard.org.
b. Product listing in the CHPS Low-Emitting Materials Product List at; www.chps.net/manual/lem_table.htm.

2.03 SUSPENSION SYSTEM(S)

A. Manufacturers:
1. Armstrong World Industries, Inc: www.armstrong.com.
2. Acoustic Ceiling Products, Inc.: www.acpideas.com.
3. CertainTeed Corporation: www.certainteed.com.
4. Chicago Metallic Corporation: www.chicagometallic.com.
5. Hunter Douglas Contract: www.hunterdouglascontract.com.
6. USG: www.usg.com.
7. Substitutions: See Section 01 6000 - Product Requirements.

B. Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with stabilizer bars, clips, splices, perimeter moldings, and hold down clips as required.

C. Exposed Steel Suspension System Type ____: Formed steel, commercial quality cold rolled; heavy-duty.
1. Profile: Tee; 15/16 inch wide face.
2. Finish: White painted.

2.04 ACCESSORIES

A. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.

B. Perimeter Moldings: Same material and finish as grid.
   1. At Exposed Grid: Provide L-shaped molding for mounting at same elevation as face of grid.

C. Touch-up Paint: Type and color to match acoustical and grid units.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that layout of hangers will not interfere with other work.

3.02 INSTALLATION - SUSPENSION SYSTEM

A. Install suspension system in accordance with ASTM C636/C636M, ASTM E580/E580M, and manufacturer's instructions and as supplemented in this section.

B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.

C. Lay out system to a balanced grid design with edge units no less than 50 percent of acoustical unit size.

D. Install after major above-ceiling work is complete. Coordinate the location of hangers with other work.

E. Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.

F. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.

G. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.

H. Support fixture loads using supplementary hangers located within 6 inches of each corner, or support components independently.

I. Do not eccentrically load system or induce rotation of runners.

J. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
   1. Use longest practical lengths.
   2. Overlap and rivet corners.

3.03 INSTALLATION - ACOUSTICAL UNITS

A. Install acoustical units in accordance with manufacturer's instructions.

B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.

C. Fit border trim neatly against abutting surfaces.

D. Install units after above-ceiling work is complete.

E. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.

F. Cutting Acoustical Units:
   1. Cut to fit irregular grid and perimeter edge trim.
   2. Make field cut edges of same profile as factory edges.

3.04 ATTIC STOCK

A. Provide one additional box of replacement acoustical ceiling tile to the owner for future use.

3.05 TOLERANCES

A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.

B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

END OF SECTION

SECTION 09 6500
RESILIENT FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Resilient sheet flooring.

B. Resilient tile flooring.

C. Resilient base.

D. Resilient stair accessories.

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

1.03 REFERENCE STANDARDS

A. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2014c.

B. ASTM F1066 - Standard Specification for Vinyl Composition Floor Tile; 2004 (Reapproved 2014).

C. ASTM F1861 - Standard Specification for Resilient Wall Base; 2008 (Reapproved 2012).

D. ASTM F2034 - Standard Specification for Sheet Linoleum Floor Covering; 2008 (Reapproved 2013).

E. FS RR-T-650 - Treads, Metallic and Nonmetallic, Skid Resistant; Federal Specifications and Standards; Revision E, 1994.

F. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source; 2015.

G. RFCI (RWP) - Recommended Work Practices for Removal of Resilient Floor Coverings; Resilient Floor Covering Institute; October 2011.

1.04 SUBMITTALS

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

B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.

C. Shop Drawings: Indicate seaming plans and floor patterns.

D. Selection Samples: Submit manufacturer's complete set of color samples for Architect's initial selection.

E. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect roll materials from damage by storing on end.

1.06 FIELD CONDITIONS

A. Maintain temperature in storage area between 55 degrees F and 90 degrees F.

B. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F.

PART 2 PRODUCTS

2.01 SHEET FLOORING

A. Resident Units:

1. Patcraft, Cosmos SV I3003 Milky Way 249.
2. Contact Manufacturer's Representative: Joseph "JJ" Terzigni 614-582-8731, joseph.terzigni@patcraft.com

2.02 TILE FLOORING

A. Vinyl Compositionm Tile (VCT):
   1. Common Areas (IT Room, Storage Rooms, Janitor, Maintenance, Mechanical Closets) see finish schedule: Armstrong, Standard Excelon, Imperial Texture.

B. Vinyl Composition Tile (VCT): Homogeneous, with color extending throughout thickness, and:
   1. Minimum Requirements: Comply with ASTM F1066, of Class corresponding to type specified.
   2. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E 648 or NFPA 253.
   3. Size: 12 by 12 inch.
   4. VOC Content Limits: As specified in Section 01 6116.
   5. Thickness: 0.125 inch.
   6. Color: To be selected by Architect from manufacturer's full range.

C. Luxury Vinyl Tile (LVT) A.K.A. Vinyl Plank (VP):
   1. Common Areas (see finish schedule for locations): Patcraft, NoahII Boxwood
   2. Resident Units: Patcraft, Venus LVT 800E0 Sun Burst 30260.
   3. Contact Manufacturer's Representative: Joseph "JJ" Terzigni 614-582-8731, joseph.terzigni@patcraft.com.

D. Feature Strips: Of same material as tile.

2.03 STAIR COVERING

A. Stair Tread / Riser Combination: Rubber tread with integrated riser for the visuially impaired; full width and depth of stair tread in one piece; tapered thickness; nosing not less than 1-5/8 inch deep.
   1. Minimum Requirements: Comply with FS RR-T-650 requirements corresponding to type specified.
   2. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E 648 or NFPA 253.
   3. Nominal Thickness: 0.1875 inch.
   4. Nosing: Square.
   5. Manufacturers: Basis of design is Johnsonite, Inc; Product: standard raised round tread/riser visually impaired (virtr-rd): www.johnsonite.com. Other equivalent products are acceptable subject to approval from the Architect:
      a. Burke Flooring; _____: www.burkemercer.com.
      b. Roppe Corp; _____: www.roppe.com.
      c. Substitutions: See Section 01 6000 - Product Requirements.

2.04 RESILIENT BASE

A. Resilient Base: ASTM F1861, Type TS rubber, vulcanized thermoset; top set Style B, Cove.
   1. Height: 4 inch.
   2. Thickness: 0.125 inch.
   3. Finish: Satin.
   4. Length: 4 foot sections.
   5. Color: Color as selected from manufacturer's standards.
   6. Accessories: Premolded external corners and internal corners.
   7. Manufacturers:

2.05 ACCESSORIES

A. Subfloor Filler: White premix latex; type recommended by adhesive material manufacturer.

B. Primers, Adhesives, and Seam Sealer: Waterproof; types recommended by flooring manufacturer.

C. Moldings, Transition and Edge Strips: Same material as flooring.

D. Filler for Coved Base: Plastic.

E. Sealer and Wax: Types recommended by flooring manufacturer.

PART 3 EXECUTION

3.01 PREPARATION

A. Remove existing resilient flooring and flooring adhesives; follow the recommendations of RFCI (RWP).

B. Prepare floor substrates as recommended by flooring and adhesive manufacturers.

C. Remove sub-floor ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with sub-floor filler to achieve smooth, flat, hard surface.

D. Prohibit traffic until filler is fully cured.

3.02 INSTALLATION - GENERAL

A. Starting installation constitutes acceptance of sub-floor conditions.

B. Install in accordance with manufacturer's written instructions.

C. Spread only enough adhesive to permit installation of materials before initial set.

D. Fit joints and butt seams tightly.

E. Set flooring in place, press with heavy roller to attain full adhesion.

F. Where type of floor finish, pattern, or color are different on opposite sides of door, terminate flooring under centerline of door.

G. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated.

H. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.

I. Install feature strips where indicated.

3.03 INSTALLATION - TILE FLOORING

A. Mix tile from container to ensure shade variations are consistent when tile is placed, unless otherwise indicated in manufacturer's installation instructions.

B. Lay flooring with joints and seams parallel to building lines to produce symmetrical tile pattern.

3.04 INSTALLATION - RESILIENT BASE

A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches between joints.

B. Miter internal corners. At external corners, use premolded units. At exposed ends, use premolded units.

C. Install base on solid backing. Bond tightly to wall and floor surfaces.

D. Scribe and fit to door frames and other interruptions.

3.05 INSTALLATION - STAIR COVERINGS

A. Install stair coverings in one piece for full width and depth of tread.

B. Adhere over entire surface. Fit accurately and securely.

3.06 CLEANING

A. Remove excess adhesive from floor, base, and wall surfaces without damage.

B. Clean in accordance with manufacturer's written instructions.

3.07 PROTECTION

A. Prohibit traffic on resilient flooring for 48 hours after installation.

END OF SECTION

SECTION 09 6813
TILE CARPETING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Carpet tile, _____.

1.02 REFERENCE STANDARDS

A. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2014c.

B. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2011.

C. CRI 104 - Standard for Installation of Commercial Carpet; 2015.

D. CRI (GLP) - Green Label Plus Testing Program - Certified Products; www.carpet-rug.org; current edition.

E. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source; 2015.

1.03 SUBMITTALS

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

B. Shop Drawings: Indicate layout of joints.

C. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.

D. Samples: Submit one carpet tile illustrating color and pattern design for each carpet color selected.

E. LEED Report: Submit data documenting VOC content of carpet tile and adhesives; copy of current CRI Approved Products Listing is acceptable.

F. Manufacturer's Installation Instructions: Indicate special procedures.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in installing carpet tile with minimum three years documented experience and approved by carpet tile manufacturer.

1.05 FIELD CONDITIONS

A. Store materials in area of installation for minimum period of 24 hours prior to installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Tile Carpeting:
   1. Patcraft.

2.02 MATERIALS

A. Tile Carpeting, Type _____: Tufted, manufactured in one color dye lot.
   1. Product: Rainbow Walkoff 800D6 manufactured by Patcraft. Installed in vestibules.

2.03 ACCESSORIES

A. Edge Strips: Embossed aluminum, _____ color.

B. Carpet Tile Adhesive: Recommended by carpet tile manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that sub-floor surfaces are smooth and flat within tolerances specified for that type of work and are ready to receive carpet tile.

B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive carpet tile.

C. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of adhesive materials to sub-floor surfaces.

D. Cementitious Sub-floor Surfaces: Verify that substrates are dry enough and ready for flooring installation by testing for moisture and pH.
   1. Obtain instructions if test results are not within limits recommended by flooring material manufacturer and adhesive materials manufacturer.

E. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Prepare floor substrates as recommended by flooring and adhesive manufacturers.

3.03 INSTALLATION

A. Starting installation constitutes acceptance of sub-floor conditions.

B. Install carpet tile in accordance with manufacturer's instructions.

C. Blend carpet from different cartons to ensure minimal variation in color match.

D. Cut carpet tile clean. Fit carpet tight to intersection with vertical surfaces without gaps.

E. Lay carpet tile in square pattern, with pile direction parallel to next unit, set parallel to building lines.

F. Trim carpet tile neatly at walls and around interruptions.

G. Complete installation of edge strips, concealing exposed edges.

3.04 CLEANING

A. Remove excess adhesive without damage, from floor, base, and wall surfaces.

B. Clean and vacuum carpet surfaces.

END OF SECTION

SECTION 09 6816
SHEET CARPETING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Carpet, stretched-in, with cushion underlay and direct-glued.

B. Accessories.

1.02 REFERENCE STANDARDS

A. ASTM D2859 - Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials; 2006 (Reapproved 2011).

B. CRI 104 - Standard for Installation of Commercial Carpet; 2015.

C. CRI (CIS) - Carpet Installation Standard; Carpet and Rug Institute; 2009.

D. CRI (GLA) - Green Label Testing Program - Approved Adhesive Products; Carpet and Rug Institute; Current Edition.

1.03 SUBMITTALS

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

B. Shop Drawings: Indicate seaming plan, method of joining seams, direction of carpet pile and pattern, location of edge moldings and edge bindings, layout of flat wire system, and _____.

C. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.

D. Samples: Submit two samples ____by____ inch in size illustrating color and pattern for each carpet and cushion material specified.

E. Submit two, 4 inch long samples of edge strip for each color specified.

F. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing specified carpet with minimum three years documented experience.

1.05 FIELD CONDITIONS

A. Store materials in area of installation for minimum period of 24 hours prior to installation.

B. Maintain minimum 70 degrees F ambient temperature 24 hours prior to, during and 24 hours after installation.

C. Ventilate installation area during installation and for 72 hours after installation.

PART 2 PRODUCTS

2.01 CARPET

A. All new carpet shall bear the Carpet and Rug institute "Green Label" or shall be manufactured from at least 25% recycled materials.

B. All carpet must meet the acceptance criterion of Federal Standard DOCFF1-70 for flammability or Class II, 0.22 watts/cm2 per the International Building Code, whichever is greater.

C. All carpet must meet HUD UM-44D requirements.

D. Common Area carpet (OHFA Compliant): Patcraft, Miracle EPBL 710M6 Blue Heaven 506.

E. Resident Unit carpet:
   1. OHFA compliant - Patcraft, Socrates II-26 Emerson with EPBL

F. Contact Manufacturer's Representative: Joseph "JJ" Terzigni 614-582-8731, joseph.terzigni@patcraft.com.

2.02 CUSHION

A. Cushion: OHFA compliant - closed cell, foam pad
   1. only used in non-HC resident units
   2. Leggett & Platt carpet cushion, Twilight
      a. Product code: BZ0235
      b. R-value: 1.64
      c. Thickness: 0.4375"
      d. FHA class: 1
      e. Roll size: 6'X45'
      f. inherent characteristics: antimicrobial, top and bottom moisture barrier, CRi Green Label Plus certified, meets or exceeds indoor air quality testing criteria

2.03 ACCESSORIES

A. Sub-Floor Filler: Type recommended by carpet manufacturer.

B. Tackless Strip: Carpet gripper, of type recommended by carpet manufacturer to suit application, with attachment devices.

C. Adhesives - General: Compatible with materials being adhered; maximum VOC content as specified in Section 01 6116.

D. Seam Adhesive: Recommended by manufacturer.

E. Contact Adhesive: Compatible with carpet material; releasable type.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that sub-floor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive carpet.

B. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of adhesives to sub floor surfaces.

C. Cementitious Sub-floor Surfaces: Verify that substrates are dry enough and ready for flooring installation by testing for moisture and alkalinity (pH).
   1. Obtain instructions if test results are not within limits recommended by flooring material manufacturer and adhesive materials manufacturer.

3.02 PREPARATION

A. Prepare floor substrates as recommended by flooring and adhesive manufacturers.

B. Remove sub-floor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with sub-floor filler.

C. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Prohibit traffic until filler is cured.

D. Clean substrate.

3.03 INSTALLATION - GENERAL

A. Starting installation constitutes acceptance of sub-floor conditions.

B. Install carpet and cushion in accordance with manufacturer's instructions and CRI 104 (Commercial).

C. Verify carpet match before cutting to ensure minimal variation between dye lots.

D. Lay out carpet and locate seams in accordance with shop drawings.

1. Locate seams in area of least traffic, out of areas of pivoting traffic, and parallel to main traffic.
2. Do not locate seams perpendicular through door openings.
3. Align run of pile in same direction as anticipated traffic and in same direction on adjacent pieces.
4. Locate change of color or pattern between rooms under door centerline.
5. Provide monolithic color, pattern, and texture match within any one area.

E. Install carpet tight and flat on subfloor, well fastened at edges, with a uniform appearance.

3.04 STRETCHED-IN CARPET

A. Install tackless strips with pins facing the wall around entire perimeter, except across door openings. Use edge strip where carpet terminates at other floor coverings.

B. Space tackless strips slightly less than carpet thickness away from vertical surfaces, but not more than 3/8 inch.

C. Install cushion in maximum size pieces using spot adhesive to adhere to sub-floor.

D. Lay out cushion so that seams will be perpendicular to, or offset from, minimum 6 inches from carpet seams.

E. Butt cushion edges together and tape seams.

F. Trim cushion tight to edge of tackless strip and around projections and contours.

G. Double cut carpet seams, with accurate pattern match. Make cuts straight, true, and unfrayed. Apply seam adhesive to all cut edges immediately.

H. Join seams by hand sewing. Form seams straight, not overlapped or peaked, and free of gaps.

I. Following seaming, hook carpet onto tackless strip at one edge, power stretch, and hook firmly at other edges. Follow manufacturer's recommendations for method and amount of stretch.

J. Trim carpet neatly at walls and around interruptions. Tuck edges into space between tackless strip and wall.

3.05 DIRECT-GLUED CARPET

A. Double cut carpet seams, with accurate pattern match. Make cuts straight, true, and unfrayed. Apply seam adhesive to cut edges of woven carpet immediately.

B. Apply contact adhesive to floor uniformly at rate recommended by manufacturer. After sufficient open time, press carpet into adhesive.

C. Apply seam adhesive to the base of the edge glued down. Lay adjoining piece with seam straight, not overlapped or peaked, and free of gaps.

D. Roll with appropriate roller for complete contact of adhesive to carpet backing.

E. Trim carpet neatly at walls and around interruptions.

3.06 CLEANING

A. Remove excess adhesive from floor and wall surfaces without damage.

B. Clean and vacuum carpet surfaces.

END OF SECTION

SECTION 09 9000
PAINTING AND COATING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints, stains, varnishes, and other coatings.

C. Scope: Finish all interior and exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated, including the following:
   1. Walls, ceilings, base trim, casings, doors and frames.
   2. On roof where visible paint all pipes, ducts and chimneys that penatrate the roof to match roof color.
   3. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.
   4. Elevator pit ladders.
   5. Exposed surfaces of steel lintels and ledge angles.
   6. Prime surfaces to receive wall coverings.

D. Do Not Paint or Finish the Following Items:
   1. Items fully factory-finished unless specifically so indicated; materials and products having factory-applied primers are not considered factory finished.
   2. Items indicated to receive other finishes.
   3. Items indicated to remain unfinished.
   4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
   5. Stainless steel, anodized aluminum, bronze, terne, and lead items.
   6. Marble, granite, slate, and other natural stones.
   7. Floors, unless specifically so indicated.
   8. Ceramic and other tiles.
   9. Glass.
   10. Acoustical materials, unless specifically so indicated.
   11. Concealed pipes, ducts, and conduits.

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

1.03 DEFINITIONS

A. Conform to ASTM D16 for interpretation of terms used in this section.

1.04 REFERENCE STANDARDS

A. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications; 2014.

B. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Base Materials; 2007.

C. SSPC (PM1) - Good Painting Practice: SSPC Painting Manual, Vol. 1; Society for Protective Coatings; Fourth Edition.

1.05 SUBMITTALS

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

B. Product Data: Provide complete list of all products to be used, with the following information for each:
   1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").

2. MPI product number (e.g. MPI #47).
3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.

C. Samples: Submit one paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.
1. Where sheen is specified, submit samples in only that sheen.

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 Paint and Coatings: 1 gallon of each color.
3. Label each container with color in addition to the manufacturer's label.
4. Coating Maintenance Manual: Upon conclusion of the project, the Contractor or paint manufacturer/supplier shall furnish a coating maintenance manual, such as Sherwin-Williams “Custodian Project Color and Product Information” report or equal. Manual shall include an Area Summary with finish schedule, Area Detail designating where each product/color/finish was used, product data pages, Material Safety Data Sheets, care and cleaning instructions, touch-up procedures, and color samples of each color and finish used.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.08 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Do not apply exterior coatings during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.

D. Minimum Application Temperatures for Latex Paints: 45 degrees F for interiors; 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.

E. Minimum Application Temperature for Varnish Finishes: 65 degrees F for interior or exterior, unless required otherwise by manufacturer's instructions.

F. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide all paint and coating products used in any individual system from the same manufacturer; no exceptions.

B. Sherwin-Williams. NCR’s standards for interior and exterior paint specifications are through Sherwin-Williams. The Promar 200 Zero VOC series of products are the core standard for interior painting. The A-100 series of products are the core standards for exterior painting.

Please notify/contact Ryan Schneeman (NCR's National Account Representative) for NCR standards/spec and to register as a NCR construction project.

1. Contact information: Ryan M. Schneeman, National Strategic Account Manager, office 216-566-1765, cell 216-214-1606, ryan.schneeman@sherwin.com

C. Provide all paint and coating products from the same manufacturer to the greatest extent possible.

D. Paints:
1. Sherwin-Williams Company: www.sherwin-williams.com.

E. Transparent Finishes:
1. Sherwin-Williams Company: www.sherwin-williams.com.

F. Stains:
1. Sherwin-Williams Company: www.sherwin-williams.com.

G. Primer Sealers: Same manufacturer as top coats.

H. Block Fillers: Same manufacturer as top coats.

I. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PAINTS AND COATINGS - GENERAL

A. Paints and Coatings: Ready mixed, unless intended to be a field-catalyzed coating.
1. Provide paints and coatings of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
3. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color.
4. Supply each coating material in quantity required to complete entire project's work from a single production run.
5. Do not reduce, thin, or dilute coatings or add materials to coatings unless such procedure is specifically described in manufacturer's product instructions.

B. Primers: As follows unless other primer is required or recommended by manufacturer of top coats; where the manufacturer offers options on primers for a particular substrate, use primer categorized as "best" by the manufacturer.

C. Volatile Organic Compound (VOC) Content: Comply with Section 01 6116.

D. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.

E. Colors: As indicated on drawings
1. Selection to be made by Architect after award of contract.
2. Allow for minimum of six colors for each system, unless otherwise indicated, without additional cost to Owner.
3. Extend colors to surface edges; colors may change at any edge as directed by Architect.

2.03 PAINT SYSTEMS - INTERIOR

A. CONCRETE - (Walls & Ceilings, Poured Concrete, Precast Concrete, Unglazed Brick,Cement Board, Tilt-Up, Cast-In-Place)

B. Latex Systems
1. Gloss
a. 1st Coat: S-W Loxon Concrete & Masonry Primer A24W8300 (7 mils wet, 3 mils dry)
b. 2nd Coat: S-W ProMar® 400 Latex Gloss B21W400 Series

c. 3rd Coat: S-W ProMar® 400 Latex Gloss B21W400 Series (4 mils wet, 1.5 mils dry per coat)

C. Concrete Stain (Water Base)
1. Flat Finish Opaque
a. 1st Coat: S-W H&C Concrete Stain Solid Color Water Based
b. 2nd Coat: S-W H&C Concrete Stain Solid Color Water Based (50-300 sq/ft per gallon)

D. CONCRETE- FLOORS
1. Acrylic System
a. Gloss Finish
1) 1st Coat: S-W Porch & Floor Enamel, A32-100 series
2) 2nd Coat: S-W Porch & Floor Enamel, A32-100 series (4 mils wet, 1.4 mils dry)
3) Alternate
4) 1st Coat: S-W Sher-Crete Flexible Concrete Waterproofer, A5 Series
5) 2nd Coat: S-W Sher-Crete Flexible Concrete Waterproofer, A5 Series (14-18 mils wet per coat)
2. Concrete Stain (Water Base)
a. Low Luster Finish Opaque
1) 1st Coat: S-W H&C Concrete Stain Solid Color Water Based
2) 2nd Coat: S-W H&C Concrete Stain Solid Color Water Based (50-300 sq/ft per gallon)

E. METAL - (Aluminum, Galvanized)
1. Latex Systems
a. Gloss Finish
1) 1st Coat: S-W Pro Industrial Pro-Cryl® Primer, B66-310 Series (2-4 mils dry)
2) 2nd Coat: S-W ProMar® 400 Latex Gloss Enamel, B21W400 Series
3) 3rd Coat: S-W ProMar® 400 Latex Gloss Enamel, B21W400 Series (4 mils wet, 1.5 mils dry per coat)
b. Semi-Gloss Finish
1) 1st Coat: S-W Pro Industrial Pro-Cryl® Primer, B66-310 Series (2-4 mils dry)
2) 2nd Coat: S-W ProMar 400 Zero VOC Latex Semi-Gloss B31W4600
3) 3rd Coat: S-W ProMar 400 Zero VOC Latex Semi-Gloss B31W4600 (4 mils wet, 1.3 mils dry per coat)
c. Block Resistant Finish
1) 1st Coat: S-W Pro Industrial Pro-Cryl® Primer, B66-310 Series (2-4 mils dry)
2) 2nd Coat: S-W ProClassic® Waterborne Acrylic Semi-Gloss Enamel, B31 Series
3) 3rd Coat: S-W ProClassic® Waterborne Acrylic Semi-Gloss Enamel, B31 Series (4 mils wet, 1.3 mils dry per coat)
d. Eg-Shel / Satin Finish
1) 1st Coat: S-W Pro Industrial Pro-Cryl® Primer, B66-310 Series (2-4 mils dry)
2) 2nd Coat: S-W ProMar 400 Zero VOC Latex Eg-Shel B20W4600
3) 3rd Coat: S-W ProMar 400 Zero VOC Latex Eg-Shel B20W4600 (4 mils wet, 1.5 mils dry per coat)
e. Flat Finish
1) 1st Coat: S-W Pro Industrial Pro-Cryl® Primer, B66-310 Series (2-4 mils dry)
2) 2nd Coat: S-W ProMar 400 Zero VOC Latex Flat B30W4600
3) 3rd Coat: S-W ProMar 400 Zero VOC Latex Flat B30W4600 (4 mils wet, 1.4 mils dry per coat)
2. Alkyd / Acrylic Systems
a. Gloss Finish (Water base)
1) 1st Coat: S-W Pro Industrial Pro-Cryl® Primer, B66-310 Series (2.0 - 4.0 mils dry per coat)
2) 2nd Coat: S-W Waterbased Industrial Enamel, B53-300 Series

3) 3rd Coat: S-W Waterbased Industrial Enamel, B53-300 Series (4 mils wet, 1.6 mils dry per coat)

b. Semi-Gloss Acylic / Alkyd Finish
1) 1st Coat: S-W Pro Industrial Pro-Cryl® Primer, B66-310 Series (2-4 mils dry)
2) 2nd Coat: S-W -ProMar 200 Interior Waterbased Acrylic-Alkyd Semi-Gloss B34-8200
3) 3rd Coat: S-W ProMar 200 Interior Waterbased Acrylic-Alkyd Semi-Gloss B34-8200 (4 mils wet, 1.7 mils dry per coat)

F. WOOD- (Walls, Ceilings, Doors, Trim,)
1. Latex Systems
a. Gloss Finish
1) 1st Coat: S-W PrepRite® ProBlock Latex. B51 Series (4 mils wet, 1.4 mils dry)
2) 2nd Coat: S-W ProMar® 400 Latex Gloss, B21W400 Series
3) 3rd Coat: S-W ProMar® 400 Latex Gloss, B21W400 Series (4 mils wet, 1.5 mils dry per coat)

b. Semi-Gloss Finish
1) 1st Coat: S-W SW Multi-Purpose Interior / Exterior Latex Primer B51-450 Series (4 mils wet, 1.4 mils dry)
2) 2nd Coat: S-W ProMar 400 Zero VOC Latex Semi-Gloss B31W4600
3) 3rd Coat: S-W ProMar 400 Zero VOC Latex Semi-Gloss B31W4600 (4 mils wet, 1.3 mils dry per coat)

c. Eg-Shel / Satin Finish
1) 1st Coat: S-W SW Multi-Purpose Interior / Exterior Latex Primer B51-450 Series (4 mils wet, 1.4 mils dry)
2) 2nd Coat: S-W ProMar 400 Zero VOC Latex Eg-Shel B20W4600
3) 3rd Coat: S-W ProMar 400 Zero VOC Latex Eg-Shel B20W4600(4 mils wet, 1.5 mils dry per coat)

d. Flat Finish
1) 1st Coat: S-W SW Multi-Purpose Interior / Exterior Latex Primer B51-450 Series (4 mils wet, 1.4 mils dry)
2) 2nd Coat: S-W ProMar 400 Zero VOC Latex Flat B30W4600
3) 3rd Coat: S-W ProMar 400 Zero VOC Latex Flat B30W4600(4 mils wet, 1.4 mils dry per coat)

2. Alkyd Systems
a. Gloss Finish (Water base)
1) 1st Coat: S-W Premium Wall & Wood Primer B28W8111 (4 mils wet, 1.6 mils dry)
2) 2nd Coat: S-W Waterbased Industrial Enamel, B53-300 Series
3) 3rd Coat: S-W Waterbased Industrial Enamel, B53-300 Series (4 mils wet, 1.6 mils dry per coat)

b. Semi-Gloss (Solvent base) Finish
1) 1st Coat: S-W Premium Wall & Wood Primer B28W8111 (4 mils wet, 2 mils dry)
2) 2nd Coat: S-W ProMar 200 Interior Waterbased Acrylic-Alkyd Semi-Gloss B34-8200
3) 3rd Coat: S-W ProMar 200 Interior Waterbased Acrylic-Alkyd Semi-Gloss B34-8200(4 mils wet, 1.7 mils dry per coat)

3. At Wood Handrails:
a. 1st Coat: S-W SW Multi-Purpose Interior / Exterior Latex Primer B51-450 Series (4 mils wet, 1.4 mils dry)
b. 2nd and 3rd Coat: S-W B65W181 Hydrogloss Single Component Water Base Urethane

G. DRYWALL (Walls, Ceilings, Gypsum Board, Plaster Board, etc.)

1. Latex Systems
    a. Gloss Finish
        1) 1st Coat: S-W ProMar 200 Zero VOC Interior Latex Primer B28W2600 (4 mils wet, 1.2 mils dry)
        2) 2nd Coat: S-W ProMar® 400 Latex Gloss, B21W400 Series
        3) 3rd Coat: S-W ProMar® 400 Latex Gloss, B21W400 Series (4 mils wet, 1.5 mils dry per coat)
    b. Semi-Gloss Finish
        1) 1st Coat: S-W ProMar 200 Zero VOC Interior Latex Primer B28W2600 (4 mils wet, 1.2 mils dry)
        2) 2nd Coat: S-W ProMar 400 Zero VOC Latex Semi-Gloss B31W4600
        3) 3rd Coat: S-W ProMar 400 Zero VOC Latex Semi-Gloss B31W4600 (4 mils wet, 1.3 mils dry per coat)
    c. Eg-Shel / Satin Finish
        1) 1st Coat: S-W ProMar 200 Zero VOC Interior Latex Primer B28W2600 (4 mils wet, 1.2 mils dry)
        2) 2nd Coat: S-W ProMar 400 Zero VOC Latex Eg-Shel B20W4600
        3) 3rd Coat: S-W ProMar 400 Zero VOC Latex Eg-Shel B20W4600(4 mils wet, 1.6 mils dry per coat)
    d. Flat Finish
        1) 1st Coat: S-W ProMar 200 Zero VOC Interior Latex Primer B28W2600 (4 mils wet, 1.2 mils dry)
        2) 2nd Coat: S-W ProMar 400 Zero VOC Latex Flat B30W4600
        3) 3rd Coat: S-W ProMar 400 Zero VOC Latex Flat B30W4600 (4 mils wet, 1.4 mils dry per coat)
2. Alkyd Systems
    a. Semi- Gloss Finish (Solvent Base)
        1) 1st Coat: S-W ProMar 200 Zero VOC Interior Latex Primer B28W2600 (4 mils wet, 1.2 mils dry)
        2) 2nd Coat: S-W ProMar 200 Interior Waterbased Acrylic-Alkyd Semi-Gloss B34-8200
        3) 3rd Coat: S-W ProMar 200 Interior Waterbased Acrylic-Alkyd Semi-Gloss B34-8200(4 mils wet, 1.7 mils dry per coat)
    b. Eg-Shel / Satin Finish
        1) 1st Coat: S-W ProMar 200 Zero VOC Interior Latex Primer B28W2600 (4 mils wet, 1.2 mils dry)
        2) 2nd Coat: S-W ProMar 200 Interior Waterbased Acrylic-Alkyd Eg-Shel B33-8200
        3) 3rd Coat: S-W ProMar 200 Interior Waterbased Acrylic-Alkyd Eg-Shel B33-8200 (4 mils wet, 1.8 mils dry per coat)

2.04 ACCESSORY MATERIALS

A. Accessory Materials: Provide all primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials required to achieve the finishes specified whether specifically indicated or not; commercial quality.

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin application of coatings until substrates have been properly prepared.

B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

E. Test shop-applied primer for compatibility with subsequent cover materials.

F. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
   1. Gypsum Wallboard: 12 percent.
   2. Masonry, Concrete, and Concrete Unit Masonry: 12 percent.
   3. Interior Wood: 15 percent, measured in accordance with ASTM D4442.
   4. Concrete Floors and Traffic Surfaces: 8 percent.

3.02 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to coating application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Remove or repair existing coatings that exhibit surface defects.

D. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.

E. Seal surfaces that might cause bleed through or staining of topcoat.

F. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

G. Concrete and Unit Masonry Surfaces to be Painted: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with a solution of tri-sodium phosphate; rinse well and allow to dry. Remove stains caused by weathering of corroding metals with a solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.

H. Gypsum Board Surfaces to be Painted: Fill minor defects with filler compound. Spot prime defects after repair.

I. Galvanized Surfaces to be Painted: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.

J. Corroded Steel and Iron Surfaces to be Painted: Prepare using at least SSPC-SP 2 (hand tool cleaning) or SSPC-SP 3 (power tool cleaning) followed by SSPC-SP 1 (solvent cleaning).

K. Uncorroded Uncoated Steel and Iron Surfaces to be Painted: Remove grease, mill scale, weld splatter, dirt, and rust. Where heavy coatings of scale are evident, remove by hand or power tool wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Prime paint entire surface; spot prime after repairs.

L. Shop-Primed Steel Surfaces to be Finish Painted: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.

M. Interior Wood Surfaces to Receive Opaque Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats. Back prime concealed surfaces before installation.

3.03 APPLICATION

A. Apply products in accordance with manufacturer's instructions.

B. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

C. Apply each coat to uniform appearance.

D. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply as many coats as necessary for complete hide.

E. Sand wood and metal surfaces lightly between coats to achieve required finish.

F. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

G. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for general requirements for field inspection.

3.05 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.06 PROTECTION

A. Protect finished coatings until completion of project.

B. Touch-up damaged coatings after Substantial Completion.

END OF SECTION

SECTION 10 1400
SIGNAGE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Room and door signs.

B. Interior directional and informational signs.

C. Emergency evacuation maps.

D. Building identification signs.

1.02 REFERENCE STANDARDS

A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; current edition.

B. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

C. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2009.

1.03 SUBMITTALS

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

B. Product Data: Manufacturer's printed product literature for each type of sign, indicating sign styles, font, foreground and background colors, locations, overall dimensions of each sign.

C. **Signage Schedule**: Provide information sufficient to completely define each sign for fabrication, including room number, room name, other text to be applied, sign and letter sizes, fonts, and colors.

1. When room numbers to appear on signs differ from those on 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.

D. Samples: Submit one sample, of size similar to that required for project, illustrating sign style, font, and method of attachment.

E. Selection Samples: Where colors are not specified, submit two sets of color selection charts or chips.

F. Manufacturer's Installation Instructions: Include installation templates and attachment devices.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

1.05 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.

1.06 FIELD CONDITIONS

A. Do not install tape adhesive when ambient temperature is lower than recommended by manufacturer.

B. Maintain this minimum temperature during and after installation of signs.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Flat Signs: Basis of design: NCR Interior Signs - Family A by Columbus Sign Co.. No substitutions allowed.

B. Other Signs - _____:

2.02 SIGNAGE APPLICATIONS

A. Verify sign list, quantity and exact verbiage with Owner through Architect with the submittal process prior to fabrication.

B. Accessibility Compliance: Signs are required to comply with ADA Standards and ICC A117.1 _____, unless otherwise indicated; in the event of conflicting requirements, comply with the most comprehensive and specific requirements.
   1. All signs shall comply with ADA 703 Guidelines.
   2. Grade 2 braille dots to comply with aDA Guideline 703.3
   3. Comply with ADA section 703.1; regarding character dimensions, proportions and spacing
   4. Comply with section 703.5; finishes shall be non-glare and contrast with their background with either light characters on dark background of dark characters on a light background

C. At each door to an egress stairway, exit passageway and exit discharge, provide a tactile sign stating EXIT and complying with ICC A117.1. Provide sign adjacent to each door to an egress stairway, an exit passageway and the exit discharge.

D. At areas for assisted rescue, signage shall be provided as follows:
   1. Each door providing access to an area of refuge from an adjacent floor area shall be indentified be a sign complying with ICC A117.1, stating: AREA OF REFUGE, and including the International Symbol of Accessibility.

E. Provide and post in a conspicuous place in each section and on each floor of the facility and emergency evacuation sign showing the floor plan indicating all exits and designating egress route from location of sign. Comply with requirements of local code officials.

F. Provide stairway floor number signs.

G. A sign shall be provided at each floor landing in interior vertical exit enclosures connecting fore than three stories designating the floor level, terminus of the top and bottom of the stair enclosure and the identification of the stair. The signage shall also state the story of, and the direction to the exit discharge and tha availabliity of roof access from theh stairway for the fire department. The sign shall be located 5 feet above the floor landing in a position which is readily visible when the doors are in the open and closed positions.

H. Room and Door Signs: Provide a sign for every doorway, whether it has a door or not, not including corridors, lobbies, and similar open areas.
   1. URN - Unit Room Number Sign 3.5"X4"
   2. SID - Stair Identification sign 9.5"X7.75"
   3. ICF - In Cas of Fire sign 11"X7"
   4. EM - Evacuation Map sign 11.5"X11"
   5. SCID - Stair Core level ID sign 11.75"X10"
   6. EX - Exit Sign 3.5"X4"
   7. RSS - Typical room signs 3"X8"
   8. RR - restroom signs 9.625"X8"
   9. DWS - directional sign 10"X11"
   10. IRD - insert room sign 11.5"X11"
   11. Office Doors: Identify with room names and numbers to be determined later, not those shown on the drawings; in addition, provide "window" section for replaceable occupant name.

12. Conference and Meeting Rooms: Identify with room names and numbers to be determined later, not those shown on the drawings; in addition, provide "window" section with sliding "In Use/Vacant" indicator.
13. Hot Room: provide "window" sedtion with sliding "In Use/Vacant" indicator.
14. Service Rooms: Identify with room names and numbers to be determined later, not those indicated on drawings.
15. Rest Rooms: Identify with pictograms, the names "MEN" and "WOMEN", and braille.
16. When signs are installed on glass provide matching panel to adhere to the backside. Panel to be same size and shape as room sign in color.

I. Emergency Evacuation Maps:

J. Building Identification Signs:

2.03 ACCESSORIES

A. Tape Adhesive: Double sided tape, permanent adhesive.
   1. Applied to sign back by signage manufacturer
   2. Mounting surfaces to be fully cured per paint manufacturer's instructions, clean, smooth and free of debris.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install neatly, with horizontal edges level.

C. Locate signs and mount at heights indicated on drawings and in accordance with ADA Standards and ICC A117.1.

D. 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.

E. Protect from damage until Substantial Completion; repair or replace damaged items.

END OF SECTION

SECTION 10 2113.16

PLASTIC-LAMINATE-CLAD TOILET COMPARTMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Plastic laminate toilet compartments.

B. Urinal screens.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Blocking and supports.

1.03 REFERENCE STANDARDS

A. ANSI A208.1 - American National Standard for Particleboard; 2009.

B. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate the work with placement of support framing and anchors in walls and ceilings.

1.05 SUBMITTALS

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

B. Shop Drawings: Indicate partition plan, elevation views, dimensions, details of wall supports, door swings.

C. Product Data: Provide data on panel construction, hardware, and accessories.

D. Samples: Submit two samples of partition panels, _6__x_ 6__ inch in size illustrating panel finish, color, and sheen.

E. Manufacturer's Installation Instructions: Indicate special procedures.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Plastic Laminate Toilet Compartments:
   1. General Partitions Mfg. Corp; ____: www.generalpartitions.com.
   2. Global Steel Products Corp; ____: www.globalpartitions.com.
   3. Substitutions: Section 01 6000 - Product Requirements.

2.02 MATERIALS

A. Particleboard for Core: ANSI A208.1; composed of wood chips, sawdust or flakes, made with waterproof resin binder; of grade to suit application; sanded faces.

B. Plastic Laminate: NEMA LD 3, HGS.

C. Adhesive: Contact type.

2.03 COMPONENTS

A. Toilet Compartments: Plastic laminate finished, floor-mounted unbraced.

B. Doors, Panels, and Pilasters: Plastic laminate adhesive and pressure bonded to faces and edges of particleboard core, with beveled corners and edges; edges of cut-outs sealed.
   1. Reinforce pilasters and panels with steel plate sandwiched in particleboard core at attachment points. Router cut openings as required.

C. Urinal Screens: Wall mounted with two panel brackets, and floor-to-ceiling vertical upright consisting of pilaster anchored to floor and ceiling.

2.04 ACCESSORIES

A. Pilaster Shoes: Formed chromed steel with polished finish, 3 inches high, concealing floor fastenings.
   1. Provide adjustment for floor variations with screw jack through steel saddles integral with pilaster.
   2. Provide ceiling attachment using two adjustable hanging studs, attached to above-ceiling framing.

B. Head Rails: Hollow chrome plated steel tube, 1 x 1-5/8 inch size, with anti-grip strips and cast socket wall brackets.

C. Wall and Pilaster Brackets: Polished stainless steel.

D. Attachments, Screws, and Bolts: Stainless steel, tamper proof type.

E. Hardware: Polished stainless steel:
   1. Pivot hinges, gravity type, adjustable for door close positioning; two per door.
   2. Thumb turn door latch with exterior emergency access feature.
   3. Door strike and keeper with rubber bumper; mounted on pilaster in alignment with door latch.
   4. Coat hook with rubber bumper; one per compartment, mounted on door.
   5. Provide door pull for outswinging doors.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify correct spacing of and between plumbing fixtures.

C. Verify correct location of built-in framing, anchorage, and bracing.

3.02 INSTALLATION

A. Install partitions secure, rigid, plumb, and level in accordance with manufacturer's instructions.

B. Maintain 3/8 to 1/2 inch space between wall and panels and between wall and end pilasters.

C. Attach panel brackets securely to walls using anchor devices.

D. Attach panels and pilasters to brackets. Locate head rail joints at pilaster center lines.

3.03 TOLERANCES

A. Maximum Variation From True Position: 1/4 inch.

B. Maximum Variation From Plumb: 1/8 inch.

3.04 ADJUSTING

A. Adjust and align hardware to uniform clearance at vertical edge of doors, not exceeding 3/16 inch.

B. Adjust hinges to position doors in partial opening position when unlatched. Return out-swinging doors to closed position.

C. Adjust adjacent components for consistency of line or plane.

END OF SECTION

SECTION 10 2800

TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Commercial toilet accessories.

B. Accessories for toilet rooms and utility rooms.

C. Diaper changing stations.

D. Utility room accessories.

E. Grab bars.

1.02 RELATED REQUIREMENTS

A. Section 08 8300 - Mirrors: Other mirrors.

B. Section 09 3000 - Tiling: Ceramic washroom accessories.

1.03 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2015.

B. ASTM A167 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip; 1999 (Reapproved 2009).

C. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service; 2015.

D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

E. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.

F. ASTM B456 - Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium; 2011.

G. ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror; 2008 (Reapproved 2013).

H. ASTM F2285 - Standard Consumer Safety Performance Specification for Diaper Changing Tables for Commercial Use; 2004 (Reapproved 2010).

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with the placement of internal wall reinforcement, concealed ceiling supports, and reinforcement of toilet partitions to receive anchor attachments.

1.05 SUBMITTALS

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

B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design: Franklin Brass and AJ Washroom.

B. Commercial Toilet, Shower, and Bath Accessories:
   1. American Specialties, Inc; _____: www.americanspecialties.com.
   2. Bradley Corporation; _____: www.bradleycorp.com.

2.02 MATERIALS

A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.
   1. Grind welded joints smooth.
   2. Fabricate units made of metal sheet of seamless sheets, with flat surfaces.

B. Stainless Steel Sheet: ASTM A666, Type 304.

C. Stainless Steel Tubing: ASTM A269/A269M, Grade TP304 or TP316.

D. Galvanized Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G90/Z275 coating.

E. Fasteners, Screws, and Bolts: Hot dip galvanized; tamper-proof; security type.

F. Expansion Shields: Fiber, lead, or rubber as recommended by accessory manufacturer for component and substrate.

2.03 FINISHES

A. Stainless Steel: Satin finish, unless otherwise noted.

B. Chrome/Nickel Plating: ASTM B456, SC 2, polished finish, unless otherwise noted.

2.04 COMMERCIAL TOILET ACCESSORIES

A. Living Units: (unless otherwise noted items listed are Franklin Brass Kinley Series)
   1. Medicine Cabinet: Broan 615.
   2. Towel Bars (not over 30” in length): KIN24-SN.
   3. Toilet paper Holder - KIN62-SN; KIN20-SN.
   4. Robe Hook - KIN35-SN.
   5. Shower Curtain rod - Franklin Brass 161-5.
   6. Grab bars - Franklin Brass 1 1/2" diameter (powder coated) with snap flanges (concealed fasteners).
      a. At retrofit conditions provide Franklin Brass grab bar anchor for non-stud mount #FB549.
   7. Shower Seats: Surface Mounted Retractable Shower Seat, 3/4" thick, one-piece high density white polymer.
      a. Removable shower seats: Franklin Brass SF598; non slip blow molded polyethylene seat with back; aluminum legs with rubber feet.
      b. Built in shower seats: Reversible folding shower seat and frame; phenolic resin seat with 304 stainless steel brackets. Provide Franklin Brass 5181.
   8. Provide a weighted shower curtain in all roll in shower units. Provide “Elegance of Nylon” by AIM-Co. Inc. ; 2220 Corporate Square Blvd.; Jacksonville, FL 32216; Telephone: (904) 725-6396.
   9. Mirror: 1/4” plate glass mirror with pencil edge; size per plans.

B. Public Bathrooms:
   1. Paper towel dispenser / waste receptacle - AJ Washroom U626
   2. Paper Holders - Franklin Brass Century 5508BSF
   3. Robe Hook - Franklin Brass Century 5502SF.
   4. Wall Mounted Soap Dispenser - Franklin Brass 1920, Satin.
   5. Grab bars - Franklin Brass 1 1/2" diameter (powder coated) with snap flanges (concealed fasteners).
      a. At retrofit conditions provide Franklin Brass grab bar anchor for non-stud mount #FB549.
   6. Mirror, ¼” plate glass - size per plans.

2.05 LAUNDRY ROOM ACCESSORIES

A. Ironing Board: Nutone #AVAD40WN with Nutone surface mount collar #AVDSMN. Install with with bottom of surface mount collar at 24" a.f.f. per manufacturer's recommendations.

2.06 DIAPER CHANGING STATIONS

A. Diaper Changing Station: Wall-mounted folding diaper changing station for use in commercial toilet facilities, meeting or exceeding ASTM F2285.
   1. Material: Polyethylene.
   2. Mounting: Surface.
   3. Color: White.

2.07 UTILITY ROOM ACCESSORIES

A. Combination Utility Shelf/Mop and Broom Holder: 0.05 inch thick stainless steel, Type 304, with 1/2 inch returned edges, 0.06 inch steel wall brackets.
   1. Drying rod: Stainless steel, 1/4 inch diameter.
   2. Hooks: 2, 0.06 inch stainless steel rag hooks at shelf front.
   3. Mop/broom holders: 3 spring-loaded rubber cam holders at shelf front.
   4. Length: 36 inches.

2.08 ATTIC STOCK

A. Supply the following as "attic stock" to the owner at the conclusion of the project:
   1. Two sets of bath accesories provided in apartments and one set of bath accessories provided in the common arfea restrooms.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify exact location of accessories for installation.

C. Verify that field measurements are as indicated on drawings.

3.02 INSTALLATION

A. Install accessories in accordance with manufacturers' instructions in locations indicated on the drawings.

B. Install plumb and level, securely and rigidly anchored to substrate.

C. Mounting Heights: As required by accessibility regulations, unless otherwise indicated.

D. Mounting Heights and Locations: As required by accessibility regulations, as indicated on drawings, and as follows:

3.03 PROTECTION

A. Protect installed accessories from damage due to subsequent construction operations.

END OF SECTION

SECTION 10 4400 - FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fire extinguishers.

B. Fire extinguisher cabinets.

C. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Wood blocking product and execution requirements.

1.03 REFERENCE STANDARDS

A. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Fire Stops; 2013a.

B. NFPA 10 - Standard for Portable Fire Extinguishers; 2013.

1.04 SUBMITTALS

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

B. Shop Drawings: Indicate locations of cabinets and cabinet physical dimensions.

C. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

1.05 FIELD CONDITIONS

A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fire Extinguishers:
   1. Ansul, a Tyco Business; Cleanguard: www.ansul.com.
   2. Pyro-Chem, a Tyco Business; _____: www.pyrochem.com.
   3. Strike First Corporation of America; ABC-Seamless Steel Fire Extinguisher: www.strikefirstusa.com/#sle.
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Fire Extinguisher Cabinets and Accessories:
   1. Ansul, a Tyco Business; _____: www.ansul.com.
   2. JL Industries, Inc; _____: www.jlindustries.com.
   3. Larsen's Manufacturing Co; _____: www.larsensmfg.com.
   4. Potter-Roemer; _____: www.potterroemer.com.
   5. Pyro-Chem, a Tyco Business; _____: www.pyrochem.com.

2.02 FIRE EXTINGUISHERS

A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.

B. Multipurpose Dry Chemical Type Fire Extinguishers: Carbon steel tank, with pressure gage.
   1. Class: A:B:C type.
   2. Finish: Baked polyester powder coat, red color.
   3. Temperature range: Minus 40 degrees F to ___ degrees F.

2.03 **KITCHEN FIRE EXTINGUISHERS**

A. Wet Chemical Type Fire Extinguishers: Stainless steel tank, with pressure gage.
   1. Class: K type.
   2. Size: 1.6 gallons.
   3. Finish: Polished stainless steel.
   4. Temperature range: Minus 20 degrees F to 120 degrees F.

2.04 FIRE EXTINGUISHER CABINETS

A. Fire Rating: Listed and labeled in accordance with ASTM E814 requirements for fire resistance rating of walls where being installed.

B. Fire Rated Cabinet Construction: One-hour fire rated.

C. Cabinet Configuration: Recessed type.
   1. Size to accommodate accessories.
   2. Trimless type.
   3. Provide cabinet enclosure with right angle inside corners and seams, and with formed perimeter trim and door stiles.

D. Door: 0.036 inch metal thickness, reinforced for flatness and rigidity with nylon catch. Hinge doors for 180 degree opening with two butt hinge.

E. Door Glazing: Acrylic plastic, clear, 1/8 inch thick, flat shape and set in resilient channel glazing gasket.

F. Cabinet Mounting Hardware: Appropriate to cabinet, with pre-drilled holes for placement of anchors.

G. Weld, fill, and grind components smooth.

H. Finish of Cabinet Exterior Trim and Door: No. 4 - Brushed stainless steel.

I. Finish of Cabinet Interior: White colored enamel.

2.05 ACCESSORIES

A. Extinguisher Brackets: Formed steel, chrome-plated.

B. Extinguisher Theft Alarm: Battery operated alarm, 10 second delay for disarming, activated by opening cabinet door.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify rough openings for cabinet are correctly sized and located.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install cabinets plumb and level in wall openings, ____ inches from finished floor to inside bottom of cabinet.

C. Secure rigidly in place.

D. Place extinguishers in cabinets.

END OF SECTION

SECTION 10 5500
POSTAL SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Central mail delivery boxes.

1.02 REFERENCE STANDARDS

A. 39 CFR 111 - U.S. Postal Service Standard 4C; effective date September 3, 2006.

B. 36 CFR 1191 - Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities; Final Rule; current edition; (ADA Standards for Accessible Design).

1.03 SUBMITTALS

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

B. Product Data: Provide manufacturer's specifications and descriptive literature, installation instructions, maintenance information, and current USPS approval documentation.

C. Shop Drawings: Indicate plans for each unit or groups of units, front elevations with compartment layout and model number, overall dimensions, rough-in opening sizes, construction and anchorage details.

D. Samples: Submit two sets of manufacturer's available colors.

1.04 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide manufacturer's warranty against defects in materials or workmanship for a period of 5 years from Date of Substantial Completion.

PART 2 PRODUCTS

2.01 CENTRAL MAIL DELIVERY BOXES

A. Manufacturers:
   1. Florence Manufacturing Company: www.florencemailboxes.com.
   2. Jensen Mailboxes: www.jensenmailboxes.com.
   3. Postal Products Unlimited, Inc: www.postalproducts.com.
   4. Salsbury Industries: www.mailboxes.com.
   5. Security Manufacturing Corp: www.securitymanufacturing.com.
   6. Substitutions: See Section 01 6000 - Product Requirements.

B. Central Mail Delivery Boxes: Provide products approved for United States Postal Service (USPS) delivery.
   1. Materials: Aluminum with stainless steel hardware.
   2. Finish: Powder coat in color selected by Architect from manufacturer's standard colors.
   3. Unit Types and Sizes: As indicated on drawings.
   4. Configurations: See drawings for overall dimensions and layouts.

C. Wall-Mounted Mailboxes: Fully-recessed, complying with 39 CFR 111 (USPS-STD-4C).
   1. ____: Front-loading with master door, single-column design, with 1 outgoing mail compartment, and 1 parcel compartment. See drawings for configuration.
      a. Florence Manufacturing Compan____.
      b. Jensen Mailboxes ____.
      c. Postal Products Unlimited, Inc ____.
      d. Salsbury Industriesl ____.
      e. Security Manufacturing Corp____.

2.02 COMPONENTS

A. Locking - Front Loading Master Door: Three-point latching mechanism with USPS master lock furnished and installed by postmaster.

B. Locking - Customer Compartment Doors: USPS approved cam lock, 3 keys each lock.

C. Locking - Parcel Compartment Doors: Double-lock arrangement with USPS approved cam lock for customer access, and USPS master lock furnished and installed by postmaster.

D. Identification - Customer and Parcel Compartments: Sequential numerical or alphabetic characters, top to bottom, left to right; factory-installed.
   1. Engraved characters, 3/4 inch high, with black fill.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that rough-openings are ready to receive wall-mounted units.

B. Do not begin installation until unacceptable conditions are corrected.

3.02 INSTALLATION

A. Install postal specialties in accordance with approved shop drawings, manufacturer's instructions, and USPS requirements.

B. Adjust and lubricate door hardware to operate properly.

END OF SECTION

SECTION 10 5723
CLOSET AND UTILITY SHELVING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall mounted wire closet shelving.

B. Accessories.

1.02 SUBMITTALS

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

B. Product Data: Manufacturer's data sheets on each product to be used, with installation instructions.

C. Shop Drawings: Provide drawings prepared specifically for this project; show dimensions of shelving and attachment to substrates.

1.03 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store products under cover and elevated above grade.

C. Store flat to prevent warpage and bending.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Wire Storage Shelving:
   1. ClosetMaid Corporation : www.closetmaid.com.
   2. Organized Living; freedomRail: www.organizedliving.com.
   3. RubberMaid Closet and Organization Products : www.rubbermaidcloset.com.
   4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 SHELVING APPLICATIONS

A. Shelf Depth: 12 inches, unless otherwise indicated.

2.03 MATERIALS

A. Wire Shelving: Factory-assembled coated wire mesh shelf assemblies for wall-mounting, with all components and connections required to produce a rigid structure that is free of buckling and warping.
   1. Construction: Cold-drawn steel wire with average tensile strength of 100,000 psi resistance welded into uniform mesh units, square, rigid, flat, and free of dents or other distortions, with wires trimmed smooth.
   2. Coating: PVC or epoxy, applied after fabrication, covering all surfaces.
   3. PVC Coating: 9 to 11 mils thick.
   4. Epoxy Coating: Non-toxic epoxy-polyester powder coating baked-on finish, 3 to 5 mils thick.
   5. Standard Mesh Shelves: Cross deck wires spaced at 1 inch.

B. Hanging Rod: Tubular steel, 3/4" inch diameter, with end caps on open ends.
   1. Finish: Epoxy powder coat.
   2. Wall Thickness: 20 gage, 0.035 inch.
   3. Provide corner hanging rods and hanging rod connectors where required.

C. Wall-Mounted Standards: Vertically slotted channel standards with double-tab cantilever brackets to suit shelving; factory finished to match shelving.

D. Mounting Hardware: Provide manufacturer's standard mounting hardware; include support braces, wall brackets, back clips, end clips, poles, and other accessories as required for complete and secure installation; factory finished to match shelving.
   1. Provide intermediate support wall bracket for rod and shelf at any span 4' or more.

E. Fasteners: As recommended by manufacturer for mounting substrates.

PART 3 EXECUTION

3.01 EXAMINATION

A. Inspect areas to receive shelving, to verify that spaces are properly prepared to receive shelf units, and are of dimensions indicated on shop drawings.

B. Verify appropriate fastening hardware.

C. Do not begin installation until substrates have been properly prepared.

D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions, with shelf surfaces level.

B. Cap exposed ends of cut wires.

C. Install back clips, end clips at side walls, and support braces at open ends. Install intermediate support braces as recommended by manufacturer but in no case exceeding 48" between supports.

D. Mounting Heights: See drawings.

3.04 CLEANING

A. Clean soiled surfaces after installation.

3.05 PROTECTION

A. Protect installed work from damage.

B. Touch-up, repair, or replace damaged products before Substantial Completion in a manner that eliminates evidence of replacement.

END OF SECTION

SECTION 10 7500
FLAGPOLES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Aluminum Flagpoles.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Concrete base and foundation construction.

1.03 REFERENCE STANDARDS

A. AASHTO M 36 - Standard Specification for Corrugated Steel Pipe, Metallic-Coated, for Sewers and Drains; 2014.

B. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2015.

C. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.

D. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes [Metric]; 2013.

E. NAAMM FP 1001 - Guide Specifications for Design Loads of Metal Flagpoles; 2007.

1.04 SUBMITTALS

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

B. Product Data: Provide data on pole, accessories, and configurations.

C. Shop Drawings: Indicate detailed dimensions, base details, anchor requirements, and imposed loads.

D. Samples: Submit color samples , in size, illustrating pole material, color, and finish .

1.05 QUALITY ASSURANCE

A. Designer Qualifications: Design flagpole foundation under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed Ohio.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Spiral wrap flagpole with protective covering and pack in protective shipping tubes or containers.

B. Protect flagpole and accessories from damage or moisture.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Flagpoles:
   1. American Flagpole; ____: www.americanflagpole.com.
   2. Concord Industries, Inc; ____: www.concordindustries.com.
   3. Pole-Tech Co, Inc; ____: www.poletech.com.
   4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 FLAGPOLES

A. Flagpoles: Designed in accordance with NAAMM FP 1001.
   1. Material: Aluminum.
   2. Design: Cone tapered.
   3. Mounting: Ground mounted type.
   4. Outside Butt Diameter: as required by manufacturer.
   5. Outside Tip Diameter: as required by manufacturer.

6. Nominal Wall Thickness: as required by manufacturer.
7. Nominal Height: 30 ft; measured from nominal ground elevation.
8. Halyard: Interior type .
9. Provide complete system with all required componenets and accessories for a fully operational flag pole.

2.03 POLE MATERIALS

A. Aluminum: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper.

2.04 ACCESSORIES

A. Cleats: 9 inch size, aluminum with galvanized steel fastenings, two per halyard.

B. Halyard: 5/16 inch diameter polypropylene, braided, white.

C. Base Plate: Manufacturer's Standard.

D. Finial Ball:Manufacturer’s standard flush seam ball, sized as indicated or, if not indicated, to match pole butt diameter. Finish to match pole.

E. Internal Halyard Truck AssemblyWith Hood for Cable: Cast aluminum non-fouling revolving with single pulley mounted inside hood, stainless steel roller bearings, threaded spindle for attachment to top of pole, and bronze exit bushing for cable.
   1. Provided with stainless steel ball bearings.
   2. Provided with automotive sealed bearing, for 45’ and longer exposed poles.

F. Internal Halyard,Winch System: 1/8” (3mm) stainless steel aircraft cable with plastic coated counterweight and beaded slingassembly. Manually operated mechanical winch having automatic brake system and operated with a removable hand crank.

2.05 MOUNTING COMPONENTS

A. Foundation Tube Sleeve: AASHTO M 36M, corrugated 16 gage steel, galvanized, depth of as required by manufacturer and geographic locaton .

B. Pole Base Attachment: Flush; steel base with base cover.

2.06 FINISHING

A. Metal Surfaces in Contact With Concrete: Asphaltic paint.

B. Concealed Steel Surfaces: Galvanized to ASTM A123/A123M requirements.

C. Aluminum: Mill finish.

D. Stainless Steel: No. 4 satin finish.

E. Finial: Spun finish.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that concrete foundation is ready to receive work and dimensions are as indicated on shop drawings.

3.02 PREPARATION

A. Coat metal sleeve surfaces below grade and surfaces in contact with dissimilar materials with asphaltic paint.

3.03 INSTALLATION

A. Install flagpole, base assembly, and fittings in accordance with manufacturer's instructions.

B. Install foundation plate and centering wedges for flagpoles base set in concrete base and fasten.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1 inch.

3.05 ADJUSTING

A. Adjust operating devices so that halyard and flag function smoothly.

END OF SECTION

SECTION 11 1313
LOADING DOCK BUMPERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Dock bumpers of reinforced rubber with attachment frame.

1.02 SUBMITTALS

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

B. Product Data: Indicate unit dimensions, method of anchorage, and details of construction.

C. Manufacturer's Installation Instructions: Indicate special installation requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Dock Bumpers:
   1. Blue Giant Equipment Corporation; _____: www.bluegiant.com.
   2. Chalfant Sewing Fabricators, Inc; _____: www.chalfantusa.com.
   3. Substitutions: See Section 01 6000 - Product Requirements.

2.02 COMPONENTS

A. Bumpers: Molded rubber, ozone resistant, nylon reinforced, minimum Shore A Durometer of 70, tensile strength of 950 to 1050 psi.
   1. Projection From Wall: 3 inches.
   2. Vertical Height: 10 inches.
   3. Width: 5 inches.
   4. Profile: Rectangular.

B. Attachment Hardware: 3/4 inch diameter galvanized bolts and expansion shields.

C. Touch-up Primer: Zinc rich type.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that anchor placement is acceptable.

3.02 INSTALLATION

A. Install dock bumpers in accordance with manufacturer's instructions.

B. Set plumb and level.

END OF SECTION

SECTION 11 3013
RESIDENTIAL APPLIANCES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Kitchen appliances.

1.02 RELATED REQUIREMENTS

A. Section 22 1005 - Plumbing Piping: Plumbing connections for appliances.

B. Section 26 0583 - Wiring Connections: Electrical connections for appliances.

1.03 REFERENCE STANDARDS

A. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

1.04 SUBMITTALS

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

B. Product Data: Manufacturer's data indicating dimensions, capacity, and operating features of each piece of residential equipment specified.

C. Copies of Warranties: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

B. Electric Appliances: Listed and labeled by UL (DIR) and complying with NEMA Standards (National Electrical Manufacturers Association).

C. Gas Appliances: Bearing design certification seal of American Gas Association (AGA).

1.06 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide five (5) year manufacturer warranty on refrigeration system of refrigerators.

C. Provide ten (10) year manufacturer warranty on magnetron tube of microwave ovens.

D. Electric Range: 4 year limited warranty on surface burner elements.

E. Provide ten (10) year manufacturer warranty on tub and door liner of dishwashers.

PART 2 PRODUCTS

2.01 KITCHEN APPLIANCES

A. All Equipment Eligible for Energy Star Rating shall be Energy Star Rated.

B. All ranges shall be provided with, and have installed an anti-tip bracket.

C. Apartment Units: Shall receive one each as follows: (all colors to be selected during construction)

1. Standard Unit Range: Whirlpool 30" Slide-In Electric Range with Self-Cleaning Oven, Model #: WFC340S0AW
    a. Grease Shield: Baked on enamel finish over steel to match color of range or satin finished stainless steel with matching screws.
2. Handicap Unit Range: Whirlpool 30" Drop-In Electric Range with Self-Cleaning Oven Model #: WDE150LVQ
    a. Grease Shield: Baked on enamel finish over steel to match color of range or satin finished stainless steel with matching screws.
3. Range Hood: Whirlpool Range Hood Model #: UXT4030AWD, non-vented with charcoal filter and light.

4. Unit Refrigerator all Units: "Whirlpool" Model No.: WRS571CID, energy star, 20.6 cubic foot, frost free. Provide with optional ice maker installed.
5. Disposal: "Badger 1, 1/3 HP. Plug-in connection. Wire to wall switch.

D. Dishwasher at standard units: “Whirlpool” Model#: DU810SWPQ, Energy Star, 24” built in..
1. Dishwasher at HC units: Whirlpool Built-In Dishwasher; Model#: GU3100XTV.

E. Public Kitchen and Meeting Room shall receive the following:
1. Whirlpool 25 cu. Ft. side by side refrigerator with dispenser, Estar Refrigerator in stainless steel model WRS325FDAM
2. Countertop Microwave, Whirlpool Model#: wMC30516AS.
3. Community Room Wall Oven: Whirlpool Model#: WOD92EC7AS.
4. Dishwasher: Whirlpool model no. WDF550SAAS.
5. Disposal: "Badger 5XP, 3/4 HP. Plug-in connection. Wire to wall switch.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify utility rough-ins are provided and correctly located.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

3.03 ADJUSTING

A. Adjust equipment to provide efficient operation.

3.04 CLEANING

A. Remove packing materials from equipment and properly discard.

B. Wash and clean equipment.

END OF SECTION

SECTION 11 8250

WASTE CHUTES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Waste chutes and intake doors

1.02 REFERENCE STANDARDS

A. National Fire Protection Association(NFPA.82.1999), standards as referenced herein

1.03 SUBMITTALS

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

B. Product Data: Provide unit capacities, physical dimensions, utility requirements and locations, point loads.

C. Shop Drawings: Indicate machine location, rough-in and anchor placement dimensions and tolerances, clearances required .

D. Shop Drawings:
   1. Plans: Scale 1/4 inch to 1 foot; indicate locations, dimensions, and required associated construction activities.
   2. Elevations/Sections: Scale 1/4 inch to 1 foot; indicate locations, dimensions, and required associated required construction activities.
   3. Details: Scale 1/4 inch to 1 foot; indicate:
      a. Shop drawings specific to project conditions
      b. Interface with adjacent construction
         1) Dimensions and tolerances
      c. Products required for installation of the trash chute, but not supplied by trash chute manufacturer.

E. Maintenance Data: Identify system maintenance requirements, servicing cycles, lubrication types required and local spare part sources.

F. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

1.05 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Manufacturer’s warranty: Furnish manufacturer’s standard one (1) year warranty from date of temporary certificate of occupancy or similar, locally mandated permission to use the project common areas for their intended use. Warranty shall apply to defects in product workmanship and materials.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design: As indicated under product article below.

B. Waste Compactors:
   1. Marathon Equipment Co: www.marathonequipment.com.
   2. Wastequip, Inc: www.wastequip.com.
   3. Wilkinson-Hi-Rise LLC: www.whrise.com.
   4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MATERIALS

A. Components:
   1. The chute shall be 24” diameter of U.S. #16 gauge aluminized steel as manufactured by Wilkinson-Hi-Rise.
   2. Intakes Door: Stainless steel, 15 inches wide x 18 inches high, bottom hinged, hand operated self-closing positive latching doors bearing 1½ hour, Underwriters Laboratories “B” Label designation and rated for a 250° F maximum door temperature rise over 30 minutes, with stainless steel trim in a UL® approved, “B” Label, 1½ hour assembly.
   3. Discharge: Wilkinson, U.S. #16 gauge aluminized steel type “A” open end chute discharge rolling steel door with 165°F. fusible link hold open on an inclined steel track at the bottom of the chute to close automatically when the ambient temperature reaches 165°F. as required by city or state building and/or fire codes.
   4. Vent: Chute shall extend full diameter through roof to metal top vent cap
   5. 4’-0” above roof level with counter flashing and insect screen. A roof curb (44”x 44” x minimum of 8” high) is required for flat roof conditions and is to be provided by others.
   6. Accessories: 3/4 inch IPS flushing spray head and 1/2 inch sprinkler head above highest intake. Additional 1/2-inch sprinkler heads at every second intake (counting from the top) or as required by local code.
   7. Provide Disinfecting & Sanitizing unit for installation in line to the flushing spray head. Connection to flushing spray head, back flow prevention valve and electric control switch by others.
   8. Provide 15 inches wide x 15 inches high right side hinged, hand operated, self closing, positive latching, UL 1 1/2-hour. “B” labeled, stainless steel plumbing access door having stainless steel door trim for installation by forces erecting enclosing shaft wall. Door to have master keyed lock. Cylinder provided by others. Door for access to disinfecting & sanitizing unit above the highest intake door of the chute.
   9. Offsets (bends) in the chute, if required, shall be made the same diameter as the chute of #16 US gauge aluminized steel and have an additional layer of # 13 US gauge aluminized steel reinforcing the impact area. Offsets are not to deviate more than 15o off the vertical axis of the chute.
   10. Provide Daubert 932 sound coat (or equal) vibration dampening compound to the exterior of the chute only. Include Korfund sound isolator pads at each floor support frame.
   11. Sprinkler System: Chute shall be protected internally by automatic sprinklers. This requires a sprinkler at or above the top intake door of the chute, and in addition, a sprinkler shall be installed within the chute at alternate floor levels in building over two stories in height with mandatory sprinkler located at the lowest service level.

B. The trash chute shall be fully factory assembled and all joints, except those required to separate the sections for shipment and installation shall be welded or lock-seamed tight. The floor intake doors shall be bolted in place on throats formed into the chute. All chute sections shall flash inside the sections below and there shall be no bolts, clips, or other projections inside the chute to snag the flow of material. Pre-positioned support frames shall assure proper intake levels and there shall be an expansion joint in the chute between all support joints. Discharge hoppers and offsets, where required, shall be reinforced and separately supported in the impact area.

2.03 ACCESSORY ITEMS:

A. Provide two Rubbermaid carts model 1305-73 Recycling Tilt Truck.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verification of conditions:
   1. Area in which system is to be located is correct size and location, and is prepared for installation of trash chute and components.

B. Installer’s examination:

1. Have installer of this section examine conditions under which construction activities of this section are to be performed, then submit written notification if conditions under which construction activities of this section are to be performed are unacceptable.
2. Beginning construction activities of this section before unacceptable conditions have been corrected is prohibited.
3. General Contractor shall verify and record chute alignment with installer immediately following installation.

3.02 INSTALLATION

A. Install trash chute in accordance with shop drawings and manufacturer's printed installation instructions.

3.03 DEMONSTRATION

A. Arrange demonstration of system operation, conducted by manufacturer's representative, to Owner's maintenance personnel

3.04 INSTALLATION

A. Install unit and inlet hopper in accordance with manufacturer's instructions and with standards required by authority having jurisdiction.

B. Coordinate with waste chute discharge.

C. Anchor unit securely in place.

D. Touch-up minor damaged surfaces caused during installation. Replace damaged components as directed by Architect.

E. Adjust unit mechanism to achieve specified requirements.

3.05 CLOSEOUT ACTIVITIES

A. Demonstrate and instruct Owner on unit operation. Describe unit limitations.

END OF SECTION

SECTION 12 2113
HORIZONTAL LOUVER BLINDS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Horizontal slat louver blinds.

B. Operating hardware.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Concealed wood blocking for attachment of headrail brackets.

1.03 REFERENCE STANDARDS

A. WCMA A100.1 - Safety of Corded Window Covering Products; Current Edition, Including All Revisions.

1.04 SUBMITTALS

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

B. Product Data: Provide data indicating physical and dimensional characteristics.

C. Shop Drawings: Indicate opening sizes, tolerances required, method of attachment, clearances, and operation.

D. Manufacturer's Installation Instructions: Indicate special procedures.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Horizontal Louver Blinds Without Side Guides:
   1. SWFcontract, a division of Spring Window Fashions, LLC.; ____: www.swfcontract.com.

2.02 BLINDS WITHOUT SIDE GUIDES

A. Description: Horizontal slat louvers hung from full-width headrail with full-width bottom rail.

B. **Location: All living unit exterior windows. Including exterior doors with lites and side lites. All common area interior windows.**

C. Manual Operation: Control of raising and lowering by cord with full range locking; blade angle adjustable by control wand.

D. Blinds: Horizontal slat louvers hung from full-width headrail with full-width bottom rail; manual control of raising and lowering by cord with full range locking; blade angle adjustable by control wand; complying with WCMA A100.1.

E. Plastic Slats: PVC foam, radiused slat corners.
   1. Width: 1 inch.
   2. Texture: Smooth.

F. Slat Support: Woven polypropylene cord, ladder configuration.

G. Head Rail: Pre-finished, formed aluminum box, with end caps; internally fitted with hardware, pulleys, and bearings for operation; same depth as width of slats.

H. Bottom Rail: Pre-finished, formed PVC with top side shaped to match slat curvature; with end caps.
   1. Color: Same as headrail.
   2. **Location: doors with full lites or side lites i.e. patio doors. Confirm with arhitect.**

I. Bottom Rail: Pre-finished, formed PVC with top side shaped to match slat curvature; with end caps. Color: Same as headrail.

J. Control Wand: Extruded hollow plastic; hexagonal shape.

K. Headrail Attachment: Wall brackets.

2.03 FABRICATION

A. Determine sizes by field measurement.

B. Fabricate blinds to fit within openings with uniform edge clearance of 1/4 inch.

C. Fabricate blinds to cover window frames completely.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that openings are ready to receive the work.

B. Ensure structural blocking and supports are correctly placed. See Section 06 1000.

3.02 INSTALLATION

A. Install window treatments in accordance with manufacturer's instructions.

B. Install window treatments level, plumb, square, and true. Allow proper clearances for window operation hardware.

C. Install the following items to conceal roller and operating mechanism. Do not use exposed fasteners.
   1. Fascias.
   2. Closure panels.
   3. Endcaps.

D. Secure in place with flush countersunk fasteners.

E. Place intermediate supports per manufacturer's instructions.

3.03 TOLERANCES

A. Maximum Variation of Gap at Window Opening Perimeter: 1/4 inch.

B. Maximum Offset From Level: 1/8 inch.

3.04 ADJUSTING

A. Adjust blinds for smooth operation.

3.05 CLEANING

A. Clean blind surfaces just prior to occupancy.

3.06 TESTING AND DEMONSTRATION

A. Demonstrate operation of shades to Owner's designated representatives.

END OF SECTION

SECTION 12 2400
WINDOW SHADES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Window shades and accessories.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Concealed wood blocking for attachment of headrail brackets.

B. Section 09 2116 - Gypsum Board Assemblies: Substrate for window shade systems.

C. Section 09 5100 - Acoustical Ceilings: Shade Pockets, pocket closures and accessories.

1.03 REFERENCE STANDARDS

A. WCMA A100.1 - Safety of Corded Window Covering Products; Current Edition, Including All Revisions.

1.04 SUBMITTALS

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

B. Product Data: Provide manufacturer's standard catalog pages and data sheets including materials, finishes, fabrication details, dimensions, profiles, mounting requirements, and accessories.

C. Shop Drawings: Include shade schedule indicating size, location and keys to details.

D. Selection Samples: Include fabric samples in full range of available colors and patterns.

E. Manufacturer's Instructions: Include instructions for storage, handling, protection, examination, preparation, and installation of product.

F. Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing work of this type with minimum ____ years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver shades in manufacturer's unopened packaging, labeled to identify each shade for each opening.

B. Handle and store shades in accordance with manufacturer's recommendations.

1.07 FIELD CONDITIONS

A. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.08 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manually Operated cellular Shades:
   1. SWFcontract, a division of Springs Window Fashions, LLC.; Graber Crystal Plear 3/8" double cellular shades.: www.swfcontract.com.

2.02 WINDOW SHADE APPLICATIONS

A. Shades at exterior windows: _____.
   1. Type: cellular shades.

2. Fabric: Graber Crystal Pleat.
3. Color: As selected by Architect from manufacturer's full range of colors.
4. Mounting: Inside (between jambs).
5. Operation: Manual.

2.03 ACCESSORIES

A. Brackets and Mounting Hardware: As recommended by manufacturer for mounting configuration and span indicated.

B. Fasteners: Non-corrosive, and as recommended by shade manufacturer.

2.04 FABRICATION

A. Field measure finished openings prior to ordering or fabrication.

B. Fabricate shades to fit openings within specified tolerances.
1. Vertical Dimensions: Fill openings from head to sill with 1/2 inch space between bottom bar and window sill.
2. Horizontal Dimensions - Inside Mounting: Fill openings from jamb to jamb.

C. Dimensional Tolerances: As recommended in writing by manufacturer.

D. At openings requiring continuous multiple shade units with separate rollers, locate roller joints at window mullion centers; butt rollers end-to-end.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine finished openings for deficiencies that may preclude satisfactory installation.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. Start of installation shall be considered acceptance of substrates.

3.02 PREPARATION

A. Prepare surfaces using methods recommended by manufacturer for achieving best result for substrate under the project conditions.

B. Coordinate with window installation and placement of concealed blocking to support shades.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions and approved shop drawings, using mounting devices as indicated.

B. Installation Tolerances:
1. Inside Mounting: Maximum space between shade and jamb when closed of 1/16 inch.
2. Maximum Offset From Level: 1/16 inch.

C. Replace shades that exceed specified dimensional tolerances at no extra cost to Owner.

D. Adjust level, projection and shade centering from mounting bracket. Verify there is no telescoping of shade fabric. Ensure smooth shade operation.

3.04 CLEANING

A. Clean soiled shades and exposed components as recommended by manufacturer.

B. Replace shades that cannot be cleaned to "like new" condition.

3.05 PROTECTION

A. Protect installed products from subsequent construction operations.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 12 3530
RESIDENTIAL CASEWORK

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Kitchen cabinets.

B. Vanity cabinets.

C. Casework hardware.

1.02 RELATED REQUIREMENTS

A. Section 12 3600 - Countertops.

1.03 REFERENCE STANDARDS

A. BHMA A156.9 - American National Standard for Cabinet Hardware; 2010.

B. KCMA A161.1 - Performance and Construction Standard for Kitchen and Vanity Cabinets; 2012.

C. KCMA (DIR) - Directory of Certified Cabinet Manufacturers; current edition, online.

1.04 SUBMITTALS

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

B. Product Data: Provide component dimensions and construction details.

C. Shop Drawings: Indicate casework locations, large scale plans, elevations, clearances required, rough-in and anchor placement dimensions and tolerances.

1.05 QUALITY ASSURANCE

A. Products: Complying with KCMA A161.1 and KCMA Certified.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Residential Casework: Basis of design manufacturers listed below:
   1. Living Units: Marillat Basics, Collins Square; finish as selected.
   2. Common Areas: Merillat Basics, Wesley Square; finish as selected.

2.02 COMPONENTS

A. Cabinet Construction: Softwood lumber framing and particle board, tempered hardboard gables.

B. Kitchen Countertop: Post formed plastic laminate over particle board, coved to back splash.

C. Vanity Countertop: Post formed plastic laminate over particle board, coved to back splash.

D. Door and Drawer Fronts: Solid wood.

E. Bolts, Nuts, Washers and Screws: Of size and type to suit application.

F. Concealed Joint Fasteners: Threaded steel.

2.03 HARDWARE

A. Hardware: BHMA A156.9, types as recommended by fabricator for quality grade specified.

B. Adjustable Shelf Supports: Standard side/ back-mounted system using 1 inch spacing adjustments.

C. Drawer and Door Pulls: _____.
   1. Product: Allison Value 3 inch(76mm) CTC pull; satin nickel. part no. BP69153G10 manufactured by Amercok.

D. Cabinet Locks: Keyed cylinder, two keys per lock, master keyed, steel with chrome finish. At all common area cabinets.

E. Drawer Slides:
   1. Type: Full extension.
   2. Static Load Capacity: Commercial grade.
   3. Mounting: Side mounted.
   4. Stops: Integral type.

F. Hinges: European style concealed self-closing type, steel with satin finish.

2.04 FABRICATION

A. Shop assemble casework for delivery to site in units easily handled and to permit passage through building openings.

B. Fabricate corners and joints without gaps or inaccessible spaces or areas where dirt or moisture could accumulate.

C. Form smooth edges. Form material for countertops, shelves, and drain boards from continuous sheets.

D. Provide cutouts for plumbing fixtures, appliances, and fixtures and fittings. Prime paint contact surfaces of cut edges.

E. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.

2.05 FINISHES

A. Exposed To View Surfaces: Stain, seal and varnish of selected color. .

B. Interior Surfaces: Plastic Laminate of manufacturer's standard color .

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify adequacy of support framing.

3.02 INSTALLATION

A. Install casework, components and accessories in accordance with manufacturer's instructions.

B. Use anchoring devices to suit conditions and substrate materials encountered.

C. Set casework items plumb and square, securely anchored to building structure.

D. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch. Use filler strips; not additional overlay trim for this purpose.

E. Close ends of units, back splashes, shelves and bases.

3.03 ADJUSTING

A. Adjust doors, drawers, hardware, fixtures, and other moving or operating parts to function smoothly.

3.04 CLEANING

A. Clean casework, countertops, shelves, and hardware.

3.05 PROTECTION

A. Do not permit finished casework to be exposed to continued construction activity.

END OF SECTION

SECTION 12 3600
COUNTERTOPS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Countertops for architectural cabinet work.

B. Countertops for manufactured casework.

C. Wall-hung counters and vanity tops.

1.02 RELATED REQUIREMENTS

A. Section 06 4100 - Architectural Wood Casework.

B. Section 12 3530 - Residential Casework.

C. Section 22 4000 - Plumbing Fixtures: Sinks.

1.03 REFERENCE STANDARDS

A. ANSI A161.2 - Performance Standards for Fabricated High Pressure Decorative Laminate Countertops; 1998.

B. ANSI A208.1 - American National Standard for Particleboard; 2009.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

D. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014.

E. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.0; 2016.

F. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

G. PS 1 - Structural Plywood; 2009.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for 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. Specimen warranty.

C. Shop Drawings: Complete details of materials and installation; combine with shop drawings of cabinets and casework specified in other sections.

D. Selection Samples: For each finish product specified, color chips representing manufacturer's full range of available colors and patterns.

1.05 QUALITY ASSURANCE

A. Fabricator Qualifications: Same fabricator as for cabinets on which tops are to be installed.

B. Installer Qualifications: Fabricator.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.07 FIELD CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

PART 2 PRODUCTS

2.01 COUNTERTOPS

A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.

B. Plastic Laminate Countertops: High-pressure decorative laminate (HPDL) sheet bonded to substrate.
   1. Laminate Sheet: NEMA LD 3, Grade HGS.
      a. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
      b. NSF approved for food contact.
      c. Finish: Matte or suede, gloss rating of 5 to 20.
      d. Surface Color and Pattern: As selected by Architect from the manufacturer's full line.
      e. Manufacturers:
         1) Formica Corporation; _____: www.formica.com.
         2) Lamin-Art, Inc; _____: www.laminart.com.
         3) Panolam Industries International, Inc\Nevamar; _____: www.nevamar.com.
         4) Panolam Industries International, Inc\Pionite; _____: www.pionitelaminates.com.
         5) Wilsonart, LLC; _____: www.wilsonart.com.
   2. Exposed Edge Treatment: Postformed laminate; front edge substrate built up to minimum 1-1/4 inch thick with raised radiused edge, integral coved backsplash with radiused top edge.
   3. Provide rounded outside corners.
   4. Back and End Splashes: Same material, same construction; except at handicap units which shall be self edge.
   5. Fabricate in accordance with AWI/AWMAC/WI (AWS), Section 11 - Countertops, Custom Grade.
   6. Underside of countertops: Seal with low VOC sealant.

C. Natural Stone Countertops: Stone slabs bonded to substrate; use as large pieces as possible with inconspicuous adhesive joints.
   1. Stone: Granite without cracks, voids, or pin holes; filling with matching epoxy resin is acceptable.
   2. Color: Giallo Ornamental.
   3. Stone Thickness: 1 inch, minimum.
   4. Surface Finish: Polished.
   5. Exposed Edge Treatment: Square profile stone, 1 inch thick, with 3/16 inch radius corner.
   6. Back and End Splashes: Same material, same thickness; for field attachment.
   7. See drawings.

2.02 MATERIALS

A. Wood-Based Components:
   1. Wood fabricated from old growth timber is not permitted.

B. Plywood for Supporting Substrate: PS 1 Exterior Grade, A-C veneer grade, minimum 5-ply; minimum 3/4 inch thick; join lengths using metal splines.

C. Particleboard for Supporting Substrate: ANSI A208.1 Grade 2-M-2, 45 pcf minimum density; minimum 3/4 inch thick; join lengths using metal splines.

D. Adhesives: Chemical resistant waterproof adhesive as recommended by manufacturer of materials being joined.

E. Joint Sealant: Mildew-resistant silicone sealant, color as selected by Archtect _____.

2.03 FABRICATION

A. Fabricate tops and splashes in the largest sections practicable, with top surface of joints flush.

1. Join lengths of tops using best method recommended by manufacturer.
2. Fabricate to overhang fronts and ends of cabinets 1 inch except where top butts against cabinet or wall.
3. Prepare all cutouts accurately to size; replace tops having improperly dimensioned or unnecessary cutouts or fixture holes.
4. Provide radiused outside corners.

B. Provide back/end splash wherever counter edge abuts vertical surface unless otherwise indicated.
1. Secure to countertop with concealed fasteners and with contact surfaces set in waterproof glue.
2. Height: 4 inches standard. Provide 6" heiht at accessible units and public use common areas unless otherwise indicated.

C. Wall-Mounted Counters: Provide skirts, aprons, brackets, and braces as indicated on drawings, finished to match.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. Field Measurements: Verify countertop size and shape prior to fabrication by field measurements taken after base units are installed.

C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

D. Verify that wall surfaces have been finished and mechanical and electrical services and outlets are installed in proper locations.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

A. Securely attach countertops to cabinets using concealed fasteners. Make flat surfaces level; shim where required.

B. Attach plastic laminate countertops using screws with minimum penetration into substrate board of 5/8 inch.

C. Attach wood countertops using screws with minimum penetration into substrate board of 5/8 inch.

D. Seal joint between back/end splashes and vertical surfaces.

3.04 TOLERANCES

A. Variation From Horizontal: 1/8 inch in 10 feet, maximum.

B. Offset From Wall, Countertops: 1/8 inch maximum; 1/16 inch minimum.

C. Field Joints: 1/8 inch wide, maximum.

3.05 CLEANING

A. Clean countertops surfaces thoroughly.

3.06 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

SECTION 12 4813

ENTRANCE FLOOR MATS AND FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Carpet mat.

1.02 SUBMITTALS

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

B. Samples: Submit two samples, 24 by 24 inch in size illustrating pattern, color, finish, edging and _____.

C. Maintenance Data: Include cleaning instructions, stain removal procedures.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Floor Mats:
   1. American Floor Products Company, Inc; _____: www.afco-usa.com.
   2. R.C. Musson Rubber Co; _____: www.mussonrubber.com.
   3. Pawling Corporation; _____: www.pawling.com.
   4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 ENTRANCE FLOOR GRILLES AND GRATINGS

A. Mounting: Top of non-resilient members level with adjacent floor.

B. Structural Capacity: Capable of supporting a rolling load of 500 pounds without permanent deformation or noticeable deflection.

C. Vibration Resistant Fabrication: All members welded, riveted, or bolted; no snap or friction connections.

2.03 MATS

A. Carpet Mat: Cut nylon pile permanently bonded to vinyl backing; ____ inch wide by ____ inch long with one inch black matching vinyl border on all edges.

PART 3 EXECUTION

3.01 PREPARATION

A. Mats: Verify size of floor recess before fabricating mats.

B. Vacuum clean floor recess.

3.02 INSTALLATION

A. Install walk-off surface in floor recess flush with finish floor after cleaning of finish flooring.

END OF SECTION

SECTION 12 9315
SITE FURNISHINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Site Furnishings

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Mounting surface for bicycle racks.

B. Section 05 5000 - Metal Fabrications: Custom metal outdoor furnishings.

1.03 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2008.

B. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for 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. Selection Samples: For each finish product specified, color chips representing manufacturer's full range of available colors and patterns.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Handle furnishings with sufficient care to prevent scratches and other damage to the finish.

PART 2 PRODUCTS

2.01 BENCHES

A. Heavy-duty public space seating constructed of the following components.
   1. Product Style - Landscape Forms, Inc.; “Petoskey” Backed polysite quad support Bench, surface mounted Site and Street Furniture Seating Model Number LFK3178SM or approved equal. Landscape Forms - (800) 624-2443.
   2. Support: Tubular steel 3” o.d., 0.120-inch wall thickness.
   3. Seating Panels:Landscape Forms, Inc. PolySite 100% high-density polyethylene (HDPE) derived from recycled post-consumer packaging with over 90% recycled content by weight. PolySite timbers extruded to 2” x 6” nominal Fay 2006-08 Modernization Site Furnishings
      a. molded face boards and 2”x3” interior boards. All boards shall have eased edges as well as ends. Each board mounted with tamper-resistant screws onto heavy gauge steel backstraps.
   4. System Size: 26” deep x 32” high x 78” long - nominal.
   5. Steel Finishes - Rust inhibitor and topcoat finish of thermosetting polyester powder coat that is U.V., chip and flake resistant - Landscape Forms Pangard II or approved equal. All surfaces shall receive this coating.
   6. Color - as selected by Architect.
   7. Graffiti Guard - Landscape Forms Graffiti Guard coating. Field applied to steel per manufacturer’s instructions.
   8. Mounting - Surface mounted into thickened concrete.
   9. Warranty - 3-year manufacturer’s warranty.

2.02 BICYCLE RACKS

A. Exterior Bicycle Racks: Device allows user provided lock to simultaneously secure one wheel and part of the frame on each bicycle parked or racked.
   1. Style: Serpentine rack formed from a continuous round pipe.
   2. Capacity:tbd bicycles.
   3. Accessories: In-ground grout cover.

B. Materials:
   1. Pipe: Carbon steel, ASTM A53/A53M, Schedule 40.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine surfaces to receive site furnishings.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. Do not begin installation until unsatisfactory substrates have been properly repaired.

3.02 PREPARATION

A. Ensure surfaces to receive furnishings are clean, flat, and level.

3.03 INSTALLATION

A. Site Preparation: Provide and construct concrete base as indicated.
   1. Subgrades: Level soil to accommodate new 5” concrete slab. Compact soil.
   2. Concrete:4,000 psi air-entrained concrete with fiber mesh. Smooth wood steel trowl finish.

B. Installation of Benches:Where indicated on the drawings provide and install the bench in accordance with manufacturers instructions for an embedded installation. Provide ½” x 10” J-bolts. Set J-bolts into 12”dia. x 24” deep concrete footing. At concrete pads bolt in place to concrete pad without footing. Place top of footing flush with surrounding grade and so that the bench will be installed level and plumb. Assemble bench in accordance with manufacturer’s printed instructions.E. Installation of Picnic Table:Where indicated on the drawings provide and place the picnic table in accordance with manufacturers instructions. Provide ½” x 10” J-bolts. Set J-bolts into 12”dia. x 24” deep concrete footing. At concrete pads bolt in place to concrete pad without footing. Place top of footing flush with surrounding grade and so that the bench will be installed level and plumb. Assemble bench in accordance with manufacturer’s printed instructions.

C. Restore adjacent areas or otherwise disturbed areas after finish grading and before planting.

D. Install in accordance with manufacturer's instructions.

E. Install bicycle racks level, plumb, square, and correctly located as indicated on the drawings.

F. In-Ground Anchor Installation:
   1. Prepare holes in size according to manufacturer’s instructions.
   2. Place anchoring bolts through the holes in the pipe.
   3. Lower rack into holes, ensuring the bottom of lower bends are at least 1-1/2 inch from the ground.
   4. Pour concrete and level rack.
   5. Support until dry.

G. Surface Flange Installation: Anchor furnishings securely in place with 1/2 inch by 4 inch anchor bolts through flange holes.

3.04 CLEANING

A. Clean installed work to like-new condition. Do not use cleaning materials or methods that could damage finish.

3.05 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 14 2010
PASSENGER ELEVATORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Complete elevator systems.

B. Excavating and backfilling for hydraulic cylinder casing.

C. Elevator maintenance.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Includes elevator machine foundation.

B. Section 04 2000 - Unit Masonry: Masonry hoistway enclosure; building-in and grouting hoistway door frames.

C. Section 05 1200 - Structural Steel Framing: Includes hoistway framing.

D. Section 05 5000 - Metal Fabrications: Includes pit ladder, sill supports, divider beams, and overhead hoist beams.

E. Section 21 1300 - Fire-Suppression Sprinkler Systems: Sprinkler heads in hoistway.

F. Section 22 3000 - Plumbing Equipment: Pit drain.

G. Section 26 0533.13 - Conduit for Electrical Systems:
   1. Empty conduit to elevator equipment devices remote from elevator machine room or hoistway.
   2. Empty conduit from controller cabinet in machine room to remote group supervisory panel in lobby.

H. Section 26 0583 - Wiring Connections:
   1. Electrical characteristics and wiring connections.
   2. Electrical service to main disconnect in elevator machine room.
   3. Emergency power transfer cabinet.
   4. Electrical power for elevator installation and testing.
   5. Electrical disconnecting device to elevator equipment prior to activation of sprinkler system.
   6. Electrical service for machine room.
   7. Lighting in elevator pit.
   8. Empty conduit for telephone service to machine room.

I. Section 28 4600 - Fire Detection and Alarm:
   1. Fire and smoke detectors and interconnecting devices.
   2. Fire alarm signal lines to elevator controller cabinet.

J. Section 31 2316 - Excavation: Excavation for cylinder casing and hydraulic lines between cylinder and remote machine room.

1.03 REFERENCE STANDARDS

A. ASME A17.1 - Safety Code for Elevators and Escalators; 2013.

B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2016.

D. UL (BMD) - Building Materials Directory; current edition.

E. UL (ECMD) - Electrical Construction Materials Directory; current edition.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Construction Use of Elevator: Elevator may be used for transport of construction personnel and materials.
   1. Enclose cab with protective plywood on floor, walls, and ceiling.
   2. Provide temporary lighting.
   3. Provide control panel with manual and emergency operation with key operation for attendant operator.

1.05 SUBMITTALS

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

B. Shop Drawings: Indicate the following information:
   1. Locations of Machine Room Equipment: Driving machines, controllers, governors and other components.
   2. Hoistway Components: Car, counterweight, sheaves, machine and sheave beams, guide rails, buffers, ropes, and other components.
   3. Rail bracket spacing; maximum loads imposed on guide rails requiring load transfer to building structural framing.
   4. Individual weight of principal components; load reaction at points of support.
   5. Loads on hoisting beams and location of trolley beams.
   6. Clearances and over-travel of car and counterweight.
   7. Locations in hoistway and machine room of traveling cables and connections for car light.
   8. Location and sizes of access doors, doors, and frames.
   9. Expected heat dissipation of elevator equipment in machine room.
   10. Applicable seismic design data; certified by a licensed Professional Structural Engineer.
   11. Interface with building security system.
   12. Electrical characteristics and connection requirements.
   13. Show arrangement of equipment in machine room so rotating elements, sheaves, and other equipment can be removed for repairs or replaced without disturbing other components. Arrange equipment for clear passage through access door.

C. Product Data: Provide data on the following items:
   1. Signal and operating fixtures, operating panels, indicators.
   2. Cab design, dimensions, layout, and components.
   3. Cab and hoistway door and frame details.
   4. Electrical characteristics and connection requirements.

D. Samples: Submit two samples, ___2_x_2__ inch in size illustrating cab floor material, cab interior finishes, cab and hoistway door and frame finishes, and handrail material and finish.

E. Maintenance Contract.

F. Maintenance Data: Include:
   1. Parts catalog with complete list of equipment replacement parts; identify each entry with equipment description and identifying code.
   2. Technical information for servicing operating equipment.
   3. Legible schematic of hydraulic piping and wiring diagrams of installed electrical equipment and changes made in the Work. List symbols corresponding to identity or markings on machine room and hoistway apparatus.

1.06 QUALITY ASSURANCE

A. Perform Work in accordance with applicable code and as supplemented in this section.

B. Designer Qualifications: Design guide rails, brackets, anchors, and machine anchors under direct supervision of a Professional Structural Engineer experienced in design of work of this type and licensed in Ohio.

C. Fabricate and install door and frame assemblies in accordance with NFPA 80.

D. Perform electrical work in accordance with NFPA 70.

E. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum ten years documented experience.

F. Installer Qualifications: Employees and supervisor on payroll of elevator equipment manufacturer.

G. Products Requiring Fire Resistance Rating: Listed and classified by UL.

H. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.07 WORK NOT INCLUDED: GENERAL CONTRACTOR SHALL PROVIDE THE FOLLOWING IN ACCORDANCE WITH THE REQUIREMENTS OF THE MODEL BUILDING CODE AND ANSI A17.1 CODE. FOR SPECIFIC RULES, REFER TO ANSI A17.1, SECTION 300 FOR HYDRAULIC ELEVATORS. STATE OR LOCAL REQUIREMENTS MUST BE USED IF MORE STRINGENT.

A. Elevator hoist beam to be provided at top of elevator shaft. Beam must be able to accommodate proper loads and clearances for elevator installation and operation.

B. Supply in ample time for installation by other trades, inserts, anchors, bearing plates, brackets, supports and bracing including all setting templates and diagrams for placement.

C. Hatch walls require a minimum two hours of fire rating. Hoistway should be clear and plumb with variations not to exceed 1/2" at any point.

D. Elevator hoistways shall have barricades, as required.

E. Install bevel guards at 75° on all recesses, projections or setbacks over 2" (4" for A17.1 2000 areas) except for loading or unloading.

F. Provide rail bracket supports at pit, each floor and roof. For guide rail bracket supports, provide divider beams between hoistway at each floor and roof.

G. Pit floor shall be level and free of debris. Reinforce dry pit to sustain normal vertical forces from rails and buffers.

H. Where pit access is by means of the lowest hoistway entrance, a vertical ladder of non-combustible material extending 42" minimum, (48" minimum for A17.1-2000 areas) shall be provided at the same height, above sill of access door or handgrips.

I. Machine room to be enclosed and protected.

J. Machine Room temperature must be maintained between 55º and 90º F.

K. If machine room is remote from the elevator hoistway, clear access must be available above the ceiling or metal/concrete raceways in floor for oil line and wiring duct from machine room.

L. Access to the machinery space and machine room must be in accordance with the governing authority or code.

M. Provide an 8” x 16” cutout through machine room wall, for oil line and wiring duct, coordinated with elevator contractor at the building site.

N. All wire and conduit should run remote from either the hoistways or the machine room.

O. When heat, smoke or combustion sensing devices are required, connect to elevator machine room terminals. Contacts on the sensors should be sided for 120 volt D.C.

P. Install and furnish finished flooring in elevator cab.

Q. Finished floors and entrance walls are not to be constructed until after sills and door frames are in place. Consult elevator contractor for rough opening size. The general contractor shall supply the drywall framing so that the wall fire resistance rating is maintained, when drywall construction is used.

R. Where sheet rock or drywall construction is used for front walls, it shall be of sufficient strength to maintain the doors in true lateral alignment. Drywall contractor to coordinate with elevator contractor.

S. Before erection of rough walls and doors; erect hoistway sills, headers, and frames. After rough walls are finished; erect fascias and toe guards. Set sill level and slightly above finished floor at landings.

T. To maintain legal fire rating (masonry construction), door frames are to be anchored to walls and properly grouted in place.

U. The elevator wall shall interface with the hoistway entrance assembly and be in strict compliance with the elevator contractor's requirements.

V. General Contractor shall fill and grout around entrances, as required.

W. Elevator sill supports shall be provided at each opening.

X. All walls and sill supports must be plumb where openings occur.

Y. For applications with jack hole, free and clear access to the elevator pit area for the jack hole-drilling rig is required.

Z. Where jack hole is required, remove all spoils from jack hole drilling.

AA. When not provided by Elevator Contractor, jack hole shall accommodate the jack unit. If required the jack hole is to be provided in strict accordance with the elevator contractor's shop drawings.

AB. Locate a light fixture and convenience outlet in pit with switch located adjacent to the access door.

AC. A light switch and fused disconnect switch for each elevator should be located inside the machine room adjacent to the door, where practical, per the National Electrical Code (NFPA No. 70).

AD. As indicated by elevator contractor, provide a light outlet for each elevator, in center of hoistway (or in the machine room).

AE. For signal systems and power operated door: provide ground and branch wiring circuits, including main line switch. For car light and fan: provide a feeder and branch wiring circuits, including main line switch.

AF. Wall thickness may increase when fixtures are mounted in drywall. These requirements must be coordinated between the general contractor and the elevator contractor.

AG. Provide supports, patching and recesses to accommodate hall button boxes, signal fixtures, etc..

AH. Locate telephone and convenience outlet on control panel.

1.08 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide one year manufacturer warranty for elevator operating equipment and devices.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with requirements, manufacturers offering hydraulic elevators that may be incorporated into the Work include, but are not limited to, the following:
   1. ThyssenKrupp Elevator; ____: www.thyssenkruppelevator.com.
   2. Otis Elevator Co; ____: www.otis.com.
   3. Schindler Elevator Corp; Schindler 3300 Low-Rise MRL: www.us.schindler.com.
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. All components to be manufactured by same entity, unless otherwise indicated.

2.02 ELEVATORS

A. Elevator No.1: Passenger, holeless hydraulic type with cylinder in hoistway.
   1. Operation and Controls: Two-stop automatic.
   2. Additional Service Controls: In addition, provide:
      a. Limited access service.
   3. Hoistway Doors and Frames: Baked enamel on steel.
   4. Cab Height: 96 inches.
   5. Hoistway and Cab Entrance Frame Opening Size: _3'-6"_x_7'-0"___ inches.
   6. Door Type: Single leaf.
   7. Door Operation: Side opening.
   8. Rated Net Capacity: 4500 lbs.
   9. Rated Speed: 125 ft/min.
   10. Starts per hour: Design for 80 minimum.
   11. Nominal Platform Size: 5'-8" x 7'-10" inches.
   12. Travel Distance: As indicated on drawings.
   13. Number of Stops: 3.
   14. Number of Openings: 1 Front; 0 Rear.

B. Car Enclosures: As follows:
   1. Front Walls: Satin stainless steel with integral car door frames.
   2. Car Fixtures: Satin stainless steel.
   3. Side and Rear Wall Panels: Plastic-Laminate Wall Panels: Plastic laminate adhesively applied to 1/2-inch (13-mm) fire-retardant-treated particleboard with plastic-laminate panel backing complying with NEMA LD 3, Type BKV and manufacturer's standard protective edge trim. Panels have a flame-spread rating of 25 or less, when tested according to ASTM E 84.
      a. Color: As selected by the Architect from the manufacturer's full line of colors and patterns.
   4. Reveals: Enameled Steel
   5. Door Faces Exterior: Enameled Steel.
   6. Door Faces (Interior): Enameled Steel.
   7. Nickel silver sills are more durable than aluminum but are as expensive as bronze.
   8. Door Sills: Nickel silver.
   9. Satin Metal Ceiling: Flush panels, of satin stainless steel, with low-voltage downlights in the center of each panel.
   10. Handrails: 2” flat satin stainless steel at side and rear walls with full returns at ends.
   11. Floor prepared to receive scheduled finish material..

C. Additional Requirements: As follows:
   1. Provide inspection certificate in each car, mounted under acrylic cover with satin stainless steel frame.
   2. Provide protective blanket hooks in each cars and one complete set of full-height blankets.
   3. Provide ADA compliant “hands free” emergency phone.

2.03 HOISTWAY EQUIPMENT

A. Platform: Fabricated frame of formed or structural steel shapes, gusseted and rigidly welded with a wood subfloor. Underside of the platform shall be fireproofed. The car platform shall be designed and fabricated to support one-piece loads weighing up to 25% of the rated capacity.

B. Sling: Steel stiles affixed to a steel crosshead and bolstered with bracing members to remove strain from the car enclosure.

C. Guide Rails: Steel, omega shaped, fastened to the building structure with steel brackets.
   1. Guide Shoes: Slide guides shall be mounted on top and bottom of the car.

2. Buffers: Provide substantial buffers in the elevator pit. Mount buffers on a steel template that is fastened to the pit floor or continuous channels fastened to the elevator guide rail or securely anchored to the pit floor. Provide extensions if required by project conditions.
3. Jack: Jack unit shall be of sufficient size to lift the gross load the height specified. Factory test jack to insure adequate strength and freedom from leakage. Brittle material, such as gray cast iron, is prohibited in the jack construction. Provide the following jack type: Twin post holeless telescopic 2-stage. Two jacks piped together, mounted one on each side of the car with each having two telescopic sections designed to extend in a synchronized manner when oil is pumped into the Assembly. Each jack section will be guided from within the casing or the plunger assembly used to house the section. Each plunger shall have a high pressure sealing system which will not allow for seal movement or displacement during the course of operation. Each Jack Assembly shall have a check valve built into the assembly to allow for automatically re-syncing the two plunger sections by moving the jack to its fully contracted position. The jack shall be designed to be mounted on the pit floor or in a recess in the pit floor. Each jack section shall have a bleeder valve to discharge any air trapped in the section.

D. Wiring, Piping, and Oil: Provide all necessary hoistway wiring in accordance with the National Electrical Code. All necessary code compliant pipe and fittings shall be provided to connect the power unit to the jack unit. Provide proper grade readily biodegradable oil as specified by the manufacturer of the power unit (see Power Unit section 2.04.G for further details)

2.04 POWER UNIT

A. Power Unit (Oil Pumping and Control Mechanism): A self-contained unit consisting of the following items:
1. Oil reservoir with tank cover.
a. An oil hydraulic pump.
b. An electric motor.
c. Oil control valve with the following components built into single housing; high pressure relief valve, check valve, automatic unloading up start valve, lowering and leveling valve, and electro-magnetic controlling solenoids.

B. Pump: Positive displacement type pump specifically manufactured for oil-hydraulic elevator service. Pump shall be designed for steady discharge with minimum pulsation to give smooth and quiet operation. Output of pump shall not vary more than 10 percent between no load and full load on the elevator car.

C. Motor: Standard manufacture motor specifically designed for oil-hydraulic elevator service. Duty rating shall be selected for specified speed and load.

D. Control System: Shall be microprocessor based and protected from environmental extremes and excessive vibrations in a NEMA 1 enclosure.

E. Oil Control Unit: The following components shall be built into a single housing. Welded manifolds with separate valves to accomplish each function are not acceptable. Adjustments shall be accessible and be made without removing the assembly from the oil line.
1. Relief valve shall be externally adjustable and be capable of bypassing the total oil flow without increasing back pressure more than 10 percent above that required to barely open the valve.
a. Up start and stop valve shall be adjustable and designed to bypass oil flow during start and stop of motor pump assembly. Valve shall close slowly, gradually diverting oil to or from the jack unit, ensuring smooth up starts and up stops.
b. Check valve shall be designed to close quietly without permitting any perceptible reverse flow.
c. Lowering valve and leveling valve shall be adjustable for down start speed, lowering speed, leveling speed and stopping speed to ensure smooth "down" starts and stops.

The leveling valve shall be designed to level the car to the floor in the direction the car is traveling after slowdown is initiated.

F. Solid State Starting: Provide an electronic starter featuring adjustable starting currents.
   1. Oil Type: USDA certified biobased product, ultra low toxicity, readily biodegradable, energy efficient, high performing fluid made from canola oil with antioxidant, anticorrosive, antifoaming, and metal-passivating additives. Especially formulated for operating in environmentally sensitive areas. USDA certified biobased product, >90% bio-based content, per ASTM D6866.

2.05 HOISTWAY ENTRANCES

A. Doors and Frames: Provide complete hollow metal type hoistway entrances at each hoistway opening bolteddown construction.
   1. Manufacturer's standard entrance design consisting of hangers, doors, hanger supports, hanger covers, fascia plates, sight guards, and necessary hardware.

B. Main landing door & frame finish: ASTM A1008 steel panels, factory applied powder coat finish.

C. Typical door & frame finish: ASTM A 366 steel panels,factory applied powder coat enamel finish.

D. Interlocks: Equip each hoistway entrance with an approved type interlock tested as required by code. Provide door restriction devices as required by code.

E. Door Hanger and Tracks: Provide sheave type two point suspension hangers and tracks for each hoistway horizontal sliding door.
   1. Sheaves: Polyurethane tires with ball bearings properly sealed to retain grease.
   2. Hangers: Provide an adjustable device beneath the track to limit the up-thrust of the doors during operation.
   3. Tracks: Drawn steel shapes, smooth surface and shaped to conform to the hanger sheaves.

F. Hoistway Sills: Extruded metal, with groove(s) in top surface. Provide mill finish on nickel silver.

2.06 CONTROLS

A. Controller: The elevator control system shall be microprocessor based and software oriented. Control of the elevator shall be automatic in operation by means of push buttons in the car numbered to correspond to floors served, for registering car stops, and by "up-down" push buttons at each intermediate landing and "call" push buttons at terminal landings.

B. Automatic Light and Fan shut down: The control system shall evaluate the system activity and automatically turn off the cab lighting and ventilation fan during periods of inactivity. The settings shall be field programmable.

C. Elevator Controls: Provide landing buttons and hall lanterns.

D. Door Controls:
   1. Program door control to open doors automatically when car arrives at floor.
   2. Render "Door Close" button inoperative when car is standing at dispatching terminal with doors open.
   3. If doors are prevented from closing for approximately ten seconds because of an obstruction, automatically disconnect door reopening devices, close doors more slowly until obstruction is cleared. Sound buzzer.
   4. Door Safety Devices: Moveable, retractable safety edges, quiet in operation; equip with photo-electric light rays.

E. Landing Buttons: Stainless steel type, one for originating UP and one for originating DOWN calls, one button only at terminating landings; marked with arrows.

F. Landing Position Indicators: Illuminating white.

G. Provide "Firefighter's Operation" in accordance with applicable code. Designated Landing: 1st flor.

2.07 EMERGENCY POWER

A. Arrange elevator operation to operate under emergency power when normal power supply fails. Provide controls to coordinate with generator transfer switch.

B. Emergency Power Supply: Self-contained battery power to lower elevator to ground floor only.

2.08 HALL STATIONS

A. Hall Stations, General: Provide buttons with red-illuminating LED halos to indicate that a call has been registered at that floor for the indicated direction. Provide 1 set of pushbutton risers.
   1. Provide one pushbutton riser with faceplates having a brushed stainless steel finish.

B. 1. Phase 1 firefighter's service key switch, with instructions, shall be incorporated into the hall station at the designated level.

C. microbanhydro
   1. Floor Identification Pads: Provide door jamb pads at each floor. Jamb pads shall comply with Americans with Disabilities Act (ADA) requirements.
   2. Hall Position Indicator: Not Applicable
   3. Hall lanterns: Not Applicable
   4. Special Equipment: Not Applicable

2.09 MISCELLANEOUS ELEVATOR COMPONENTS

A. Oil Hydraulic Silencer: Install an oil hydraulic silencer (muffler device) at the power unit location. The silencer shall contain pulsation absorbing material inserted in a blowout proof housing arranged for inspecting interior parts without removing unit from oil line.

2.10 ELECTRICAL CHARACTERISTICS AND COMPONENTS

A. Electrical Characteristics:
   1. 50 hp.
   2. 125 rated load amperes.
   3. 208 volts, three phase, 60 Hz.
   4. 175 amperes maximum fuse size.
   5. 160 minimum circuit capacity.
   6. 90 percent minimum power factor at rated load.
   7. Starter Characteristics: Reduced voltage maximum 120 and drawn for 5 seconds.
   8. Refer to Section 26 0583 for additional requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that hoistway, pit, and machine room are ready for work of this section.

C. Verify hoistway shaft and openings are of correct size and within tolerance.

D. Verify location and size of machine foundation and position of machine foundation bolts.

E. Verify that electrical power is available and of the correct characteristics.

3.02 PREPARATION

A. Arrange for temporary electrical power for installation work and testing of elevator components.

B. Excavate for hydraulic cylinder casing and hydraulic lines between plunger and remote machine room in accordance with Section 31 2316.

3.03 INSTALLATION

A. Install system components. Connect equipment to building utilities.

B. Provide conduit, boxes, wiring, and accessories.

C. Install hydraulic piping between cylinder and pump unit.

D. Mount machines on vibration and acoustic isolators, on bed plate and concrete pad. Place on structural supports and bearing plates. Securely fasten to building supports. Prevent lateral displacement.

E. Accommodate equipment in space indicated.

F. Install guide rails using threaded bolts with metal shims and lock washers under nuts. Compensate for expansion and contraction movement of guide rails.

G. Accurately machine and align guide rails. Form smooth joints with machined splice plates.

H. Coordinate installation of hoistway wall construction.

I. Install hoistway door sills, frames, and headers in hoistway walls. Grout sills in place. Set entrances in vertical alignment with car openings and aligned with plumb hoistway lines.

J. Fill hoistway door frames solid with grout in accordance with Section 04 2000.

K. Structural Metal Surfaces: Clean surfaces of rust, oil or grease; wipe clean with solvent; prime two coats.

L. Machine Room Components: Clean and degrease; prime one coat, finish with one coat of enamel.

M. Adjust equipment for smooth and quiet operation.

3.04 ERECTION TOLERANCES

A. Guide Rail Alignment: Plumb and parallel to each other in accordance with ASME A17.1 .

B. Cab Movement on Aligned Guide Rails: Smooth movement, with no objectionable lateral or oscillating movement or vibration.

3.05 ADJUSTING

A. Adjust for smooth acceleration and deceleration of car so not to cause passenger discomfort.

B. Adjust automatic floor leveling feature at each floor to achieve 1/4 inch from flush.

3.06 CLEANING

A. Remove protective coverings from finished surfaces.

B. Clean surfaces and components ready for inspection.

3.07 PROTECTION

A. Do not permit construction traffic within cab after cleaning.

B. Protect installed products until project completion.

C. Touch-up, repair, or replace damaged products before Date of Substantial Completion.

3.08 MAINTENANCE

A. Provide a separate maintenance contract for specified maintenance service.

1. Initial Maintenance Service: Beginning at Substantial Completion, provide 12 months' full maintenance service by skilled employees of the elevator Installer. Include monthly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper elevator operation at rated speed and capacity. Provide parts and supplies as used in the manufacture and installation of original equipment.
2. Include 24-hour-per-day, 7-day-per-week emergency callback service for 12 month period.
   a. Retain subparagraph below with either of above. Revise to one hour for hospitals, etc., and for metropolitan areas or to more than two hours for remote locations.
   b. Response Time: Three hours or less.

3. Continuing Maintenance Proposal: Provide a continuing maintenance proposal from Installer to Owner, in the form of a standard yearly (or other period) maintenance agreement, starting on date initial maintenance service is concluded. State services, obligations, conditions, and terms for agreement period and for future renewal options.
4. Continuing Maintenance Proposal: Provide a continuing maintenance proposal from Installer to Owner with terms, conditions, and obligations as set forth in, and in the same form as, "Draft of Elevator Maintenance Agreement" at end of this Section, starting on date initial maintenance service is concluded.

B. Perform maintenance work using competent and qualified personnel under the supervision and in the direct employ of the elevator manufacturer or original installer.

C. Maintenance service shall not be assigned or transferred to any agent or subcontractor without prior written consent of Owner.

D. Examine system components every two months. Clean, adjust, and lubricate equipment.

E. Include systematic examination, adjustment, and lubrication of elevator equipment. Maintain hydraulic fluid levels. Repair or replace parts whenever required. Use parts produced by the manufacturer of the original equipment. Replace wire ropes when necessary to maintain the required factor of safety.

F. Perform work without removing cars during peak traffic periods.

END OF SECTION

SECTION 21 0050

FIRE SUPPRESSION EXECUTION

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes the following:
   1. Definitions
   2. Coordination.
   3. Piping materials and installation instructions common to most piping systems.
   4. Mechanical sleeve seals.
   5. Sleeves.
   6. Escutcheons.
   7. Grout.
   8. Fire-suppression demolition.
   9. Concrete bases.
   10. Supports and anchorages.

1.02 RELATED DOCUMENTS

A. Drawings, General Provisions of the Contract, including General Conditions, Supplementary General Conditions, other Division 00 & 01 Specification Sections, shall apply to this division.

B. These requirements apply to all Division 21 work.

1.03 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.04 COORDINATION

A. Coordination: Coordinate construction operations to ensure efficient and orderly installation of the Work.
   1. Coordinate construction operations, that depend on each other for proper installation, connection, and operation.
   2. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
   3. Coordinate installation of different components with other contractors to ensure maximum accessibility for required maintenance, service, and repair.
   4. Make adequate provisions to accommodate items scheduled for later installation.
   5. Where availability of space is limited, coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair of all components.

B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
   1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.

C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
   1. Preparation of Construction Schedule.
   2. Preparation of the Schedule of Values.
   3. Installation and removal of temporary facilities and controls.
   4. Delivery and processing of submittals.
   5. Progress meetings.
   6. Preinstallation conferences.
   7. Project closeout activities.
   8. Startup and adjustment of systems.
   9. Project closeout activities.

1.05 PROJECT MEETINGS

A. General: Attend meetings and conferences at Project site, unless otherwise indicated.
   1. Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Engineer of scheduled meeting dates and times.
   2. Agenda: Request the meeting agenda if not furnished prior to meeting.
   3. Minutes: Record significant discussions and agreements achieved. Request the meeting minutes if not furnished. Note all discrepancies and notify Engineer of all changes to the Work or to the Contract Documents.

B. Preconstruction Conference: Attend the preconstruction conference before starting construction, no later than 15 days after execution of the Agreement to review responsibilities and personnel assignments.
   1. Attendees: Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
   2. Agenda: Discuss items of significance that could affect progress, including the following as applicable:
      a. Tentative construction schedule.
      b. Phasing.
      c. Critical work sequencing and long-lead items.
      d. Designation of key personnel and their duties.
      e. Procedures for processing field decisions and Change Orders.
      f. Procedures for requests for interpretations (RFIs).
      g. Procedures for testing and inspecting.
      h. Procedures for processing Applications for Payment.
      i. Distribution of the Contract Documents.
      j. Submittal procedures.
      k. LEED requirements.
      l. Preparation of Record Documents.
      m. Use of the premises.
      n. Work restrictions.
      o. Owner's occupancy requirements.
      p. Responsibility for temporary facilities and controls.
      q. Construction waste management and recycling.

r. Parking availability.
s. Office, work, and storage areas.
t. Equipment deliveries and priorities.
u. First aid.
v. Security.
w. Progress cleaning.
x. Working hours.

C. Preinstallation Conferences: Attend a preinstallation conference at Project site before each construction activity that requires coordination with other construction.
1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect of scheduled meeting dates.
2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following as applicable:
a. The Contract Documents.
b. Options.
c. Related requests for interpretations (RFIs).
d. Related Change Orders.
e. Purchases, deliveries, submittals.
f. Review of mockups.
g. Possible conflicts.
h. Compatibility problems.
i. Time schedules.
j. Weather limitations.
k. Manufacturer's written recommendations.
l. Warranty requirements.
m. Compatibility of materials.
n. Acceptability of substrates.
o. Space and access limitations.
p. Regulations of authorities having jurisdiction.
q. Testing and inspecting requirements.
r. Installation procedures.
s. Coordination with other work.
t. Required performance results.
u. Protection of adjacent work.
v. Protection of construction and personnel.
3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
4. Reporting: Distribute minutes of the meeting to each party present, to parties who should have been present, and to the Engineer.
5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

1.06 SUBMITTALS

A. Alternate Products: Alternate manufacturers, equipment and /or products must be specified or approved prior to bid in writing via addendum to be accepted. All costs associated with deviations from the basis of design shall be borne by the contractor. Deviations shall include alternate manufacturer and/or alternate product and shall include all significant dimensional, performance, electrical, or installation differences from the basis of design products. Costs for

reimbursement shall include the costs of other trades affected, and shall include all engineering costs to evaluate such deviations.

B. Substitutions: Unspecified manufacturers shall be considered substitutions and shall be submitted for consideration under the specified substitution procedures. Substitutions shall be submitted to the engineer for evaluation. If approved by the engineer, substitution shall be offered to the owner for consideration. All costs associated with substitutions shall be borne by the contractor. Costs for reimbursement shall include the costs of other trades affected, and shall include all engineering costs to evaluate such deviations.

C. Coordination Drawings: Prepare Coordination Drawings (coordinated shop drawings) to maximize utilization of space for efficient installation of different components and for installation of products and materials fabricated by separate entities. Submit to Engineer for review before starting work.
   1. Content: Project-specific information, drawn accurately to scale. Do not base Coordination Drawings on reproductions of the Contract Documents or standard printed data. Include the following information, as applicable:
      a. Indicate functional and spatial relationships of components of the work with all other systems and trades.
      b. Indicate required installation sequences.
      c. Indicate dimensions shown on the Contract Drawings and make specific note of dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide sketches of proposed alternate construction to Engineer for resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

D. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home and office telephone numbers. Provide names, addresses, and telephone numbers of individuals assigned as standbys in the absence of individuals assigned to Project. Submit to Engineer before starting work.
   1. Post copies of list in Project meeting room, in temporary field office, and by each temporary telephone. Keep list current at all times.

E. Make all necessary field measurements and investigations to assure that the equipment and assemblies will meet contract requirements. If equipment is submitted which differs in arrangement from that shown, provide drawings that show the rearrangement of all associated systems. Approval will be given only if all features of the equipment and associated systems, including accessibility, are equivalent to that required by the contract.

F. Prior to submitting shop drawings for review, contractor shall certify in writing that manufacturers of all major items of equipment have each reviewed drawings and specifications, and have jointly coordinated and properly integrated their equipment and controls to provide a complete and efficient installation.

G. Welding certificates.

1.07 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
   1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
   2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Electrical Characteristics for Fire-Suppression Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified at contractor's cost. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.08 WARRANTIES

A. All work shall include a parts and labor warranty on materials and workmanship for a period of 1 year.

B. Refer to Division 01 for additional warranty requirements.

PART 2 PRODUCTS

2.01 SLEEVES

A. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

B. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

C. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include underdeck clamp, clamping ring with set screws, nuts, and bolts for membrane flashing.

D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

2.02 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
   1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
   2. Design Mix: 5000-psi, 28-day compressive strength.
   3. Packaging: Premixed and factory packaged.

2.03 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
   1. Sealing Elements: EPDM-rubber or NBR interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
   2. Pressure Plates: Carbon steel.
   3. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements.

2.04 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.

C. One-Piece, Cast-Brass Type: With set screw, and polished chrome-plated finish.

D. Split-Casting, Cast-Brass Type: With concealed hinge, set screw and polished chrome-plated finish.

2.05 PIPE, TUBE, AND FITTINGS

A. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.06 JOINING MATERIALS

A. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

B. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

C. Welding Filler Metals: Comply with AWS D10.12.

D. Solvent Cements for Joining CPVC Plastic Piping: ASTM F 493.

PART 3 EXECUTION

3.01 FIRE-SUPPRESSION DEMOLITION

A. Refer to Division 01 Section “Cutting and Patching” and Division 02 Section “Selective Structure Demolition” for general demolition requirements and procedures.

B. Contractor shall be responsible for all work and costs associated with demolition of work shown or noted on plans.

C. Verify exact requirements before bid and include direct and related indirect costs in estimate including permit application, fees, dust control, protection of existing, temporary HVAC, fuel usage, scaffolding, disconnection, disposal, cutting and patching.

D. Occupied Buildings: For occupied buildings, coordinate with local management for communication with building users, occupants, and/or residents regarding potential for disruption, and provide 72 hour advance notification for planned outages. Install new work to the fullest extent possible before interrupting existing services to minimize disruption to residents. Provide temporary heat/cooling equipment to prevent disruptions from lasting over four hours.

E. In performing the work:
   1. Coordinate with existing conditions and other trades before starting work.
   2. Remove portions of walls, floors, ceilings, etc. required for access to demolished and new work.
   3. Disconnect, demolish, and remove systems, equipment, and components indicated to be removed.
   4. Piping to Be Removed: Remove portion indicated to be removed and cap or plug remaining with same or compatible piping material.
   5. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
   6. Equipment to Be Removed: Arrange for disconnection of electrical power. Disconnect and cap services and remove equipment. Remove related supports, anchorages, and concrete bases.
   7. Equipment to Be Removed and Reinstalled: Arrange for disconnection of electrical power. Disconnect and cap services and remove, clean, and store equipment. When appropriate, reinstall, reconnect, arrange for power connection and make equipment operational.
   8. Equipment to Be Removed and Salvaged: Arrange for disconnection of electrical power. Disconnect and cap services, remove equipment and deliver to Owner.

F. If new or existing to remain products are damaged during demolition, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

G. Subcontract the General Contractor to perform patching, repair or replacement of walls floors, ceilings, etc. removed for access to the work. General contractor shall repair finishes to match surrounding finishes.

3.02 COMMON REQUIREMENTS

A. Install according to manufacturer requirements and other Division specification sections.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of systems. Indicated locations and arrangements were used to size and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas. Where located within walls and other concealed areas subject to damage, provide suitable protection.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping and equipment with clearances to permit servicing.

G. Install piping at indicated slopes free of sags and bends and with fittings for branch connections and changes in direction.

H. Select system components with pressure rating equal to or greater than system operating pressure.

I. Contact manufacturer's representative to visit site and observe installation in order to confirm installation requirements and warranty coverage. Document observation in writing and include in O&M manuals.

J. Provide service and maintenance for not less than one year from the Date of Substantial Completion or for the warranty period specified in Division 01, whichever is longer. Refer to Division 01 for additional service and requirements.

3.03 PENETRATIONS

A. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls. Sleeve ends shall be flush with both wall surfaces unless otherwise noted. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level. Concrete and masonry penetrations: seal space outside of sleeves with grout. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.

B. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants.".

C. Roof-Penetrations: Seal penetration of roof with flexible boot-type flashing units applied in coordination with roofing work.

D. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetration using sleeve and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

E. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

F. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at. Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07." Comply with requirements in Division 07."

G. Apply firestopping to penetrations of fire and/or smoke rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07.

H. Penetrations of membranes of rated walls shall be protected by UL listed products. Coordinate exact installation conditions with selected fire sealants supplier. For penetrations which do not have a standard UL installation detail, arrange for engineering determination from damper manufacturer and/or sealant supplier and provide modifications required to match detail.

I. Install escutcheons for penetrations of walls, ceilings, and floors.

3.04 PIPING JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

D. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

E. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
   1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
   2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

F. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

G. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

H. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Comply with ASTM F 402, for safe-handling practice of cleaners, primers, and solvent cements. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.

3.05 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:
   1. Install unions, adjacent to each valve and at final connection to each piece of equipment.
   2. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
   3. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.06 INSTALLATION - COMMON REQUIREMENTS

A. Install equipment, valves, and specialties according to manufacturer installation instructions and recommendations.

B. Refer to other Sections of these Specifications for additional requirements.

C. Install to allow maximum possible headroom unless specific mounting heights are indicated.

D. Install work level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

E. Install work to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

F. Install to allow right of way for piping installed at required slope.

G. Contact equipment manufacturer's representative to visit site and observe installation in order to confirm installation requirements and warranty coverage. Document observation in writing and include in O&M manuals.

H. Provide service and maintenance for not less than one year from the Date of Substantial Completion or for the warranty period specified in Division 01, whichever is longer. Refer to Division 01 for additional service and requirements.

3.07 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
   1. Provide concrete bases which are plumb, level and fully supported to prevent shifting over time.
   2. Provide concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
   3. Place and secure anchorage devices. Install according to equipment manufacturer's recommendations, setting drawings, templates, diagrams, instructions, and directions for supported equipment. Provide anchor bolts according to anchor-bolt manufacturer's written instructions. Install anchor bolts to elevations required for proper attachment to supported equipment. Unless otherwise noted, install epoxy-coated anchor bolts to match equipment that extend through concrete base, and anchor into structural concrete.
   4. Where located on structural floor, provide dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
   5. Provide 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section "Cast-in-Place Concrete."

3.08 SUPPORTS AND ANCHORAGES

A. Provide supports to match construction type and adjacent assembly rating.

B. For combustible construction, provide wood supports and anchorages. Cut, fit, and place nailers, blocking, and anchorages to support, and anchor materials and equipment. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

C. For non-combustible building construction provide metal supports and anchorages. Refer to Division 05 Section "Metal Fabrications" for structural steel. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor HVAC materials and equipment. Field Welding shall comply with AWS D1.1.

D. Attach to substrates as required to support applied loads.

3.09 GROUTING

A. Clean surfaces that will come into contact with grout. Provide forms as required for placement of grout.

B. Mix and install grout for equipment base bearing surfaces, and anchors.

C. Place grout around anchors and completely filling equipment base and provide smooth bearing surface for equipment. Avoid air entrapment during placement of grout.

D. Allow grout to cure before loading or applying forces.

3.10 SLEEVE-SEAL INSTALLATION

A. Install to seal below-grade exterior wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

END OF SECTION

SECTION 21 0500

COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pipe, fittings, sleeves, escutcheons, seals, and connections for sprinkler systems.

1.02 RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.

B. Section 09 9123 - Interior Painting: Preparation and painting of interior fire protection piping systems.

C. Section 21 0553 - Identification for Fire Suppression Piping and Equipment: Piping identification.

D. Section 22 0553 - Identification for Plumbing Piping and Equipment: Piping identification.

E. Section 21 1300 - Fire-Suppression Sprinkler Systems: Sprinkler systems design.

F. Section 21 1200 - Fire-Suppression Standpipes: Standpipe design.

1.03 REFERENCE STANDARDS

A. ASME A112.18.1 - Plumbing Supply Fittings; 2012.

B. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Welding, Brazing, and Fusing Qualifications; 2015.

C. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2011.

D. ASME B16.9 - Factory-Made Wrought Buttwelding Fittings; 2012.

E. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings; 1999 (Reapproved 2014).

F. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.

G. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2015.

H. ASTM A536 - Standard Specification for Ductile Iron Castings; 1984 (Reapproved 2014).

I. ASTM F438 - Standard Specification for Socket-Type Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40; 2015.

J. ASTM F439 - Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80; 2013.

K. ASTM F442/F442M - Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe (SDR-PR); 2013.

L. ASTM F493 - Standard Specification for Solvent Cements for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe and Fittings; 2014.

M. AWWA C110/A21.10 - Ductile-Iron and Gray-Iron Fittings; 2012.

N. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings; 2012.

O. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast; 2009.

P. AWWA C606 - Grooved and Shouldered Joints; 2015.

Q. ITS (DIR) - Directory of Listed Products; current edition.

R. NFPA 13 - Standard for the Installation of Sprinkler Systems; 2016.

S. NFPA 14 - Standard for the Installation of Standpipe and Hose Systems; 2016.

T. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

1.04 COORDINATION

A. Coordinate bidding with other trades. For work not included by other trades or utility, include costs in bid for all work required for operational, UL listed fire protection systems (tap, underground piping, site work, PIV, backflow assembly, FDC, draft curtains, etc.). Provide itemized costs for adjacent and subcontracted work.

B. Coordinate design with building use and structure combustibility, hazard/flow requirements, pipe routing, offsets and listed head locations.

C. Coordinate fire protection design with local codes, requirements and AHJ interpretation before applying for permit..

D. Coordinate construction operations to ensure efficient and orderly installation of the Work.

1.05 SUBMITTALS

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

B. Product Data: Provide manufacturers catalogue information. Indicate flow data and ratings.

C. Shop Drawings: Indicate pipe materials used, jointing methods, supports, floor and wall penetration seals. Indicate installation, layout, weights, mounting and support details, and piping connections.

D. Alternate Products: Alternate manufacturers, equipment and /or products must be specified or approved prior to bid in writing via addendum to be accepted. All costs associated with deviations from the basis of design shall be borne by the contractor. Deviations shall include alternate manufacturer and/or alternate product and shall include all significant dimensional, performance, electrical, or installation differences from the basis of design products. Costs for reimbursement shall include the costs of other trades affected, and shall include all engineering costs to evaluate such deviations.

E. Substitutions: Unspecified manufacturers shall be considered substitutions and shall be submitted for consideration under the specified substitution procedures. Substitutions shall be submitted to the engineer for evaluation. If approved by the engineer, substitution shall be offered to the owner for consideration. All costs associated with substitutions shall be borne by the contractor. Costs for reimbursement shall include the costs of other trades affected, and shall include all engineering costs to evaluate such deviations.

F. Coordination Drawings: Prepare Coordination Drawings (coordinated shop drawings) to maximize utilization of space for efficient installation of different components and for installation of products and materials fabricated by separate entities. Submit to Engineer for review before starting work.
   1. Content: Project-specific information, drawn accurately to scale. Do not base Coordination Drawings on reproductions of the Contract Documents or standard printed data. Include the following information, as applicable:
      a. Indicate functional and spatial relationships of components of the work with all other systems and trades.
      b. Indicate required installation sequences.
      c. Indicate dimensions shown on the Contract Drawings and make specific note of dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide sketches of proposed alternate construction to Engineer for resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

G. Project Record Documents: Record actual locations of components and tag numbering.

H. Operation and Maintenance Data: Include installation instructions and spare parts lists.

I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this section with minimum 3 years experience. approved by manufacturer.

B. Conform to UL, FM, and Warnock Hersey requirements.

C. Valves: Bear FM, ITS (DIR), and UL (DIR) product listing label or marking. Provide manufacturer's name and pressure rating marked on valve body.

D. Products Requiring Electrical Connection: Listed and classified as suitable for the purpose specified and indicated.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store valves in shipping containers, with labeling in place.

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.

1.08 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 FIRE PROTECTION SYSTEMS

A. Sprinkler Systems: Conform to NFPA 13.

B. Standpipe and Hose Systems: Conform to NFPA 14.

C. Welding Materials and Procedures: Conform to ASME BPVC-IX.

2.02 BURIED PIPING

A. Ductile Iron Pipe: AWWA C151/A21.51.
   1. Fittings: AWWA C110/A21.10, standard thickness.
   2. Joints: AWWA C111/A21.11, rubber gasket.
   3. Mechanical Couplings: Shaped composition sealing gasket, steel bolts, nuts, and washers.

2.03 ABOVE GROUND PIPING

A. Steel Pipe: ASTM A53 Schedule 40, black.
   1. Steel Fittings: ASME B16.9, wrought steel, buttwelded or ASTM A234/A234M, wrought carbon steel or alloy steel.
   2. Malleable Iron Fittings: ASME B16.3, threaded fittings and ASTM A47/A47M.
   3. Mechanical Grooved Couplings: Malleable iron housing clamps to engage and lock, "C" shaped elastomeric sealing gasket, steel bolts, nuts, and washers; galvanized for galvanized pipe.

B. CPVC Pipe: ASTM F442/F442M, SDR 13.5 (wet systems only).
   1. Fittings: ASTM F438 Schedule 40, or ASTM F439 schedule 80, CPVC.
   2. Joints: Solvent welded, using ASTM F493 cement.

2.04 PIPE SLEEVES

A. Vertical Piping:
   1. Sleeve Length: 1 inch above finished floor.
   2. Provide sealant for watertight joint.

3. Drilled Penetrations: Provide 1-1/2 inch angle ring or square set in silicone adhesive around penetration.

B. Plastic, Sheet Metal, or Moisture-Resistant Fiber: Pipe passing through interior walls, partitions, and floors, unless steel or brass sleeves are specified below.

C. Pipe Passing Through Below Grade Exterior Walls:
1. Zinc coated or cast iron pipe.
2. Provide watertight space with link rubber or modular seal between sleeve and pipe on both pipe ends.

2.05 ESCUTCHEONS

A. Material:
1. Metals and Finish: Comply with ASME A112.18.1.

B. Construction:
1. One-piece for mounting on chrome-plated tubing or pipe and one-piece or split-pattern type elsewhere.
2. Internal spring tension devices or setscrews to maintain a fixed position against a surface.

2.06 PIPE HANGERS AND SUPPORTS

A. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron, adjustable swivel, split ring.

B. Hangers for Pipe Sizes 2 inches and Over: Carbon steel, adjustable, clevis.

C. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.

D. Wall Support for Pipe Sizes to 3 inches: Cast iron hook.

E. Wall Support for Pipe Sizes 4 inches and Over: Welded steel bracket and wrought steel clamp.

F. Vertical Support: Steel riser clamp.

G. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

2.07 MECHANICAL COUPLINGS

A. Rigid Mechanical Couplings for Grooved Joints:
1. Dimensions and Testing: Comply with AWWA C606.
2. Minimum Working Pressure: 300 psig.
3. Housing Material: Fabricate of ductile iron conforming to ASTM A536.
4. Housing Coating: Factory applied orange enamel.
5. Gasket Material: EPDM suitable for operating temperature range from minus 30 degrees F to 230 degrees F.
6. Bolts and Nuts: Hot dipped galvanized or zinc electroplated steel.
7. Provide stops for direct stab installation without field assembly.

PART 3 EXECUTION

3.01 FIRE SUPPRESSION DEMOLITION

A. Refer to Division 01 Section “Cutting and Patching” and Division 02 Section “Selective Structure Demolition” for general demolition requirements and procedures.

B. Disconnect, demolish, and remove fire-suppression systems, equipment and components indicated to be removed.
1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
3. Equipment to Be Removed: Disconnect and cap services and remove equipment.

4. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
5. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.02 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and foreign material, from inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.03 INSTALLATION

A. Install sprinkler system and service main piping, hangers, and supports in accordance with NFPA 13.

B. Install standpipe piping, hangers, and supports in accordance with NFPA 14.

C. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.

D. Install piping to conserve building space, to not interfere with use of space and other work.

E. Group piping whenever practical at common elevations.

F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

G. Inserts:
1. Provide inserts for placement in concrete formwork.
2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.

H. Pipe Hangers and Supports:
1. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
2. Place hangers within 12 inches of each horizontal elbow.
3. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
4. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
5. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
6. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

I. Slope piping and arrange systems to drain at low points. Use eccentric reducers to maintain top of pipe level.

J. Prepare pipe, fittings, supports, and accessories for finish painting. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

K. Do not penetrate building structural members unless indicated.

L. Provide sleeves when penetrating footings, floors, walls, partitions, and rated assemblies. Seal pipe and sleeve penetrations to achieve fire resistance equivalent to fire separation required.

M. Escutcheons:
   1. Install and firmly attach escutcheons at piping penetrations into finished spaces.
   2. Provide escutcheons on both sides of partitions separating finished areas through which piping passes.
   3. Use chrome plated escutcheons in occupied spaces and to conceal openings in construction.

N. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

3.04 CLEANING

A. Upon completion of work, clean all parts of the installation.

B. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

END OF SECTION

SECTION 21 0523

GENERAL-DUTY VALVES FOR WATER-BASED FIRE-SUPPRESSION PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Two-piece ball valves with indicators.

B. Check valves.

C. Bronze OS&Y gate valves.

D. Iron OS&Y gate valves.

E. Trim and drain valves.

1.02 RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.

B. Section 21 0500 - Common Work Results for Fire Suppression: Pipe and fittings.

C. Section 21 0553 - Identification for Fire Suppression Piping and Equipment.

D. Section 21 1300 - Fire-Suppression Sprinkler Systems.

E. Section 28 4600 - Fire Detection and Alarm.

F. Section 33 1416 - Site Water Utility Distribution Piping.

1.03 ABBREVIATIONS AND ACRONYMS

A. EPDM: Ethylene-propylene diene monomer.

B. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

C. NRS: Non-rising stem.

D. OS&Y: Outside screw and yoke.

E. PTFE: Polytetrafluoroethylene.

F. SBR: Styrene-butadiene rubber.

1.04 REFERENCE STANDARDS

A. ASME B31.9 - Building Services Piping; 2014.

B. AWWA C606 - Grooved and Shouldered Joints; 2015.

C. FM (AG) - FM Approval Guide; current edition.

D. NFPA 13 - Standard for the Installation of Sprinkler Systems; 2016.

E. NFPA 13R - Standard for the Installation of Sprinkler Systems in Low-Rise Residential Occupancies; 2016.

F. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

G. UL 262 - Gate Valves for Fire-Protection Service; Current Edition, Including All Revisions.

H. UL 312 - Check Valves for Fire-Protection Service; Current Edition, Including All Revisions.

I. UL 1091 - Standard for Butterfly Valves for Fire-Protection Service; Current Edition, Including All Revisions.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

1.06 SUBMITTALS

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

B. Product Data: Provide data on valves including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.

C. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

D. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts listings.

1.07 QUALITY ASSURANCE

A. Where listed products are specified, provide products listed, classified, and labeled by FM (AG), UL (DIR), or testing firm acceptable to authorities having jurisdiction as suitable for the purpose indicated.

B. Installer and Maintenance Contractor Qualifications:
   1. Company specializing in performing the work of this section with minimum five years documented experience.
   2. Trained and approved by manufacturer to design, install, test and maintain the equipment specified herein.
   3. Complies with manufacturer's certification requirements.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:
   1. Protect internal parts against rust and corrosion.
   2. Protect threads and flange faces.
   3. Set valves open to minimize exposure of functional surfaces.

B. Use the following precautions during storage:
   1. Maintain valve end protection and protect flanges and specialties from dirt.
      a. Provide temporary inlet and outlet caps.
      b. Maintain caps in place until installation.
   2. Store valves in shipping containers and maintain in place until installation.
      a. Store valves indoors and maintain at higher than ambient dew point temperature.
      b. If outdoor storage is unavoidable, store valves off the ground in watertight enclosures.

C. Use the following precautions for handling:
   1. Do not use operating handles or stems as lifting or rigging points.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. UL Listed: Provide valves listed in UL (DIR) under following headings and bearing UL mark:

B. Comply with NFPA 13 and NFPA 13R for valves.

C. Valve Pressure Ratings: Not less than minimum pressure rating indicated or higher as required.

D. Valve Sizes: Same as upstream piping unless otherwise indicated.

E. Valve Actuator Types:
   1. Handwheel: For other than quarter-turn trim and drain valves.
   2. Hand-lever: For quarter-turn trim and drain valves 2 NPS and smaller.

2.02 TWO-PIECE BALL VALVES WITH INDICATORS

A. UL 1091, except with ball instead of disc and FM (AG) standard listing for indicating valves (butterfly or ball type), Class Number 1112.

B. Description:
   1. Minimum Pressure Rating: 175 psig.
   2. Body Design: Two piece.

3. Body Material: Forged brass or bronze.
4. Port Size: Full or standard.
5. Seat: PTFE.
6. Stem: Bronze or stainless steel.
7. Ball: Chrome-plated brass.
8. Actuator: Worm gear or traveling nut.
9. End Connections for Valves 1 NPS through 2 NPS: Threaded ends.

2.03 CHECK VALVES

A. UL 312 and FM (AG) standard listing for check valves, Class Number 1045.

B. Minimum Pressure Rating: 175 psig.

C. Type: Center guided check valve.

D. Body Material: Cast iron, ductile iron.

E. Center guided check with elastomeric seal.

F. Hinge Spring: Stainless steel.

G. End Connections: Flanged, grooved, or threaded.

2.04 BRONZE OS&Y GATE VALVES

A. UL 262 and FM (AG) standard listing for fire-service water control valves (OS&Y and NRS-type gate valves).

B. Minimum Pressure Rating: 175 psig.

C. Body and Bonnet Material: Bronze or brass.

D. Wedge: One-piece bronze or brass.

E. Wedge Seat: Bronze.

F. Stem: Bronze or brass.

G. Packing: Non-asbestos PTFE.

H. Supervisory Switch: External.

I. End Connections: Threaded.

2.05 IRON OS&Y GATE VALVES

A. UL 262 and FM (AG) standard listing for fire-service water control valves (OS&Y and NRS-type gate valves).

B. Minimum Pressure Rating: 175 psig.

C. Body and Bonnet Material: Cast or ductile iron.

D. Wedge: Cast or ductile iron, or bronze with elastomeric coating.

E. Wedge Seat: Cast or ductile iron, or bronze with elastomeric coating.

F. Stem: Brass or bronze.

G. Packing: Non-asbestos PTFE.

H. Supervisory Switch: External.

I. End Connections: Flanged.

2.06 TRIM AND DRAIN VALVES

A. Ball Valves:
   1. Description:
      a. Pressure Rating: 175 psig.
      b. Body Design: Two piece.

c. Body Material: Forged brass or bronze.
d. Port Size: Full or standard.
e. Seat: PTFE.
f. Stem: Bronze or stainless steel.
g. Ball: Chrome-plated brass.
h. Actuator: Hand-lever.
i. End Connections for Valves 1 NPS through 2-1/2 NPS: Threaded ends.
j. End Connections for Valves 1-1/4 NPS and 2-1/2 NPS: Grooved ends.

PART 3 EXECUTION

3.01 EXAMINATION

A. Confirm valve interior to be free of foreign matter and corrosion.

B. Remove packing materials.

C. Examine guides and seats by operating valves from the fully open position to the fully closed position.

D. Examine valve threads and mating pipe for form and cleanliness.

E. Examine mating flange faces for conditions that might cause leakage.
1. Check bolting for proper size, length, and material.
2. Verify gasket for size, defects, damage, and suitable material composition for service.
3. Replace all defective valves with new valves.

3.02 INSTALLATION

A. Comply with specific valve installation requirements and application in the following Sections:
1. Section 21 1300 for application of valves in wet and dry pipe, fire-suppression sprinkler systems.
2. Section 33 1416 for application of valves in fire-suppression water-service piping outside the building.

B. Install listed fire protection shutoff valves supervised-open, located to control sources of water supply except from fire department connections.
1. Install permanent identification signs indicating portion of system controlled by each valve.

C. Install check valve in water supply connections and backflow preventer at potable water supply connections.

D. Valves with threaded connections to have unions at equipment arranged for easy access, service, maintenance, and equipment removal without system shutdown.

E. Valves in horizontal piping installed with stem at or above the pipe center.

F. Position valves to allow full stem movement.

G. Install valve tags. Comply with Section 21 0553 requirements for valve tags, schedules, and signs on surfaces concealing valves; and the appropriate NFPA standard applying to the piping system in which valves are installed.

END OF SECTION

SECTION 21 0553

IDENTIFICATION FOR FIRE SUPPRESSION PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Stencils.

D. Pipe markers.

E. Ceiling tacks.

1.02 RELATED REQUIREMENTS

A. Section 09 9123 - Interior Painting: Stencil paint.

1.03 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems; 2015.

1.04 SUBMITTALS

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

B. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.

C. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

D. Product Data: Provide manufacturers catalog literature for each product required.

E. Manufacturer's Installation Instructions: Indicate special procedures, and installation instructions.

F. Project Record Documents: Record actual locations of tagged valves.

PART 2 PRODUCTS

2.01 IDENTIFICATION APPLICATIONS

A. Control Panels: Nameplates.

B. Instrumentation: Tags.

C. Major Control Components: Nameplates.

D. Piping (where exposed or accessible): Pipe markers.

E. Pumps: Nameplates.

F. Small-sized Equipment: Tags.

G. Valves: Nameplates and ceiling tacks where above lay-in ceilings.

2.02 NAMEPLATES

A. Description: Laminated three-layer plastic with engraved letters.

2.03 TAGS

A. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch diameter.

B. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.

C. Valve Tag Chart: Typewritten letter size list in anodized aluminum frame.

2.04 STENCILS

A. Stencils: With clean cut symbols and letters of following size:
   1. 3/4 to 1-1/4 inch Outside Diameter of Insulation or Pipe: 8 inch long color field, 1/2 inch high letters.
   2. 1-1/2 to 2 inch Outside Diameter of Insulation or Pipe: 8 inch long color field, 3/4 inch high letters.
   3. 2-1/2 to 6 inch Outside Diameter of Insulation or Pipe: 12 inch long color field, 1-1/4 inch high letters.

B. Paint for Stencils: As specified in Section 09 9123, semi-gloss enamel, colors conforming to ASME A13.1.

2.05 PIPE MARKERS

A. Color: Conform to ASME A13.1.

B. 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.

C. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

D. Underground Plastic Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

2.06 CEILING TACKS

A. Description: Steel with 3/4 inch diameter color coded head.

PART 3 EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

B. Prepare surfaces in accordance with Section 09 9123 for stencil painting.

3.02 INSTALLATION

A. Install 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. Apply stencil painting in accordance with Section 09 9123.

D. Install plastic pipe markers in accordance with manufacturer's instructions.

E. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.

F. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.

G. Locate ceiling tacks to locate valves above T-bar type panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION

SECTION 21 0700

FIRE-SUPPRESSION SYSTEMS INSULATION

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Insulation Materials:
      a. Calcium silicate.
      b. Cellular glass.
      c. Flexible elastomeric.
      d. Mineral fiber.
   2. Insulating cements.
   3. Adhesives.
   4. Mastics.
   5. Sealants.
   6. Factory-applied jackets.
   7. Field-applied fabric-reinforcing mesh.
   8. Field-applied jackets.
   9. Tapes.
   10. Securements.

1.02 SUBMITTALS

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

B. Shop Drawings:
   1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
   2. Detail attachment and covering of heat tracing inside insulation.
   3. Detail insulation application at pipe expansion joints for each type of insulation.
   4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
   5. Detail removable insulation at piping specialties and equipment connections.
   6. Detail application of field-applied jackets.
   7. Detail application at linkages of control devices.
   8. Detail field application for fire-suppression water storage tanks.

C. Field quality-control reports.

1.03 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, and cement material containers, with appropriate markings of applicable testing and inspecting agency.
   1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
   2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

PART 2 PRODUCTS

2.01 INSULATION MATERIALS

A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Calcium Silicate:
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Industrial Insulation Group (The); Thermo-12 Gold.
   2. Preformed Pipe Sections: Flat-, curved-, and grooved-block sections of noncombustible, inorganic, hydrous calcium silicate with a non-asbestos fibrous reinforcement. Comply with ASTM C 533, Type I.
   3. Prefabricated Fitting Covers: Comply with ASTM C 450 and ASTM C 585 for dimensions used in preforming insulation to cover valves, elbows, tees, and flanges.

G. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Cell-U-Foam Corporation; Ultra-CUF.
      b. Pittsburgh Corning Corporation; Foamglas Super K.
   2. Block Insulation: ASTM C 552, Type I.
   3. Special-Shaped Insulation: ASTM C 552, Type III.
   4. Board Insulation: ASTM C 552, Type IV.
   5. Preformed Pipe Insulation without Jacket: Comply with ASTM C 552, Type II, Class 1.
   6. Preformed Pipe Insulation with Factory-Applied ASJ: Comply with ASTM C 552, Type II, Class 2.
   7. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.

H. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Aeroflex USA Inc.; Aerocel.
      b. Armacell LLC; AP Armaflex.
      c. RBX Corporation; Insul-Sheet 1800 and Insul-Tube 180.

I. Mineral-Fiber, Preformed Pipe Insulation:
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Fibrex Insulations Inc.; Coreplus 1200.
      b. Johns Manville; Micro-Lok.
      c. Knauf Insulation; 1000(Pipe Insulation).
      d. Manson Insulation Inc.; Alley-K.
      e. Owens Corning; Fiberglas Pipe Insulation.
   2. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
   3. Type II, 1200 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type II, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.02 INSULATING CEMENTS

A. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449/C 449M.
   1. Products: Subject to compliance with requirements, provide one of the following:

a. Insulco, Division of MFS, Inc.; SmoothKote.
b. P. K. Insulation Mfg. Co., Inc.; PK No. 127, and Quik-Cote.
c. Rock Wool Manufacturing Company; Delta One Shot.

2.03 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Calcium Silicate Adhesive: Fibrous, sodium-silicate-based adhesive with a service temperature range of 50 to 800 deg F.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Childers Products, Division of ITW; CP-97.
b. Foster Products Corporation, H. B. Fuller Company; 81-27/81-93.
c. Marathon Industries, Inc.; 290.
d. Mon-Eco Industries, Inc.; 22-30.
e. Vimasco Corporation; 760.

C. Cellular-Glass, Phenolic, Polyisocyanurate, and Polystyrene Adhesive: Solvent-based resin adhesive, with a service temperature range of minus 75 to plus 300 deg F.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Childers Products, Division of ITW; CP-96.
b. Foster Products Corporation, H. B. Fuller Company; 81-33.

D. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Aeroflex USA Inc.; Aeroseal.
b. Armacell LCC; 520 Adhesive.
c. Foster Products Corporation, H. B. Fuller Company; 85-75.
d. RBX Corporation; Rubatex Contact Adhesive.

E. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Childers Products, Division of ITW; CP-82.
b. Foster Products Corporation, H. B. Fuller Company; 85-20.
c. ITW TACC, Division of Illinois Tool Works; S-90/80.
d. Marathon Industries, Inc.; 225.
e. Mon-Eco Industries, Inc.; 22-25.

F. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A, for bonding insulation jacket lap seams and joints.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Childers Products, Division of ITW; CP-82.
b. Foster Products Corporation, H. B. Fuller Company; 85-20.
c. ITW TACC, Division of Illinois Tool Works; S-90/80.
d. Marathon Industries, Inc.; 225.
e. Mon-Eco Industries, Inc.; 22-25.

G. PVC Jacket Adhesive: Compatible with PVC jacket.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Dow Chemical Company (The); 739, Dow Silicone.
b. Johns Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
c. P.I.C. Plastics, Inc.; Welding Adhesive.
d. Speedline Corporation; Speedline Vinyl Adhesive.

2.04 MASTICS

A. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:
    a. Childers Products, Division of ITW; CP-35.
    b. Foster Products Corporation, H. B. Fuller Company; 30-90.
    c. ITW TACC, Division of Illinois Tool Works; CB-50.
    d. Marathon Industries, Inc.; 590.
    e. Mon-Eco Industries, Inc.; 55-40.
    f. Vimasco Corporation; 749.
2. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm at 43-mil dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.
5. Color: White.

B. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.
1. Products: Subject to compliance with requirements, provide one of the following:
    a. Childers Products, Division of ITW; CP-10.
    b. Foster Products Corporation, H. B. Fuller Company; 35-00.
    c. ITW TACC, Division of Illinois Tool Works; CB-05/15.
    d. Marathon Industries, Inc.; 550.
    e. Mon-Eco Industries, Inc.; 55-50.
    f. Vimasco Corporation; WC-1/WC-5.
2. Water-Vapor Permeance: ASTM F 1249, 3 perms at 0.0625-inch dry film thickness.
3. Service Temperature Range: Minus 20 to plus 200 deg F.
4. Solids Content: 63 percent by volume and 73 percent by weight.
5. Color: White.

2.05 SEALANTS

A. Joint Sealants for Cellular-Glass Products:
1. Products: Subject to compliance with requirements, provide one of the following:
    a. Childers Products, Division of ITW; CP-76.
    b. Foster Products Corporation, H. B. Fuller Company; 30-45.
    c. Marathon Industries, Inc.; 405.
    d. Mon-Eco Industries, Inc.; 44-05.
    e. Pittsburgh Corning Corporation; Pittseal 444.
    f. Vimasco Corporation; 750.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Permanently flexible, elastomeric sealant.
4. Service Temperature Range: Minus 100 to plus 300 deg F.
5. Color: White or gray.

B. FSK and Metal Jacket Flashing Sealants:
1. Products: Subject to compliance with requirements, provide one of the following:
    a. Childers Products, Division of ITW; CP-76-8.
    b. Foster Products Corporation, H. B. Fuller Company; 95-44.
    c. Marathon Industries, Inc.; 405.
    d. Mon-Eco Industries, Inc.; 44-05.
    e. Vimasco Corporation; 750.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: Aluminum.

C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:
1. Products: Subject to compliance with requirements, provide the following:
    a. Childers Products, Division of ITW; CP-76.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: White.

2.06 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
   1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
   2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
   3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.07 FIELD-APPLIED FABRIC-REINFORCING MESH

A. Woven Polyester Fabric: Approximately 1 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. inch, in a Leno weave.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Foster Products Corporation, H. B. Fuller Company; Mast-A-Fab.
      b. Vimasco Corporation; Elastafab 894.

2.08 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Johns Manville; Zeston.
      b. P.I.C. Plastics, Inc.; FG Series.
      c. Proto PVC Corporation; LoSmoke.
      d. Speedline Corporation; SmokeSafe.
   2. Adhesive: As recommended by jacket material manufacturer.
   3. Color: Color-code jackets based on system. Color as selected by Architect.
   4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
      a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.
   5. Factory-fabricated tank heads and tank side panels.

C. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105 or 5005, Temper H-14.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Childers Products, Division of ITW; Metal Jacketing Systems.
      b. PABCO Metals Corporation; Surefit.
      c. RPR Products, Inc.; Insul-Mate.
   2. Factory cut and rolled to size.
   3. Finish and thickness are indicated in field-applied jacket schedules.
   4. Moisture Barrier for Indoor Applications: 3-mil- thick, heat-bonded polyethylene and kraft paper.
   5. Moisture Barrier for Outdoor Applications: 3-mil- thick, heat-bonded polyethylene and kraft paper.
   6. Factory-Fabricated Fitting Covers:
      a. Same material, finish, and thickness as jacket.
      b. Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.

c. Tee covers.
d. Flange and union covers.
e. End caps.
f. Beveled collars.
g. Valve covers.
h. Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

2.09 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0835.
b. Compac Corp.; 104 and 105.
c. Ideal Tape Co., Inc., an American Biltrite Company; 428 AWF ASJ.
d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
2. Width: 3 inches.
3. Thickness: 11.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
b. Compac Corp.; 110 and 111.
c. Ideal Tape Co., Inc., an American Biltrite Company; 491 AWF FSK.
d. Venture Tape; 1525 CW, 1528 CW, and 1528 CW/SQ.
2. Width: 3 inches.
3. Thickness: 6.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive. Suitable for indoor and outdoor applications.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0555.
b. Compac Corp.; 130.
c. Ideal Tape Co., Inc., an American Biltrite Company; 370 White PVC tape.
d. Venture Tape; 1506 CW NS.
2. Width: 2 inches.
3. Thickness: 6 mils.
4. Adhesion: 64 ounces force/inch in width.
5. Elongation: 500 percent.
6. Tensile Strength: 18 lbf/inch in width.

D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
b. Compac Corp.; 120.
c. Ideal Tape Co., Inc., an American Biltrite Company; 488 AWF.
d. Venture Tape; 3520 CW.

2. Width: 2 inches.
3. Thickness: 3.7 mils.
4. Adhesion: 100 ounces force/inch in width.
5. Elongation: 5 percent.
6. Tensile Strength: 34 lbf/inch in width.

2.10 SECUREMENTS

A. Aluminum Bands: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 3/4 inch wide with wing seal.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Childers Products; Bands.
      b. PABCO Metals Corporation; Bands.
      c. RPR Products, Inc.; Bands.

B. Insulation Pins and Hangers:
   1. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
      a. Products: Subject to compliance with requirements, provide one of the following:
         1) AGM Industries, Inc.; Tactoo Insul-Hangers, Series T.
         2) GEMCO; Perforated Base.
         3) Midwest Fasteners, Inc.; Spindle.
      b. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
      c. Spindle: Aluminum, fully annealed, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
      d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
   2. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
      a. Products: Subject to compliance with requirements, provide one of the following:
         1) AGM Industries, Inc.; Tactoo Insul-Hangers, Series TSA.
         2) GEMCO; Press and Peel.
         3) Midwest Fasteners, Inc.; Self Stick.
      b. Baseplate: Galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
      c. Spindle: Aluminum, fully annealed, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
      d. Adhesive-backed base with a peel-off protective cover.
   3. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick, aluminum sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
      a. Products: Subject to compliance with requirements, provide one of the following:
         1) AGM Industries, Inc.; RC-150.
         2) GEMCO; R-150.
         3) Midwest Fasteners, Inc.; WA-150.
         4) Nelson Stud Welding; Speed Clips.
      b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.

C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

D. Wire: 0.062-inch soft-annealed, stainless steel.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. C & F Wire.
    b. Childers Products.
    c. PABCO Metals Corporation.
    d. RPR Products, Inc.

PART 3 EXECUTION

3.01 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.02 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment and piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment and pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
    1. Install insulation continuously through hangers and around anchor attachments.
    2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
    3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
    4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:
    1. Draw jacket tight and smooth.

2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
   a. For below ambient services, apply vapor-barrier mastic over staples.
4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above ambient services, do not install insulation to the following:
1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Manholes.
5. Handholes.
6. Cleanouts.

3.03 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Below-Grade Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

F. Insulation Installation at Floor Penetrations:
   1. Pipe: Install insulation continuously through floor penetrations.
   2. Seal penetrations through fire-rated assemblies.

3.04 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
   1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
   2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
   3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
   4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
   5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.
   6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
   7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
   8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
   9. Stencil or label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.05 CALCIUM SILICATE INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes:
   1. Secure single-layer insulation with stainless-steel bands at 12-inch intervals and tighten bands without deforming insulation materials.
   2. Install 2-layer insulation with joints tightly butted and staggered at least 3 inches. Secure inner layer with wire spaced at 12-inch intervals. Secure outer layer with stainless-steel bands at 12-inch intervals.
   3. Apply a skim coat of mineral-fiber, hydraulic-setting cement to insulation surface. When cement is dry, apply flood coat of lagging adhesive and press on one layer of glass cloth or tape. Overlap edges at least 1 inch. Apply finish coat of lagging adhesive over glass cloth or tape. Thin finish coat to achieve smooth, uniform finish.

B. Insulation Installation on Pipe Flanges:
   1. Install preformed pipe insulation to outer diameter of pipe flange.
   2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
   3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of block insulation of same material and thickness as pipe insulation.
   4. Finish flange insulation same as pipe insulation.

C. Insulation Installation on Pipe Fittings and Elbows:
   1. Install preformed sections of same material as straight segments of pipe insulation when available.
   2. When preformed insulation sections of insulation are not available, install mitered sections of calcium silicate insulation. Secure insulation materials with wire or bands.
   3. Finish fittings insulation same as pipe insulation.

D. Insulation Installation on Valves and Pipe Specialties:
   1. Install mitered segments of calcium silicate insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
   2. Install insulation to flanges as specified for flange insulation application.
   3. Finish valve and specialty insulation same as pipe insulation.

3.06 CELLULAR-GLASS INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and applicable insulation joint sealant.
3. For insulation with factory-applied jackets on above ambient services, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below ambient services, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:
1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as pipe insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:
1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:
1. Install preformed sections of cellular-glass insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

3.07 FLEXIBLE ELASTOMERIC INSULATION INSTALLATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:
1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:
1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:
1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.08 MINERAL-FIBER INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes:
   1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
   2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and applicable insulation joint sealant.
   3. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
   4. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:
   1. Install preformed pipe insulation to outer diameter of pipe flange.
   2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
   3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
   4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:
   1. Install preformed sections of same material as straight segments of pipe insulation when available.
   2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:
   1. Install preformed sections of same material as straight segments of pipe insulation when available.
   2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
   3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
   4. Install insulation to flanges as specified for flange insulation application.

3.09 FIELD-APPLIED JACKET INSTALLATION

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.
   1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
   2. Embed glass cloth between two 0.062-inch- thick coats of lagging adhesive.
   3. Completely encapsulate insulation with coating, leaving no exposed insulation.

B. Where FSK jackets are indicated, install as follows:
   1. Draw jacket material smooth and tight.
   2. Install lap or joint strips with same material as jacket.
   3. Secure jacket to insulation with manufacturer's recommended adhesive.
   4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.
   5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

C. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.
   1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

D. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.10 FINISHES

A. Equipment and Pipe Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below.
   1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
      a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

D. Do not field paint aluminum or stainless-steel jackets.

3.11 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:
   1. Inspect field-insulated equipment, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location(s) for each type of equipment defined in the "Equipment Insulation Schedule" Article. For large equipment, remove only a portion adequate to determine compliance.
   2. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.12 EQUIPMENT INSULATION SCHEDULE

A. Insulation materials and thicknesses are identified below. If more than one material is listed for a type of equipment, selection from materials listed is Contractor's option.

B. Insulate indoor and outdoor equipment in paragraphs below that is not factory insulated.

C. Fire-suppression water storage tank insulation shall be one of the following:
   1. Cellular Glass: 2 inches thick.
   2. Flexible Elastomeric: 1 inch thick.
   3. Mineral-Fiber Pipe and Tank: 1 inch thick.

3.13 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Indoor fire-suppression piping.
2. Underground piping.

3.14 INDOOR PIPING INSULATION SCHEDULE

A. Indoor Engine Coolant Piping for Remote Radiator of Engine-Driven Fire Pump: Mineral-fiber, preformed pipe, Type I or II, 2 inches thick.

B. Indoor Engine Exhaust Piping and Silencer, All Pipe Sizes: Calcium silicate, 4 inches thick.

3.15 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

A. Outdoor Engine Coolant Piping for Remote Radiator of Engine-Driven Fire Pump:
   1. All Pipe Sizes: Insulation shall be one of the following:
      a. Calcium Silicate: 2 inches thick.
      b. Cellular Glass: 2 inches thick.
      c. Mineral-Fiber, Preformed Pipe, Type I or II: 2 inches thick.

B. Outdoor Engine Exhaust Piping and Silencer, All Pipe Sizes: Calcium silicate, 4 inches thick.

C. Outdoor Fire-Suppression Piping Filled with Water: Insulation shall be one of the following:
   1. Cellular Glass: 2 inches thick.
   2. Flexible Elastomeric: 2 inches thick.
   3. Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inches thick.

3.16 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Concealed:
   1. None.

D. Piping, Exposed:
   1. PVC, Color-Coded by System: 30 mils thick.

3.17 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Equipment, Concealed:
   1. None.

D. Equipment, Exposed, up to 48 Inches in Diameter or with Flat Surfaces up to 72 Inches:
   1. Painted Aluminum, Smooth: 0.032 inch thick.

E. Equipment, Exposed, Larger Than 48 Inches in Diameter or with Flat Surfaces Larger Than 72 Inches:
   1. Painted Aluminum, Smooth with: 0.040 inch thick.

F. Outdoor Exposed Piping:
   1. Painted Aluminum, Smooth: 0.032 inch thick.

END OF SECTION

SECTION 21 0719

FIRE SUPPRESSION PIPING INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Piping insulation.

B. Jackets and accessories.

1.02 RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.

B. Section 09 9123 - Interior Painting: Painting insulation jacket.

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 C547 - Standard Specification for Mineral Fiber Pipe Insulation; 2015.

C. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel; 2008 (Reapproved 2013).

D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

E. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2014.

F. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.04 SUBMITTALS

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

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with not less than three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

1.07 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

A. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible.
   1. 'K' Value: ASTM C177, 0.24 at 75 degrees F.
   2. Maximum Service Temperature: 850 degrees F.
   3. Maximum Moisture Absorption: 0.2 percent by volume.

B. Insulation: ASTM C547 and ASTM C795; semi-rigid, noncombustible, end grain adhered to jacket.
   1. 'K' Value: ASTM C177, 0.24 at 75 degrees F.

2. Maximum Service Temperature: 650 degrees F.
3. Maximum Moisture Absorption: 0.2 percent by volume.

C. Vapor Barrier Jacket: White kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm-inches.

D. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.

2.03 JACKETS

A. PVC Plastic.
1. Jacket: One piece molded type fitting covers and sheet material, off-white color.
a. Minimum Service Temperature: 0 degrees F.
b. Maximum Service Temperature: 150 degrees F.
c. Moisture Vapor Permeability: 0.002 perm inch, maximum, when tested in accordance with ASTM E96/E96M.
d. Thickness: 10 mil.
e. Connections: Brush on welding adhesive.

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.

D. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.

E. Glass fiber insulated pipes conveying fluids below ambient temperature:
1. Provide vapor barrier jackets, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.

F. Glass fiber insulated pipes conveying fluids above ambient temperature:
1. Provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples.
2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.

G. Inserts and Shields:
1. Application: Piping 1-1/2 inches diameter or larger.
2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
3. Insert Location: Between support shield and piping and under the finish jacket.
4. Insert Configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
5. Insert Material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.

H. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, refer to Section 07 8400.

I. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet above finished floor): Finish with canvas jacket sized for finish painting.

J. Heat Traced Piping: Insulate fittings, joints, and valves with insulation of like material, thickness, and finish as adjoining pipe. Size large enough to enclose pipe and heat tracer. Cover with aluminum jacket with seams located on bottom side of horizontal piping.

3.03 SCHEDULE

A. Piping Exposed to Freezing with Heat Tracing:

END OF SECTION

SECTION 21 1100

FACILITY FIRE-SUPPRESSION WATER-SERVICE PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Water pipe.

B. Valves.

C. Fire department connections.

D. Water meters.

E. Bedding and cover materials.

F. Polyethylene jacketing (encasement).

G. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 21 1300 - Fire-Suppression Sprinkler Systems.

B. Section 31 2316 - Excavation.

C. Section 31 2316.13 - Trenching.

D. Section 31 2323 - Fill.

1.03 REFERENCE STANDARDS

A. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2011.

B. ASME B16.4 - Gray Iron Threaded Fittings: Classes 125 and 250; 2011.

C. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Welding, Brazing, and Fusing Qualifications; 2015.

D. ASTM A536 - Standard Specification for Ductile Iron Castings; 1984 (Reapproved 2014).

E. ASTM A674 - Standard Practice for Polyethylene Encasement for Ductile Iron Pipe for Water or Other Liquids; 2010 (Reapproved 2014).

F. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2015.

G. AWWA C104/A21.4 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water; 2013.

H. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems; 2010.

I. AWWA C110/A21.10 - Ductile-Iron and Gray-Iron Fittings; 2012.

J. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings; 2012.

K. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast; 2009.

L. AWWA C203 - Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape-Hot-Applied; 2015.

M. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances; 2010.

N. AWWA M11 - Steel Water Pipe - A Guide For Design and Installation; 2004 w/Errata.

O. NFPA 13 - Standard for the Installation of Sprinkler Systems; 2016.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate the installation of work with size, location and installation of service utilities.

B. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

C. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.

1.05 SUBMITTALS

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

B. Welders Certificate: Include welders certification of compliance with ASME BPVC-IX.

C. Product Data:
   1. Include data on pipe materials, pipe fittings, valves, and accessories.
   2. Provide manufacturer's catalog information.
   3. Indicate valve data and ratings.

D. Field Quality Control Submittals: Testing activities.

E. Project Record Documents:
   1. Record actual locations of piping mains, valves, connections, fire hydrants, free-standing fire department connections, underground manholes and vaults, valve boxes, thrust restraints, and invert elevations.
   2. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

F. Maintenance Data: Include installation instructions, spare parts lists, and exploded assembly views.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing work of the type specified and with at least five years documented experience.

B. Provide grooved joint couplings, fittings, valves, specialties, and grooving tools from a single manufacturer.

C. Perform Work in accordance with Local Authority Having Jurisdiction, local municipality, local water utility, and Owner's requirements.

1.07 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.

1.08 FIELD CONDITIONS

A. Do not install underground piping when bedding is wet or frozen.

1.09 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

C. Provide ten year warranty for manufacturer's defects and labor costs for replacement.

PART 2 PRODUCTS

2.01 WATER PIPE

A. Steel Pipe and Fittings:
   1. Pipe: Standard weight, zinc-coated, listed, ASTM A53/A53M.
   2. Fittings: Comply with ASME B16.3, Class 150, zinc coated, threaded or ASME B16.4, Class 125, zinc-coated
   3. Mechanically Factory Applied Protective Materials:
      a. Clean by wire brushing and solvent cleaning.
      b. Apply one coat of coal-tar primer and two coats of coal-tar enamel conforming to AWWA C203.

c. Protect threaded pipe ends and fittings prior to coating.

B. Ductile Iron Pipe: Listed, AWWA C104/A21.4:
   1. Fittings: Ductile iron, standard thickness.
   2. Joints: AWWA C111/A21.11, rubber gasket with rods.
   3. Jackets: AWWA C105/A21.5 polyethylene jacket.

C. Ductile Iron Pipe: Listed, AWWA C151/A21.51.
   1. Fittings: AWWA C110/A21.10, ductile iron, standard thickness.
   2. Joints: AWWA C111/A21.11, rubber gasket with 3/4 inch diameter rods.

2.02 VALVES

A. Valves: Manufacturer's name and pressure rating marked on valve body.

B. Detector Check with Water Meter:
   1. Manufacturers:
      a. Badger Meter, Inc: www.badgermeter.com.
      b. FEBCO: www.febcoonline.com.
      c. Watts Water Technologies, Inc: www.wattswater.com.
      d. Substitutions: See Section 01 6000 - Product Requirements.
   2. 4 NPS up to and including 10 NPS:
      a. Description: Double check valve, water meter, by-pass piping, and isolation valves designed to measure both low flow and high water volume usage.
         1) Listed.
         2) Valve Body: Comprised of epoxy coated stainless steel, ductile iron, or cast iron.
         3) Valve Ends: Flanged.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that building service connection and municipal utility water main size, location, and invert are as indicated.

3.02 PREPARATION

A. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, remove burrs.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare pipe connections to equipment with flanges or unions.

3.03 TRENCHING

A. Earthwork: Perform earthwork operations in accordance with Sections 31 2316, 31 2316.13, and 31 2323.

B. Hand trim excavation for accurate placement of pipe to elevations indicated.

C. Form and place concrete for pipe thrust restraints at each change of pipe direction. Place concrete to permit full access to pipe and pipe accessories. Provide 4 sq feet thrust restraint bearing on subsoil.

D. Backfill around sides and to top of pipe with cover fill, tamp in place and compact, then complete backfilling.

3.04 INSTALLATION

A. General Requirements:
   1. Location of Water Lines:
      a. Terminate the work covered by this Section at a point approximately 5 feet from the building unless indicated otherwise.
   2. Sleeving:

a. Sleeve water piping where piping is required to be installed within 3 feet of existing structures.
b. Provide ductile iron or Schedule 40 steel sleeves.
c. Fill annular space between pipe and sleeves with mastic.
d. Install water pipe and sleeve without damaging structures or causing settlement or movement of foundations or footings.

3. Pipe Laying and Jointing:
a. Remove fins and burrs from pipe and fittings.
b. Prior to placing in position, clean pipe, fittings, valves, and accessories, and maintain in clean condition.
c. Provide proper facilities for lowering pipe sections into trenches.
d. Dropping or dumping of piping, fittings, valves, or any other water line material into trenches is not permitted.
e. Cut pipe in a neat workmanlike manner accurately to length established at the site and work into place without forcing or springing.
f. Replace by one of the proper length any pipe or fitting that does not allow sufficient space for proper installation of jointing material.
g. Wedging or blocking between bells and spigots will not be permitted.
h. Install bell-and-spigot pipe with the bell end pointing in the direction of laying.
i. Grade the pipeline in straight lines avoiding the formation of dips and low points.
j. Support piping at proper elevation and grade.
k. Secure firm, uniform support.
l. Wood support blocking will not be permitted.
m. Install pipe so that the full length of each pipe section and each fitting will rest solidly on the pipe bedding; excavate recesses to accommodate bells, joints, and couplings.
n. Provide anchors and supports where necessary for fastening work into place.
o. Provide proper provisions for expansion and contraction of pipelines.
p. Keep trenches free of water until joints have been properly made.
q. Close open ends of piping temporarily with wood blocks or bulkheads at the end of each work day.
r. Do not install pipe during unacceptable trench conditions or inclement weather.
s. Minimum Depth of Pipe Cover: Not less than 2-1/2 feet.

4. Connections to Existing Water Lines:
a. Ensure minimal interruption of service on the existing line.
b. Make connections to existing lines under pressure in accordance with the recommended procedures of the manufacturer of the pipe being tapped.

5. Penetrations:
a. Provide ductile-iron or Schedule 40 steel for pipes passing through walls of valve pits and structures.
b. Fill annular space between sleeves and walls with rich cement mortar.
c. Fill annular space between pipe and sleeves with mastic.

B. Special Requirements:
1. Ductile Iron Piping:
a. Unless otherwise specified, install pipe and fittings in accordance with paragraph "General Requirements".
b. Jointing:
c. Allowable Deflection:
1) Maximum Allowable Deflection: As stated in AWWA C600.
2) If the alignment requires deflection in excess of the above limitations, furnish special blends or a sufficient number of shorter pipe lengths to provide angular deflections within the limit set forth.

d. Pipe Anchorage:
    1) Provide concrete thrust blocks (reaction backing), for pipe anchorage except where metal harness is indicated.
    2) Thrust blocks to comply with the requirements of AWWA C600 for thrust restraint, except that size and positioning of thrust blocks to be as indicated.
    3) Use concrete, ASTM C94/C94M, having a minimum compressive strength of 2,500 psi at 28 days; or use concrete of a mix not leaner than one part cement, 2-1/2 parts sand, and 5 parts gravel, having the same minimum compressive strength.
    4) Provide metal harness in accordance with the requirements of AWWA C600 for thrust restraint, using tie rods and clamps as indicated in NFPA 13, except as otherwise indicated.
e. Exterior Protection: Completely encase buried ductile iron pipelines with polyethylene tube or sheet, using Class A polyethylene film, in accordance with AWWA C105/A21.5.

2. Steel Piping:
    a. Jointing:
        1) Assemble grooved, shouldered, and _____ type joints in accordance with the recommendations of the coupling manufacturer.
    b. Allowable Offsets:
    c. Pipe Anchorage:
        1) Provide concrete thrust blocks (reaction backing) for pipe anchorage, except where metal harness is indicated.
        2) Thrust blocks to be in accordance with the recommendations for thrust restraint in AWWA M11, except that size and positioning of thrust blocks are to be as indicated.
        3) Use ASTM C94/C94M concrete having a minimum compressive strength of 2500 psi at 28 days; or use concrete of a mix not leaner than one part cement, 2-1/2 parts sand, and 5 parts gravel, having the same minimum compressive strength.
        4) Metal Harness:
            (a) Provide in accordance with the recommendations for joint harnesses in AWWA M11, except as otherwise indicated.
            (b) Fabricated by the pipe manufacturer and furnished with the pipe.

C. Valves:
    1. Set valves on solid bearing.
    2. Center and plumb valve box over valve.
    3. Set box cover flush with finished grade.

3.05 SERVICE CONNECTIONS

3.06 FIELD QUALITY CONTROL

A. Field Tests and Inspections:
    1. See Section 01 4000 - Quality Requirements, for additional requirements.
    2. Provide all labor, equipment, and incidentals required for field testing, except that water and electric power needed for field tests will be furnished as set forth in Section 01 5100 - Temporary Utilities.
    3. Conduct piping tests before joints are covered and after concrete thrust blocks have hardened sufficiently and at least 5 days after placing of concrete after concrete thrust blocks have hardened sufficiently and at least 5 days after placing of concrete.
    4. Fill pipeline 24 hours before testing and apply test pressure to stabilize system, using only potable water.
    5. Pressure test piping to 100 psi.

6. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.
7. Prepare reports of testing activities.

3.07 CLOSEOUT ACTIVITIES

A. See Section 01 7800 - Closeout Submittals, for closeout submittals.

B. See Section 01 7900 - Demonstration and Training, for additional requirements.

C. Demonstrate proper operation of equipment to Owner's designated representative.

END OF SECTION

SECTION 21 1300

FIRE-SUPPRESSION SPRINKLER SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wet-pipe sprinkler system.

B. System design, installation, and certification.

C. Fire department connections.

1.02 RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.

B. Section 21 0500 - Common Work Results for Fire Suppression: Pipe and fittings.

C. Section 21 0553 - Identification for Fire Suppression Piping and Equipment.

1.03 REFERENCE STANDARDS

A. ICC-ES AC01 - Acceptance Criteria for Expansion Anchors in Masonry Elements; 2015.

B. ICC-ES AC106 - Acceptance Criteria for Predrilled Fasteners (Screw Anchors) in Masonry Elements; 2012.

C. ICC-ES AC193 - Acceptance Criteria for Mechanical Anchors in Concrete Elements; 2015.

D. ICC-ES AC308 - Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements; 2015.

E. ITS (DIR) - Directory of Listed Products; current edition.

F. NFPA 13 - Standard for the Installation of Sprinkler Systems; 2016.

G. NFPA 13R - Standard for the Installation of Sprinkler Systems in Low-Rise Residential Occupancies; 2016.

H. UL 405 - Fire Department Connection Devices; Current Edition; Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week before starting work of this section.

1.05 SUBMITTALS

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

B. Product Data: Provide data on sprinklers, valves, and specialties, including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.

C. Shop Drawings:
   1. Submit preliminary layout of finished ceiling areas indicating only sprinkler locations coordinated with ceiling installation.
   2. Indicate hydraulic calculations, detailed pipe layout, hangers and supports, sprinklers, components and accessories. Indicate system controls.
   3. Submit shop drawings to Authorities Having Jurisdiction for approval. Submit proof of approval to Architect.

D. Samples: Submit two of each style of sprinkler specified.

E. Project Record Documents: Record actual locations of sprinklers and deviations of piping from drawings. Indicate drain and test locations.

F. Operation and Maintenance Data: Include components of system, servicing requirements, record drawings, inspection data, replacement part numbers and availability, and location and numbers of service depot.

G. 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 Sprinklers: Type and size matching those installed, in quantity required by referenced NFPA design and installation standard.
3. Sprinkler Wrenches: For each sprinkler type.

H. Project Record Documents: Record actual locations of sprinklers and deviations of piping from drawings. Indicate drain and test locations.

1.06 QUALITY ASSURANCE

A. Maintain one copy of referenced design and installation standard on site.

B. Conform to FM (AG) requirements.

C. Designer Qualifications: Design system under direct supervision of a Professional Engineer and/or state licensed experienced in design of this type of work and licensed in Ohio.

D. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

E. Installer Qualifications: Company specializing in performing the work of this section with minimum 5 years experience approved by manufacturer.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store products in shipping containers and maintain in place until installation. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Sprinklers, Valves, and Equipment:
1. Tyco Fire Protection Products: www.tyco-fire.com.
2. Viking Corporation: www.vikinggroupinc.com.
3. Reliable.
4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 SPRINKLER SYSTEM

A. Sprinkler System: Provide coverage for entire building.

B. Non-residential Occupancy: Ordinary hazard, Group 1; comply with NFPA 13.

C. Occupancy: Residential; comply with NFPA 13R.

D. Water Supply: Determine volume and pressure from water flow test data.

E. Provide fire department connections where indicated.

F. Storage Cabinet for Spare Sprinklers and Tools: Steel, located adjacent to alarm valve.

2.03 SPRINKLERS

A. Suspended Ceiling Type: Concealed pendant type with matching push on escutcheon plate.
1. Response Type: Quick.
2. Coverage Type: Standard.
3. Finish: Enamel, color White.
4. Escutcheon Plate Finish: Enamel, color as selected.
5. Fusible Link: Glass bulb type temperature rated for specific area hazard.

B. Exposed Area Type: Upright type.
1. Response Type: Quick.
2. Coverage Type: Extended.
3. Fusible Link: Glass bulb type temperature rated for specific area hazard.

C. Sidewall Type: Semi-recessed horizontal sidewall type with matching push on escutcheon plate.

1. Response Type: Quick.
2. Coverage Type: Extended.
3. Finish: Enamel, color White.
4. Escutcheon Plate Finish: Enamel, color as selected.
5. Fusible Link: Glass bulb type temperature rated for specific area hazard.

D. Residential Sprinklers: Concealed upright type with matching push on escutcheon plate.
1. Response Type: Quick.
2. Finish: Enamel, color White.
3. Cover Plate Finish: Enamel, color as selected.
4. Fusible Link: Glass bulb type temperature rated for specific area hazard.

2.04 PIPING SPECIALTIES

A. Wet Pipe Sprinkler Alarm Valve: Check type valve with divided seat ring, rubber faced clapper to automatically actuate water motor alarm, pressure retard chamber and variable pressure trim with the following additional capabilities and features:
1. Activate electric alarm.
2. Test and drain valve.
3. Replaceable internal components without removing valve from installed position.
4. Manufacturers:
a. Victaulic Company; Series 751 with Series 760 motor alarm: www.victaulic.com.
b. Substitutions: See Section 01 6000 - Product Requirements.

B. Glycol Systems: Include pre-mixed glycerin solution for areas subject to freezing with the following additional capabilities and features:
1. Backflow preventer at connection point and expansion tank sized for temperature range.
2. Fill valve, funnel, and test / air vent valve at top of system.
3. Test and drain valves at lowest and most remote points of system.

C.

D. Backflow Preventer: Reduced pressure principle valve assembly backflow preventer with drain and OS & Y gate valve on each end.

E. Test Connections:
1. Backflow Preventer Test Connection:
a. Provide downstream of the backflow prevention assembly, listed hose valves with 2.5 inch National Standard male hose threads with cap and chain.
b. Furnish one valve for each 250 gpm of system demand or fraction thereof.
c. Provide permanent sign reading "Test Valve" in accordance with Section 22 0553.

F. Water Flow Switch: Vane type switch for mounting horizontal or vertical, with two contacts; rated 10 amp at 125 volt AC and 2.5 amp at 24 volt DC.

G. Fire Department Connections:
1. Type: Free standing made of corrosion resistant metal complying with UL 405.
a. Sleeve: Brass, 18 inches height.
b. Signage: Raised or engraved lettering 1 inch minimum indicating system type.
c. Manufacturers:
1) Elkhart Brass Manufacturing Company, Inc: www.elkhartbrass.com.
2) Substitutions: See Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with referenced NFPA design and installation standard.

B. Install equipment in accordance with manufacturer's instructions.

C. Provide approved double check valve assembly at sprinkler system water source connection.

D. Place pipe runs to minimize obstruction to other work.

E. Place piping in concealed spaces above finished ceilings.

F. Center sprinklers in two directions in ceiling tile and provide piping offsets as required.

G. Apply masking tape or paper cover to ensure concealed sprinklers, cover plates, and sprinkler escutcheons do not receive field paint finish. Remove after painting. Replace painted sprinklers.

H. Flush entire piping system of foreign matter.

I. Install guards on sprinklers where indicated.

J. Hydrostatically test entire system.

K. Require test be witnessed by Fire Marshal and Authority Having Jurisdiction.

3.02 INTERFACE WITH OTHER PRODUCTS

A. Ensure required devices are installed and connected as required to fire alarm system.

END OF SECTION

SECTION 22 0050

PLUMBING EXECUTION

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes the following:
   1. Definitions
   2. Coordination
   3. Piping materials and installation instructions common to most piping systems.
   4. Dielectric fittings.
   5. Mechanical sleeve seals.
   6. Sleeves.
   7. Escutcheons.
   8. Grout.
   9. Plumbing demolition.
   10. Equipment installation requirements common to equipment sections.
   11. Concrete bases.
   12. Supports and anchorages.

1.02 RELATED DOCUMENTS

A. Drawings, General Provisions of the Contract, including General Conditions, Supplementary General Conditions, other Division 00 & 01 Specification Sections, shall apply to this division.

B. These requirements apply to all Division 22 work.

1.03 DEFINITIONS

A. Finished Spaces: Spaces other than plumbing and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and plumbing equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.04 COORDINATION

A. Coordination: Coordinate construction operations to ensure efficient and orderly installation of the Work.
   1. Coordinate construction operations, that depend on each other for proper installation, connection, and operation.
   2. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
   3. Coordinate installation of different components with other contractors to ensure maximum accessibility for required maintenance, service, and repair.
   4. Make adequate provisions to accommodate items scheduled for later installation.
   5. Where availability of space is limited, coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair of all components.

B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
   1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.

C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
   1. Preparation of Construction Schedule.
   2. Preparation of the Schedule of Values.
   3. Installation and removal of temporary facilities and controls.
   4. Delivery and processing of submittals.
   5. Progress meetings.
   6. Preinstallation conferences.
   7. Project closeout activities.
   8. Startup and adjustment of systems.
   9. Project closeout activities.

1.05 PROJECT MEETINGS

A. General: Attend meetings and conferences at Project site, unless otherwise indicated.
   1. Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Engineer of scheduled meeting dates and times.
   2. Agenda: Request the meeting agenda if not furnished prior to meeting.
   3. Minutes: Record significant discussions and agreements achieved. Request the meeting minutes if not furnished. Note all discrepancies and notify Engineer of all changes to the Work or to the Contract Documents.

B. Preconstruction Conference: Attend the preconstruction conference before starting construction, no later than 15 days after execution of the Agreement to review responsibilities and personnel assignments.
   1. Attendees: Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
   2. Agenda: Discuss items of significance that could affect progress, including the following as applicable:
      a. Tentative construction schedule.
      b. Phasing.
      c. Critical work sequencing and long-lead items.
      d. Designation of key personnel and their duties.
      e. Procedures for processing field decisions and Change Orders.
      f. Procedures for requests for interpretations (RFIs).
      g. Procedures for testing and inspecting.
      h. Procedures for processing Applications for Payment.
      i. Distribution of the Contract Documents.
      j. Submittal procedures.
      k. LEED requirements.
      l. Preparation of Record Documents.
      m. Use of the premises.
      n. Work restrictions.
      o. Owner's occupancy requirements.
      p. Responsibility for temporary facilities and controls.
      q. Construction waste management and recycling.

r. Parking availability.
s. Office, work, and storage areas.
t. Equipment deliveries and priorities.
u. First aid.
v. Security.
w. Progress cleaning.
x. Working hours.

C. Preinstallation Conferences: Attend a preinstallation conference at Project site before each construction activity that requires coordination with other construction.
1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect of scheduled meeting dates.
2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following as applicable:
a. The Contract Documents.
b. Options.
c. Related requests for interpretations (RFIs).
d. Related Change Orders.
e. Purchases, deliveries, submittals.
f. Review of mockups.
g. Possible conflicts.
h. Compatibility problems.
i. Time schedules.
j. Weather limitations.
k. Manufacturer's written recommendations.
l. Warranty requirements.
m. Compatibility of materials.
n. Acceptability of substrates.
o. Space and access limitations.
p. Regulations of authorities having jurisdiction.
q. Testing and inspecting requirements.
r. Installation procedures.
s. Coordination with other work.
t. Required performance results.
u. Protection of adjacent work.
v. Protection of construction and personnel.
3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
4. Reporting: Distribute minutes of the meeting to each party present, to parties who should have been present, and to the Engineer.
5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

1.06 SUBMITTALS

A. Alternate Products: Alternate manufacturers, equipment and /or products must be specified or approved prior to bid in writing via addendum to be accepted. All costs associated with deviations from the basis of design shall be borne by the contractor. Deviations shall include alternate manufacturer and/or alternate product and shall include all significant dimensional, performance, electrical, or installation differences from the basis of design products. Costs for

reimbursement shall include the costs of other trades affected, and shall include all engineering costs to evaluate such deviations.

B. Substitutions: Unspecified manufacturers shall be considered substitutions and shall be submitted for consideration under the specified substitution procedures. Substitutions shall be submitted to the engineer for evaluation. If approved by the engineer, substitution shall be offered to the owner for consideration. All costs associated with substitutions shall be borne by the contractor. Costs for reimbursement shall include the costs of other trades affected, and shall include all engineering costs to evaluate such deviations.

C. Coordination Drawings: Prepare Coordination Drawings (coordinated shop drawings) to maximize utilization of space for efficient installation of different components and for installation of products and materials fabricated by separate entities. Submit to Engineer for review before starting work.
   1. Content: Project-specific information, drawn accurately to scale. Do not base Coordination Drawings on reproductions of the Contract Documents or standard printed data. Include the following information, as applicable:
      a. Indicate functional and spatial relationships of components of the work with all other systems and trades.
      b. Indicate required installation sequences.
      c. Indicate dimensions shown on the Contract Drawings and make specific note of dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide sketches of proposed alternate construction to Engineer for resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

D. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home and office telephone numbers. Provide names, addresses, and telephone numbers of individuals assigned as standbys in the absence of individuals assigned to Project. Submit to Engineer before starting work.
   1. Post copies of list in Project meeting room, in temporary field office, and by each temporary telephone. Keep list current at all times.

E. Make all necessary field measurements and investigations to assure that the equipment and assemblies will meet contract requirements.

F. If equipment is submitted which differs in arrangement from that shown, provide drawings that show the rearrangement of all associated systems. Approval will be given only if all features of the equipment and associated systems, including accessibility, are equivalent to that required by the contract.

G. Prior to submitting shop drawings for review, contractor shall certify in writing that manufacturers of all major items of equipment have each reviewed drawings and specifications, and have jointly coordinated and properly integrated their equipment and controls to provide a complete and efficient installation.

1.07 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
   1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
   2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Electrical Characteristics for Plumbing Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.08 WARRANTIES

A. All work shall include a parts and labor warranty on materials and workmanship for a period of 1 year.

B. Refer to Division 01 for additional warranty requirements.

PART 2 PRODUCTS

2.01 SLEEVES

A. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

B. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop.

C. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include underdeck clamp, clamping ring with set screws, nuts, and bolts for membrane flashing.

D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

2.02 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
   1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
   2. Design Mix: 5000-psi, 28-day compressive strength.
   3. Packaging: Premixed and factory packaged.

2.03 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

B. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.

C. Pressure Plates: Carbon steel. Include two for each sealing element.

D. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.04 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.

C. One-Piece, Cast-Brass Type: With set screw.
   1. Finish: Polished chrome-plated.

D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
   1. Finish: Polished chrome-plated.

2.05 PIPE, TUBE, AND FITTINGS

A. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.06 JOINING MATERIALS

A. Pipe-Flange Gasket Materials: ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.

B. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

C.]Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

D. Brazing Filler Metals: AWS A5.8, BCuP Series or BAg1, unless otherwise indicated.

E. Welding Filler Metals: Comply with AWS D10.12.

F. Solvent Cements for Joining Plastic Piping:
   1. CPVC Piping: ASTM F 493.
   2. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

2.07 DIELECTRIC FITTINGS

A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure, and temperature.

C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.

D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.

E. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.

F. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.

PART 3 EXECUTION

3.01 PLUMBING DEMOLITION

A. Refer to Division 01 Section "Cutting and Patching" and Division 02 Section "Selective Structure Demolition" for general demolition requirements and procedures.

B. Contractor shall be responsible for all work and costs associated with demolition shown or noted on plans.

C. Verify exact requirements before bid and include direct and related indirect costs in estimate including permit application, fees, dust control, protection of existing, temporary HVAC, fuel usage, scaffolding, disconnection, disposal, cutting and patching.

D. Occupied Buildings: For occupied buildings, coordinate with local management for communication with building users, occupants, and/or residents regarding potential for disruptions, and provide 72 hour advance notification for planned outages. Install new work to the fullest extent possible before interrupting existing services to minimize disruption to residents. For water, domestic hot water, sanitary and gas/propane services to dwelling units, perform work during off hours (12:00 AM to 6:00 AM) during outages to minimize disruption to residents. Provide temporary piping and/or equipment for water, gas, and sanitary services to the building for disruptions lasting over 4 hours.

E. In performing the work:
   1. Coordinate with existing conditions and other trades before starting work.
   2. Remove portions of walls, floors, ceilings, etc. required for access to demolished and new work.
   3. Disconnect, demolish, and remove systems, equipment, and components indicated to be removed.

4. Piping to Be Removed: Remove portion indicated to be removed and cap or plug remaining with same or compatible piping material.
5. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
6. Equipment to Be Removed: Arrange for disconnection of electrical power. Disconnect and cap services and remove equipment. Remove related supports, anchorages, and concrete bases.
7. Equipment to Be Removed and Reinstalled: Arrange for disconnection of electrical power. Disconnect and cap services and remove, clean, and store equipment. When appropriate, reinstall, reconnect, arrange for power connection and make equipment operational.
8. Equipment to Be Removed and Salvaged: Arrange for disconnection of electrical power. Disconnect and cap services, remove equipment and deliver to Owner.

F. If new or existing to remain products are damaged during demolition, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

G. Subcontract the General Contractor to perform patching, repair or replacement of walls floors, ceilings, etc. removed for access to the work. General contractor shall repair finishes to match surrounding finishes.

3.02 COMMON REQUIREMENTS

A. Install according to manufacturer requirements and other Division specification sections.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas. Where located within walls and other concealed areas subject to damage, provide suitable protection.

D. Piping indicated to be exposed and piping in equipment rooms and service areas shall be at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping and equipment with clearances to permit servicing.

G. Install piping at indicated slopes free of sags and bends and with fittings for branch connections and changes in direction.

H. Install piping to allow application of insulation.

I. Select system components with pressure rating equal to or greater than system operating pressure.

J. Contact manufacturer's representative to visit site and observe installation in order to confirm installation requirements and warranty coverage. Document observation in writing and include in O&M manuals.

K. Provide service and maintenance for not less than one year from the Date of Substantial Completion or for the warranty period specified in Division 01, whichever is longer. Refer to Division 01 for additional service and requirements.

3.03 PENETRATIONS

A. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls. Sleeve ends shall be flush with both wall surfaces unless otherwise noted. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level. Concrete and masonry penetrations: seal space outside of

sleeves with grout. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.

B. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants.".

C. Roof-Penetrations: Seal penetration of roof with flexible boot-type flashing units applied in coordination with roofing work.

D. Aboveground, Exterior-Wall Pipe Penetrations: Position pipe in center of sleeve. Maintain 1% outward slope, unless otherwise indicated. Seal penetrations using non-expanding foam. After cured, trim flush with sleeve end and paint with color to match surrounding finish.

E. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

F. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at. Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07." Comply with requirements in Division 07."

G. Apply firestopping to non-ducted penetrations of fire and/or smoke rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07.

H. Penetrations of membranes of rated walls shall be protected by UL listed products. Coordinate exact installation conditions with selected fire sealants supplier. For penetrations which do not have a standard UL installation detail, arrange for engineering determination from damper manufacturer and/or sealant supplier and provide modifications required to match detail.

I. Install escutcheons for penetrations of walls, ceilings, and floors.

3.04 PIPING JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

D. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

E. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
   1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
   2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

F. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

G. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

H. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402, for safe-handling practice of cleaners, primers, and solvent cements.
2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
3. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
4. PVC Nonpressure Piping: Join according to ASTM D 2855.

I. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.

J. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.

K. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
1. Plain-End Pipe and Fittings: Use butt fusion.
2. Plain-End Pipe and Socket Fittings: Use socket fusion.

L. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

3.05 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:
1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.06 INSTALLATION - COMMON REQUIREMENTS

A. Install equipment, fixtures, valves and specialties according to manufacturer installation instructions and recommendations.

B. Refer to other Sections of these Specifications for additional requirements.

C. Install to allow maximum possible headroom unless specific mounting heights are indicated.

D. Install work level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

E. Install work to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

F. Install work to allow right of way for piping installed at required slope.

G. Contact equipment manufacturer's representative to visit site and observe installation in order to confirm installation requirements and warranty coverage. Document observation in writing and include in O&M manuals.

H. Provide service and maintenance for not less than one year from the Date of Substantial Completion or for the warranty period specified in Division 01, whichever is longer. Refer to Division 01 for additional service and requirements.

3.07 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
1. Provide concrete bases which are plumb, level and fully supported to prevent shifting over time.

2. Provide concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
3. Place and secure anchorage devices. Install according to equipment manufacturer's recommendations, setting drawings, templates, diagrams, instructions, and directions for supported equipment. Provide anchor bolts according to anchor-bolt manufacturer's written instructions. Install anchor bolts to elevations required for proper attachment to supported equipment. Unless otherwise noted, install epoxy-coated anchor bolts to match equipment that extend through concrete base, and anchor into structural concrete.
4. Where located on structural floor, provide dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
5. Provide 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section "Cast-in-Place Concrete."

3.08 SUPPORTS AND ANCHORAGES

A. Provide supports to match construction type and adjacent assembly rating.

B. For combustible construction, provide wood supports and anchorages. Cut, fit, and place nailers, blocking, and anchorages to support, and anchor materials and equipment. Select fasteners that will not penetrate members to opposite side. Tighten connections between members. Install fasteners without splitting wood members.

C. For non-combustible building construction provide metal supports and anchorages. Refer to Division 05 Section "Metal Fabrications" for structural steel. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor HVAC materials and equipment. Field Welding shall comply with AWS D1.1.

D. Attach to substrates as required to support applied loads.

3.09 GROUTING

A. Clean surfaces that will come into contact with grout. Provide forms as required for placement of grout.

B. Mix and install grout for HVAC equipment base bearing surfaces, and anchors.

C. Place grout around anchors and completely filling equipment base and provide smooth bearing surface for equipment. Avoid air entrapment during placement of grout.

D. Allow grout to cure before loading or applying forces.

3.10 SLEEVE-SEAL INSTALLATION

A. Install to seal below-grade exterior wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

END OF SECTION

SECTION 22 0516

EXPANSION FITTINGS AND LOOPS FOR PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Flexible pipe connectors.

B. Pipe loops, offsets, and swing joints.

1.02 RELATED REQUIREMENTS

A. Section 22 1005 - Plumbing Piping.

1.03 REFERENCE STANDARDS

A. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service; 2015.

1.04 SUBMITTALS

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

B. Project Record Documents: Record installed locations of flexible pipe connectors, expansion joints, anchors, and guides.

PART 2 PRODUCTS

2.01 FLEXIBLE PIPE CONNECTORS - COPPER PIPING

A. Manufacturers:
   1. Mercer Rubber Company: www.mercer-rubber.com.
   2. Metraflex Company: www.metraflex.com.
   3. Substitutions: See Section 01 6000 - Product Requirements.

B. Inner Hose: Bronze.

C. Exterior Sleeve: Braided bronze.

D. Pressure Rating: 125 psi and 450 degrees F.

E. Joint: Flanged.

F. Size: Use pipe sized units.

G. Maximum offset: 3/4 inch on each side of installed center line.

H. Application: Copper piping.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install flexible pipe connectors on pipes connected to vibration isolated equipment. Provide line size flexible connectors.

C. Provide support and equipment required to control expansion and contraction of piping. Provide loops, pipe offsets, and swing joints, or expansion joints where indicatedto allow .5" of expansion per 50' of length.

D. Substitute grooved piping for vibration isolated equipment instead of flexible connectors. Grooved piping need not be anchored.

END OF SECTION

SECTION 22 0519

METERS AND GAGES FOR PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pressure gages and pressure gage taps.

B. Thermometers and thermometer wells.

1.02 RELATED REQUIREMENTS

1.03 REFERENCE STANDARDS

A. ASME B40.100 - Pressure Gauges and Gauge Attachments; 2013.

B. ASTM E1 - Standard Specification for ASTM Liquid-in-Glass Thermometers; 2014.

C. ASTM E77 - Standard Test Method for Inspection and Verification of Thermometers; 2014.

D. UL 393 - Indicating Pressure Gauges for Fire-Protection Service; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative 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 GAGES

A. Manufacturers:
   1. Dwyer Instruments, Inc: www.dwyer-inst.com.
   2. Moeller Instrument Company, Inc: www.moellerinstrument.com.
   3. Omega Engineering, Inc: www.omega.com.
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Pressure Gages: ASME B40.100, UL 393 drawn steel case, phosphor bronze bourdon tube, rotary brass movement, brass socket, with front recalibration adjustment, black scale on white background.
   1. Case: Steel with brass bourdon tube.
   2. Size: 4-1/2 inch diameter.
   3. Mid-Scale Accuracy: One percent.
   4. Scale: Psi and kPa.

2.02 PRESSURE GAGE TAPPINGS

A. Gage Cock: Tee or lever handle, brass for maximum 150 psi.

B. Needle Valve: Brass, 1/4 inch NPT for minimum 150 psi.

C. Pulsation Damper: Pressure snubber, brass with 1/4 inch connections.

D. Syphon: Steel, Schedule 40, 1/4 inch angle or straight pattern.

2.03 STEM TYPE THERMOMETERS

A. Manufacturers:
   1. Dwyer Instruments, Inc: www.dwyer-inst.com.
   2. Omega Engineering, Inc: www.omega.com.
   3. Weksler Glass Thermometer Corp: www.wekslerglass.com.
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Thermometers - Adjustable Angle: Red- or blue-appearing non-toxic liquid in glass; ASTM E1; 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: 9 inch scale.
   2. Window: Clear Lexan.
   3. Accuracy: 2 percent, per ASTM E77.
   4. Calibration: Degrees F.

2.04 DIAL THERMOMETERS

A. Manufacturers:
   1. Dwyer Instruments, Inc: www.dwyer-inst.com.
   2. Omega Engineering, Inc: www.omega.com.
   3. Weksler Glass Thermometer Corp: www.wekslerglass.com.
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Thermometers - Adjustable Angle: Dial type bimetallic actuated; ASTM E1; stainless steel case, adjustable angle with front recalibration, silicone fluid damping, white with black markings and black pointer, hermetically sealed lens, stainless steel stem.
   1. Size: 5 inch diameter dial.
   2. Accuracy: 1 percent.
   3. Calibration: Degrees F.

2.05 THERMOMETER SUPPORTS

A. Socket: Brass separable sockets for thermometer stems with or without extensions as required, and with cap and chain.

B. Flange: 3 inch outside diameter reversible flange, designed to fasten to sheet metal air ducts, with brass perforated stem.

2.06 TEST PLUGS

A. Test Plug: 1/4 inch or 1/2 inch brass fitting and cap for receiving 1/8 inch outside diameter pressure or temperature probe with neoprene core for temperatures up to 200 degrees F.

2.07 STATIC PRESSURE GAGES

A. Manufacturers:
   1. Dwyer Instruments, Inc: www.dwyer-inst.com.
   2. Omega Engineering, Inc: www.omega.com.
   3. Weksler Glass Thermometer Corp: www.wekslerglass.com.
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. 3-1/2 inch diameter dial in metal case, diaphragm actuated, black figures on white background, front recalibration adjustment, 2 percent of full scale accuracy.

C. Accessories: Static pressure tips with compression fittings for bulkhead mounting, 1/4 inch diameter tubing.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install pressure gages with pulsation dampers. Provide gage cock to isolate each gage. Extend nipples and siphons to allow clearance from insulation.

C. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2 inch for installation of thermometer sockets. Ensure sockets allow clearance from insulation.

D. Provide instruments with scale ranges selected according to service with largest appropriate scale.

E. Install gages and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.

F. Adjust gages and thermometers to final angle, clean windows and lenses, and calibrate to zero.

G. Locate test plugs adjacent thermometers and thermometer sockets.

3.02 SCHEDULES

A. Pressure Gages, Location and Scale Range:
   1. Pumps, 0 to 100 psi.
   2. Expansion tanks, 0 to 100 psi.
   3. Standpipe, highest points, 0 to 150 psi.
   4. Standpipe and sprinkler water supply connection, 0 to 100 psi.
   5. Sprinkler system, 0 to 100 psi.
   6. Pressure reducing valves, 0 to 100 psi.
   7. Backflow preventers, 0 to 100 psi.

B. Pressure Gage Tappings, Location:
   1. Boiler - inlets and outlets.

C. Thermometers, Location and Scale Range:
   1. Headers to central equipment, 0 to 150 degrees F.
   2. Domestic hot water supply and recirculation, 0 to 150 degrees F.

END OF SECTION

SECTION 22 0523

GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Applications.

B. General requirements.

C. Ball valves.

D. Butterfly valves.

E. Check valves.

F. Gate valves.

G. Plug valves.

1.02 RELATED REQUIREMENTS

1.03 REFERENCE STANDARDS

A. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2012.

B. ASME B31.9 - Building Services Piping; 2014.

C. ASTM A48/A48M - Standard Specification for Gray Iron Castings; 2003 (Reapproved 2012).

D. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings; 2004 (Reapproved 2014).

E. ASTM B61 - Standard Specification for Steam or Valve Bronze Castings; 2008 (Reapproved 2013).

F. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings; 2015.

G. MSS SP-67 - Butterfly Valves; 2011.

H. MSS SP-70 - Cast Iron Gate Valves, Flanged and Threaded Ends; 2011.

I. MSS SP-78 - Cast Iron Plug Valves, Flanged and Threaded Ends; 2011.

J. MSS SP-80 - Bronze Gate, Globe, Angle and Check Valves; 2013.

K. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; 2010.

L. NSF 61 - Drinking Water System Components - Health Effects; 2014 (Errata 2015).

M. NSF 372 - Drinking Water System Components - Lead Content; 2011.

1.04 SUBMITTALS

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

B. Product Data: Provide data on valves including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.

1.05 QUALITY ASSURANCE

A. Manufacturer:

1. Obtain valves for each valve type from single manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Minimize exposure of operable surfaces by setting plug and ball valves to open position.
2. Protect valve parts exposed to piped medium against rust and corrosion.

PART 2 PRODUCTS

2.01 APPLICATIONS

A. See Drawings for specific valve locations.

B. Provide the following valves for the applications if not indicated on Drawings:
   1. Shutoff: Ball, butterfly, gate or plug.
   2. Throttling: Provide ball type balancing valve with gauge taps and scale.

C. Substitutions of valves with higher CWP classes or SWP ratings for same valve types are permitted when specified CWP ratings or SWP classes are not available.

D. Domestic, Hot and Cold Water Valves:
   1. 2 NPS and Smaller:
      a. Bronze: Provide with solder-joint or threaded ends.
      b. Ball: One piece, full port, bronze with brass trim.
      c. Bronze Swing Check: Class 125, bronze disc.
      d. Bronze Gate: Class 125, NRS.
   2. 2-1/2 NPS and Larger:
      a. Iron, 2-1/2 NPS to 4 NPS: Provide with threaded or flanged ends.
      b. Iron Grooved-End Butterfly: 175 CWP.
      c. Iron Gate: Class 125, NRS.

2.02 GENERAL REQUIREMENTS

A. Valve Pressure and Temperature Ratings: No less than rating indicated; as required for system pressures and temperatures.

B. Valve Sizes: Match upstream piping unless otherwise indicated.

C. Valve Actuator Types:

D. Valves in Insulated Piping: With 2 NPS stem extensions and the following features:
   1. Gate Valves: Rising stem.
   2. Ball Valves: Extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
   3. Butterfly Valves: Extended neck.
   4. Memory Stops: Fully adjustable after insulation is installed.

E. Valve-End Connections:

F. General ASME Compliance:
   1. Solder-joint Connections: ASME B16.18.
   2. Building Services Piping Valves: ASME B31.9.

G. Valve Materials for Potable Water: NSF 61 and NSF 372.

H. Bronze Valves:
   1. Fabricate from dezincification resistant material.
   2. Copper alloys containing more than 15 percent zinc are not permitted.

I. Source Limitations: Obtain each valve type from a single manufacturer.

2.03 BRONZE BALL VALVES

A. One Piece, Reduced Port with Bronze Trim:
   1. Comply with MSS SP-110.
   2. SWP Rating: 400 psig.
   3. CWP Rating: 600 psig.
   4. Body: Bronze.
   5. Ends: Threaded.

6. Seats: PTFE or TFE.
7. Stem: Bronze.
8. Ball: Chrome plated brass.

B. Two Piece, Full Port with Bronze Trim:
1. Comply with MSS SP-110.
2. SWP Rating: 150 psig.
3. CWP Rating: 600 psig.
4. Body: Bronze.
5. Ends: Threaded.
6. Seats: PTFE or TFE.
7. Stem: Bronze.
8. Ball: Chrome plated brass.

2.04 IRON, GROOVED-END BUTTERFLY VALVES

A. CWP Rating: 175 psig (1200 kPa).
1. Comply with MSS SP-67, Type I.
2. Body: Coated ductile iron.
3. Stem: Two-piece stainless steel.
4. Disc: Coated ductile iron.
5. Disc Seal: EPDM.

2.05 BRONZE LIFT CHECK VALVES

A. Class 125:
1. Comply with MSS SP-80, Type 1, Metal Disc to Metal Seat and Type 2, Nonmetallic Disc to Metal Seat.
2. CWP Rating: 200 psig.
3. Design: Vertical flow.
4. Body: Comply with ASTM B61 or ASTM B62, bronze.
5. Ends: Threaded as indicated.

2.06 BRONZE SWING CHECK VALVES

A. Class 125: CWP Rating: 200 psig (1380 kPa) and _____.
1. Comply with MSS SP-80, Type 3.
2. Design: Horizontal flow.
3. Body: Bronze, ASTM B62.
4. Ends: Threaded as indicated.
5. Disc: Bronze.

2.07 BRONZE GATE VALVES

A. Non-Rising Stem (NRS) or Rising Stem (RS):
1. Comply with MSS SP-80, Type I.
2. Class 125: CWP Rating: 200 psig:.
3. Body: ASTM B62, bronze with integral seat and screw-in bonnet.
4. Ends: Threaded or solder joint joint.
5. Stem: Bronze.
6. Disc: Solid wedge; bronze.
7. Packing: Asbestos free.
8. Handwheel: Malleable iron, bronze, or aluminum.

2.08 IRON GATE VALVES

A. NRS or OS & Y:
1. Comply with MSS SP-70, Type I.
2. Class 125: CWP Rating: 200 psig:.

3. Body: ASTM A126, gray iron with bolted bonnet.
4. Ends: Flanged.
5. Trim: Bronze.
6. Disc: Solid wedge.
7. Packing and Gasket: Asbestos free.

2.09 LUBRICATED PLUG VALVES

A. Regular Gland with Flanged Ends:
   1. Comply with MSS SP-78, Type II.
   2. Class 125: CWP Rating: 200 psig.
   3. Class 250: CWP Rating: 400 psig.
   4. Body: ASTM A48/A48M or ASTM A126, cast iron with lubrication sealing system.
   5. Pattern: Regular or short.
   6. Plug: Cast iron or bronze with sealant groove.

PART 3 EXECUTION

3.01 EXAMINATION

A. Discard all packing materials and verify that valve interior, including threads and flanges are completely clean without signs of damage or degradation that could result in leakage.

B. Verify valve parts to be fully operational in all positions from closed to fully open.

C. Confirm gasket material to be suitable for the service, to be of correct size, and without defects that could compromise effectiveness.

D. Should valve is determined to be defective, replace with new valve.

3.02 INSTALLATION

A. Provide unions or flanges with valves to facilitate equipment removal and maintenance while maintaining system operation and full accessibility for servicing.

B. Provide separate valve support as required and locate valve with stem at or above center of piping, maintaining unimpeded stem movement.

C. Install check valves where necessary to maintain direction of flow as follows:
   1. Swing Check: Install horizontal maintaining hinge pin level.

END OF SECTION

SECTION 22 0553

IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Stencils.

D. Pipe markers.

E. Ceiling tacks.

1.02 RELATED REQUIREMENTS

A. Section 09 9123 - Interior Painting: Identification painting.

1.03 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems; 2015.

1.04 SUBMITTALS

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

B. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.

C. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

D. Product Data: Provide manufacturers catalog literature for each product required.

E. Manufacturer's Installation Instructions: Indicate special procedures, and installation.

F. Project Record Documents: Record actual locations of tagged valves.

PART 2 PRODUCTS

2.01 IDENTIFICATION APPLICATIONS

A. Heat Transfer Equipment: Nameplates.

B. Piping: Tags.

C. Pumps: Nameplates.

D. Tanks: Nameplates.

E. Valves: Tags and ceiling tacks where located above lay-in ceiling.

F. Water Treatment Devices: Nameplates.

2.02 NAMEPLATES

A. Description: Laminated three-layer plastic with engraved letters.
   1. Letter Color: White.
   2. Letter Height: 1/4 inch.
   3. Background Color: Black.
   4. Plastic: Conform to ASTM D709.

2.03 TAGS

2.04 STENCILS

A. Stencils: With clean cut symbols and letters of following size:
   1. 3/4 to 1-1/4 inch Outside Diameter of Insulation or Pipe: 8 inch long color field, 1/2 inch high letters.

2. 1-1/2 to 2 inch Outside Diameter of Insulation or Pipe: 8 inch long color field, 3/4 inch high letters.
3. 2-1/2 to 6 inch Outside Diameter of Insulation or Pipe: 12 inch long color field, 1-1/4 inch high letters.

2.05 PIPE MARKERS

A. Comply with ASME A13.1.

B. 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.

C. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

D. Color code as follows:
1. Potable, Cooling, Boiler, Feed, Other Water: Green with white letters.
2. Flammable Fluids: Yellow with black letters.

2.06 CEILING TACKS

A. Description: Steel with 3/4 inch diameter color coded head.

B. Color code as follows:
1. Plumbing Valves: Green.

PART 3 EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

B. Prepare surfaces in accordance with Section 09 9123 for stencil painting.

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. Apply stencil painting in accordance with Section 09 9123.

D. Install plastic pipe markers in accordance with manufacturer's instructions.

E. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.

F. Use tags on piping 3/4 inch diameter and smaller.
1. Identify service, flow direction, and pressure.
2. Install in clear view and align with axis of piping.
3. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.

G. Locate ceiling tacks to locate valves or dampers above lay-in panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION

SECTION 22 0719

PLUMBING PIPING INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Piping insulation.

1.02 RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.

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 C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2014.

C. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation; 2015.

D. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel; 2008 (Reapproved 2013).

E. ASTM D1056 - Standard Specification for Flexible Cellular Materials--Sponge or Expanded Rubber; 2014.

F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

G. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2014.

H. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative 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. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years of documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified in this section and approved by manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

1.07 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

A. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible, with wicking material to transport condensed water to the outside of the system for evaporation to the atmosphere.
   1. 'K' Value: ASTM C177, 0.23 at 75 degrees F.
   2. Maximum Service Temperature: 220 degrees F.
   3. Maximum Moisture Absorption: 0.2 percent by volume.

2.03 POLYETHYLENE

A. Manufacturers:
   1. Armacell LLC: www.armacell.us.
   2. Substitutions: See Section 01 6000 - Product Requirements.

B. Insulation: Flexible closed-cell polyethylene tubing, slit lengthwise for installation, complying with applicable requirements of ASTM D1056.
   1. 'K' Value: ASTM C177; 0.25 at 75 degrees F.
   2. Maximum Service Temperature: 200 degrees F.
   3. Density: 2 lb/cu ft.
   4. Maximum Moisture Absorption: 1.0 percent by volume.
   5. Moisture Vapor Permeability: 0.05 perm inch, when tested in accordance with ASTM E96/E96M.
   6. Connection: Contact adhesive.

2.04 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Manufacturer:
   1. Aeroflex USA, Inc: www.aeroflexusa.com.
   2. Armacell LLC: www.armacell.us.
   3. Substitutions: See Section 01 6000 - Product Requirements.

B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 3; use molded tubular material.
   1. 'K' Value: ASTM C534; 0.25 at 75 degrees F.
   2. Minimum Service Temperature: Minus 40 degrees F.
   3. Maximum Service Temperature: 220 degrees F.
   4. Connection: Waterproof vapor barrier adhesive.

C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

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. For hot piping conveying fluids 140 degrees F or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.

C. For hot piping conveying fluids over 140 degrees F, insulate flanges and unions at equipment.

D. Glass fiber insulated pipes conveying fluids above ambient temperature:
   1. Provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples.
   2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.

E. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, refer to Section 07 8400.

3.03 SCHEDULES

A. Plumbing Systems:
   1. Domestic Hot Water Supply:
   2. Domestic Hot Water Recirculation:
      a. Glass Fiber Insulation:
         1) Pipe Size Range: All sizes.
         2) Thickness: 1 inch.
      b. Polyethylene Insulation:
         1) Pipe Size Range: All sizes.
         2) Thickness: 1 inch.
   3. Domestic Cold Water:
      a. closed cell elastomeric or polyethylene
      b. 1/2" thick

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. Flanges, unions, and couplings.
   4. Pipe hangers and supports.
   5. Valves.
   6. Flow controls.

1.02 REFERENCE STANDARDS

A. ANSI Z21.22 - American National Standard for Relief Valves and Automatic Gas Shutoff Devices for Hot Water Supply Systems; 1999, and addenda A&B (R2004).

B. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2012.

C. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2013.

D. ASME B31.9 - Building Services Piping; 2014.

E. ASME BPVC-IV - Boiler and Pressure Vessel Code, Section IV - Rules for Construction of Heating Boilers; 2015.

F. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Welding, Brazing, and Fusing Qualifications; 2015.

G. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2015.

H. ASTM B32 - Standard Specification for Solder Metal; 2008 (Reapproved 2014).

I. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2014.

J. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2013.

K. ASTM B813 - Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube; 2010.

L. ASTM B828 - Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings; 2002 (Reapproved 2010).

M. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120; 2015.

N. ASTM D2235 - Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings; 2004 (Reapproved 2011).

O. ASTM D2239 - Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter; 2012.

P. ASTM D2241 - Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series); 2015.

Q. ASTM D2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40; 2013.

R. ASTM D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems; 2012.

S. ASTM D2609 - Standard Specification for Plastic Insert Fittings for Polyethylene (PE) Plastic Pipe; 2015.

T. ASTM D2661 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe and Fittings; 2014.

U. ASTM D2665 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings; 2014.

V. ASTM D2729 - Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 2011.

W. ASTM D2846/D2846M - Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution Systems; 2014.

X. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings; 1996 (Reapproved 2010).

Y. ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 2015.

Z. ASTM F437 - Standard Specification for Threaded Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80; 2015.

AA. ASTM F438 - Standard Specification for Socket-Type Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40; 2015.

AB. ASTM F439 - Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80; 2013.

AC. ASTM F441/F441M - Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80; 2015.

AD. ASTM F442/F442M - Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe (SDR-PR); 2013.

AE. ASTM F493 - Standard Specification for Solvent Cements for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe and Fittings; 2014.

AF. ASTM F628 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe With a Cellular Core; 2012e2.

AG. ASTM F876 - Standard Specification for Crosslinked Polyethylene (PEX) Tubing; 2015a.

AH. ASTM F877 - Standard Specification for Crosslinked Polyethylene (PEX) Plastic Hot- and Cold-Water Distribution Systems; 2011a.

AI. ASTM F1960 - Standard Specification for Cold Expansion Fittings with PEX Reinforcing Rings for Use with Cross-linked Polyethylene (PEX) Tubing; 2015.

AJ. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings; 2012.

AK. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast; 2009.

AL. AWWA C651 - Disinfecting Water Mains; 2005.

AM. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2009.

AN. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; 2010.

AO. NSF 61 - Drinking Water System Components - Health Effects; 2014 (Errata 2015).

AP. NSF 372 - Drinking Water System Components - Lead Content; 2011.

AQ. PPI TR-4 - PPI Listing of Hydrostatic Design Basis (HDB), Hydrostatic Design Stress (HDS), Strength Design Basis (SDB), Pressure Design Basis (PDB), and Minimum Required Strength (MRS) Ratings For Thermoplastic Piping Materials or Pipe; 2013.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative 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.

1.04 QUALITY ASSURANCE

A. Perform work in accordance with applicable codes.

B. Valves: Manufacturer's name and pressure rating marked on valve body.

C. Welding Materials and Procedures: Conform to ASME BPVC-IX and applicable state labor regulations.

D. Welder Qualifications: Certified in accordance with ASME BPVC-IX.

E. Identify pipe with marking including size, ASTM material classification, ASTM specification, potable water certification, water pressure rating.

1.05 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.

1.06 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 WITHIN 5 FEET OF BUILDING

A. ABS Pipe: ASTM F628.
   1. Fittings: ABS.
   2. Joints: Solvent welded with ASTM D2235 cement.

B. ABS Pipe: ASTM D2661.
   1. Fittings: ABS.
   2. Joints: Solvent welded with ASTM D2235 cement.

C. PVC Pipe: ASTM D2665 or ASTM D3034.
   1. Fittings: PVC.
   2. Joints: Solvent welded, with ASTM D2564 solvent cement.

2.03 SANITARY SEWER PIPING, ABOVE GRADE

A. ABS Pipe: ASTM F628.
   1. Fittings: ABS.
   2. Joints: Solvent welded with ASTM D2235 cement.

B. ABS Pipe: ASTM D2661.
   1. Fittings: ABS.
   2. Joints: Solvent welded with ASTM D2235 cement.

C. PVC Pipe: ASTM D2729.
   1. Fittings: PVC.
   2. Joints: Solvent welded, with ASTM D2564 solvent cement.

D. PVC Pipe: ASTM D2665.
   1. Fittings: PVC.
   2. Joints: Solvent welded, with ASTM D2564 solvent cement.

E. PVC Pipe: ASTM D1785 Schedule 40, or ASTM D2241 SDR 26 with not less than 150 psi pressure rating.
   1. Fittings: ASTM D2466, PVC.
   2. Joints: Solvent welded, with ASTM D2564 solvent cement.

2.04 DOMESTIC WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Ductile Iron Pipe: AWWA C151/A21.51.
   1. Fittings: Ductile or gray iron, standard thickness.
   2. Joints: AWWA C111/A21.11, rubber gasket with 3/4 inch diameter rods.

B. PE Pipe: ASTM D2239.
   1. Fittings: ASTM D2609, PE.
   2. Joints: Mechanical with stainless steel clamp.

2.05 DOMESTIC WATER PIPING, ABOVE GRADE

A. Copper Tube: ASTM B88 (ASTM B88M), Type K (A), Drawn (H).
   1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
   2. Joints: ASTM B32, alloy Sn95 solder.

B. CPVC Pipe (only if approved by Owner and Engineer): ASTM D2846/D2846M, ASTM F441/F441M, or ASTM F442/F442M.
   1. Fittings: CPVC; ASTM D2846/D2846M, ASTM F437, ASTM F438, or ASTM F439.
   2. Joints: ASTM D2846/D2846M, solvent weld with ASTM F493 solvent cement.

C. Cross-Linked Polyethylene Pipe (only if approved by Owner and Engineer): ASTM F876 or ASTM F877.
   1. Manufacturers:
      a. Uponor, Inc; Logic System: www.uponorengineering.com/sle.
      b. Substitutions: See Section 01 6000 - Product Requirements.
   2. PPI TR-4 Pressure Design Basis:
      a. 80 psig at maximum 200 degrees F.
   3. Fittings: Brass and engineered polymer (EP) ASTM F1960.
   4. Joints: ASTM F1960 cold-expansion fittings (Crimp fittings are not permitted).

2.06 FLANGES, UNIONS, AND COUPLINGS

A. Unions for Pipe Sizes 3 Inches and Under:
   1. Ferrous pipe: Class 150 malleable iron threaded unions.
   2. Copper tube and pipe: Class 150 bronze unions with soldered joints.

B. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

2.07 PIPE HANGERS AND SUPPORTS

A. Provide hangers and supports that comply with MSS SP-58.
   1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
   2. Overhead Supports: Individual steel rod hangers attached to structure or to trapeze hangers.
   3. Trapeze Hangers: Welded steel channel frames attached to structure.
   4. Vertical Pipe Support: Steel riser clamp.
   5. Floor Supports: Concrete pier or steel pedestal with floor flange; fixture attachment.

6. Rooftop Supports for Low-Slope Roofs: Steel pedestals with bases that rest on top of roofing membrane, not requiring any attachment to the roof structure and not penetrating the roofing assembly, with support fixtures as specified; and as follows:
    a. Bases: High density polypropylene.
    b. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
    c. Steel Components: Stainless steel, or carbon steel hot-dip galvanized after fabrication in accordance with ASTM A123/A123M.
    d. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports; corrosion resistant material.
    e. Height: Provide minimum clearance of 6 inches under pipe to top of roofing.

B. Plumbing Piping - Drain, Waste, and Vent:
1. Hangers for Pipe Sizes 1/2 Inch to 1-1/2 Inches: Malleable iron, adjustable swivel, split ring.
2. Hangers for Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
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.

C. Plumbing Piping - Water:
1. Hangers for Pipe Sizes 1/2 Inch to 1-1/2 Inches: Malleable iron, adjustable swivel, split ring.
2. Hangers for Cold Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
3. Hangers for Hot Pipe Sizes 2 Inches to 4 Inches: Carbon steel, adjustable, clevis.
4. Hangers for Hot Pipe Sizes 6 Inches and Over: Adjustable steel yoke, cast iron pipe roll, double hanger.
5. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
6. Wall Support for Pipe Sizes 4 Inches and Over: Welded steel bracket and wrought steel clamp.
7. Wall Support for Hot Pipe Sizes 6 Inches and Over: Welded steel bracket and wrought steel clamp with adjustable steel yoke and cast iron pipe roll.
8. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
9. Floor Support for Hot Pipe Sizes to 4 Inches: Cast iron adjustable pipe saddle, locknut, nipple, floor flange, and concrete pier or steel support.
10. Floor Support for Hot Pipe Sizes 6 Inches and Over: Adjustable cast iron pipe roll and stand, steel screws, and concrete pier or steel support.
11. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

D. Hanger Fasteners: Attach hangers to structure using appropriate fasteners.

2.08 BALL VALVES

A. Construction, 4 Inches and Smaller: MSS SP-110, Class 150, 400 psi CWP, bronze or ductile iron body, 304 stainless steel or chrome plated brass ball, regular port, teflon seats and stuffing box ring, blow-out proof stem, lever handle, solder or threaded ends with union.

2.09 PIPING SPECIALTIES

A. Flow Control:
1. Manufacturers:
    a. Caleffi [Thermosetter]
    b. Substitutions: See Section 01 6000 - Product Requirements.
2. Construction: Class 125, Brass or bronze body with union on inlet and outlet, temperature and pressure test plug on inlet and outlet, blowdown/backflush drain.

3. Thermostatic Valve Performance: Automatic control of flow temperature within .5 degree of selected rating, over operating pressure range of 10 times minimum pressure required for control.

2.10 RELIEF VALVES:

A. Temperature and Pressure:
   1. Manufacturers:
      a. Watts Regulator Company: www.wattsregulator.com.
      b. Substitutions: See Section 01 6000 - Product Requirements.
   2. AGA Z21.22 certified, bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, temperature relief maximum 210 degrees F, capacity ASME BPVC-IV certified and labelled.

2.11 STRAINERS:

A. Manufacturers:
   1. Armstrong International, Inc: www.armstronginternational.com.
   2. Substitutions: See Section 01 6000 - Product Requirements.

B. Size 2 inch and Under:
   1. Threaded brass body for 175 psi CWP, Y pattern with 1/32 inch stainless steel perforated screen.
   2. Class 150, threaded bronze body 300 psi CWP, Y pattern with 1/32 inch stainless steel perforated screen.

C. Size 1-1/2 inch to 4 inch:
   1. Class 125, flanged iron body, Y pattern with 1/16 inch stainless steel perforated screen.

2.12 TRAP-SEAL PRIMER VALVES

A. Supply-Type, Trap-Seal Primer Valves:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. MIFAB, Inc.
      b. PPP Inc.
      c. Sioux Chief Manufacturing Company, Inc.
      d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
      e. Watts Industries, Inc.; Water Products Div.
   2. Standard: ASSE 1018.
   3. Pressure Rating: 125 psig minimum.
   4. Body: Bronze.
   5. Inlet and Outlet Connections: NPS 1/2 threaded, union, or solder joint.
   6. Gravity Drain Outlet Connection: NPS 1/2 threaded or solder joint.
   7. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

2.13 TRAP-SEAL PRIMER SYSTEMS

A. Trap-Seal Primer Systems:
   1. Standard: ASSE 1044,
   2. Piping: NPS 3/4, ASTM B 88, Type L; copper, water tubing.
   3. Cabinet: Recessed-mounting steel box with stainless-steel cover.
   4. Electric Controls: 24-hour timer, solenoid valve, and manual switch for 120-V ac power.
   5. Vacuum Breaker: ASSE 1001.
   6. Number Outlets: Match fixture quantity.
   7. Size Outlets: NPS 1/2.

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. Install in accordance with manufacturer's instructions.

B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

D. Install piping to maintain headroom, conserve space, and not interfere with use of space.

E. Group piping whenever practical at common elevations.

F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 22 0516.

G. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

H. Provide access where valves and fittings are not exposed.
   1. Coordinate size and location of access doors with Section 08 3100.

I. Establish elevations of buried piping outside the building to ensure not less than 3 ft of cover.

J. Install vent piping penetrating in roofed areas to maintain integrity of roof assembly; refer to roofing specification.

K. Where pipe supports are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

L. Provide support for utility meters in accordance with requirements of utility companies.

M. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting.

N. Excavate in accordance with Section 31 2316.

O. Install bell and spigot pipe with bell end upstream.

P. Install valves with stems upright or horizontal, not inverted. Refer to Section 22 0523.

Q. Install water piping to ASME B31.9.

R. Copper Pipe and Tube: Make soldered joints in accordance with ASTM B828, using specified solder, and flux meeting ASTM B813; in potable water systems use flux also complying with NSF 61 and NSF 372.

S. PVC Pipe: Make solvent-welded joints in accordance with ASTM D2855.

T. Sleeve pipes passing through partitions, walls and floors.

U. Inserts:
   1. Provide inserts for placement in concrete formwork.
   2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
   3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
   4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.

V. 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 other 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. Provide copper plated hangers and supports for copper piping.
   9. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
      a. Painting of interior plumbing systems and components is specified in Section 09 9123.
      b. Painting of exterior plumbing systems and components is specified in Section 09 9113.
   10. Provide hangers adjacent to motor driven equipment with vibration isolation; refer to Section 22 0548.
   11. Support cast iron drainage piping at every joint.

3.04 APPLICATION

A. Use grooved mechanical couplings and fasteners only in accessible locations.

B. Install unions downstream of valves and at equipment or apparatus connections.

C. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.

D. Install ball or butterfly valves for shut-off and to isolate equipment, part of systems, or vertical risers.

E. Install globe valves for throttling, bypass, or manual flow control services.

F. Provide flow controls in water recirculating systems where indicated.

G. Provide automatic flow control valve where domestic hot water system connects to domestic hot water return system. Locate where accessible for adjustment and servicing. Set thermostatic valves for 121 degree F return temperature.

H. Provide trap-seal primer valves for all floor drains which are not collecting condensate from HVAC equipment and where noted on plan. Install with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.

3.05 TOLERANCES

A. Drainage Piping: Establish invert elevations within 1/2 inch vertically of location indicated and slope to drain at minimum of 1/4 inch per foot slope.

B. Water Piping: Slope at minimum of 1/32 inch per foot and arrange to drain at low points.

3.06 TESTING

A. Pressure test piping installations according to code requirements. Provide test report to Engineer for review within 1 week and include final accepted report in project closeout submittals.

3.07 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Disinfect water distribution system in accordance with Section 33 0110.58.

B. Prior to starting work, verify system is complete, flushed and clean.

C. 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).

D. Inject disinfectant, free chlorine in liquid, powder, tablet or gas form, throughout system to obtain 50 to 80 mg/L residual.

E. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15 percent of outlets.

F. Maintain disinfectant in system for 24 hours.

G. If final disinfectant residual tests less than 25 mg/L, repeat treatment.

H. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.

I. 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.

3.08 SERVICE CONNECTIONS

A. 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.

B. Provide new water service complete with approved reduced pressure backflow preventer and water meter with by-pass valves, pressure reducing valve, and sand strainer.
   1. Provide sleeve in wall for service main and support at wall with reinforced concrete bridge. Calk enlarged sleeve and make watertight with pliable material. Anchor service main inside to concrete wall.

3.09 SCHEDULES

A. Pipe Hanger Spacing:
   1. Metal Piping (and with continuous metal saddle/trough):
      a. Pipe Size: 1/2 inches to 1-1/4 inches:
         1) Maximum Hanger Spacing: 6.5 ft.
         2) Hanger Rod Diameter: 3/8 inches.
      b. Pipe Size: 1-1/2 inches to 2 inches:
         1) Maximum Hanger Spacing: 10 ft.
         2) Hanger Rod Diameter: 3/8 inch.
      c. Pipe Size: 2-1/2 inches to 3 inches:
         1) Maximum Hanger Spacing: 10 ft.
         2) Hanger Rod Diameter: 1/2 inch.
   2. Plastic Piping:
      a. All Sizes:
         1) Maximum Hanger Spacing: 6 ft.
         2) Hanger Rod Diameter: 3/8 inch.

END OF SECTION

SECTION 22 1006
PLUMBING PIPING SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Drains.
B. Cleanouts.
C. Hose bibbs.
D. Hydrants.
E. Washing machine boxes and valves.
F. Refrigerator valve and recessed box.
G. Backflow preventers.
H. Water hammer arrestors.
I. Sumps.
J. Sanitary waste interceptors.
K. Mixing valves.

1.02 RELATED REQUIREMENTS

A. Section 22 1005 - Plumbing Piping.
B. Section 22 4000 - Plumbing Fixtures.

1.03 REFERENCE STANDARDS

A. ASME A112.6.3 - Floor and Trench Drains; 2001 (R2007).
B. ASME A112.6.4 - Roof, Deck, and Balcony Drains; 2003.
C. ASSE 1011 - Hose Connection Vacuum Breakers; 2004.
D. ASSE 1013 - Reduced Pressure Principle Backflow Preventers and Reduced Pressure Principle Fire Protection Backflow Preventers; 2011.
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. Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.
C. Shop Drawings: Indicate dimensions, weights, and placement of openings and holes.
D. Certificates: Certify that all interceptors meet or exceed capacity and flow rate scheduled on plans.
E. Sustainable Design Documentation: Submit appropriate evidence that materials used in potable water systems comply with the specified requirements.
F. Operation Data: Indicate frequency of treatment required for interceptors.
G. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.
H. Project Record Documents: Record actual locations of equipment, cleanouts, backflow preventers, water hammer arrestors.

I. 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 Loose Keys for Outside Hose Bibbs: One.

1.05 QUALITY ASSURANCE

A. 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.

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.

B. Unless otherwise noted on plans, provide fixtures as specified below.

2.02 DRAINS

A. Manufacturers:
   1. Jay R. Smith Manufacturing Company: www.jayrsmith.com.
   2. Josam Company: www.josam.com.
   3. Zurn Industries, LLC: www.zurn.com.
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Roof Drains:
   1. Assembly: ASME A112.6.4.
   2. Body: Lacquered cast iron with sump.
   3. Strainer: Removable cast aluminum or cast iron dome with vandal proof screws.
   4. Accessories: Coordinate with roofing type, refer to Division 07:
      a. Membrane flange and membrane clamp with integral gravel stop.
      b. Adjustable under deck clamp.
      c. Waterproofing flange.
      d. Controlled flow weir.
      e. Leveling frame.
      f. Adjustable extension sleeve for roof insulation.
      g. Perforated or slotted ballast guard extension for inverted roof.
      h. Perforated stainless steel ballast guard extension.

C. Roof Overflow Drains:
   1. Lacquered cast iron body and clamp collar and bottom clamp ring; pipe extended to 2 inches above flood elevation.

D. Downspout Nozzles:
   1. Bronze round with straight bottom section.

E. Floor Drain (FD-1):
   1. ASME A112.6.3; lacquered cast iron or stainless steel, two piece body with double drainage flange, weep holes, reversible clamping collar, and round, adjustable nickel-bronze strainer.

2.03 CLEANOUTS

A. Manufacturers:
   1. Substitutions: See Section 01 6000 - Product Requirements.

B. Cleanouts at Exterior Surfaced Areas (CO-1):
   1. Round cast nickel bronze access frame and non-skid cover.

C. Cleanouts at Exterior Unsurfaced Areas (CO-2):
   1. Line type with lacquered cast iron body and round epoxy coated gasketed cover.

D. Cleanouts at Interior Finished Floor Areas (CO-3):
   1. Lacquered cast iron body with anchor flange, reversible clamping collar, threaded top assembly, and round gasketed scored cover in service areas and round gasketed depressed cover to accept floor finish in finished floor areas.

E. Cleanouts at Interior Finished Wall Areas (CO-4):
   1. Line type with lacquered cast iron body and round epoxy coated gasketed cover, and round stainless steel access cover secured with machine screw.

F. Cleanouts at Interior Unfinished Accessible Areas (CO-5): Calked or threaded type. Provide bolted stack cleanouts on vertical rainwater leaders.

2.04 HOSE BIBBS

A. Manufacturers:
   1. Woodford
   2. Jay R. Smith Manufacturing Company: www.jayrsmith.com.
   3. Watts Regulator Company: www.wattsregulator.com.
   4. Zurn Industries, Inc: www.zurn.com.
   5. Substitutions: See Section 01 6000 - Product Requirements.

B. Exterior Hose Bibbs:
   1. ASSE 1019; freeze resistant, self-draining type with chrome plated wall plate, hose thread spout, and integral vacuum breaker.
   2. Provide with key/removeable handle and furnish to owner at substantial completion.

C. Interior Hose Bibbs:
   1. Bronze or brass with integral mounting flange, replaceable hexagonal disc, hose thread spout, chrome plated where exposed with handwheel, integral vacuum breaker in conformance with ASSE 1011.

2.05 HYDRANTS

A. Manufacturers:
   1. Woodford
   2. Arrowhead Brass & Plumbing, LLC: www.arrowheadbrass.com.
   3. Jay R. Smith Manufacturing Company: www.jayrsmith.com.
   4. Zurn Industries, LLC: www.zurn.com.
   5. Watts Regulator Company: www.wattsregulator.com.
   6. Substitutions: See Section 01 6000 - Product Requirements.

B. Wall Hydrants:
   1. ASSE 1019; freeze resistant, self-draining type with chrome plated wall plate hose thread spout, lockshield and removable key, and integral vacuum breaker.

C. Roof Hydrants:
   1. ASSE 1019 freeze resistant, self draining type with chrome plated base plate, standpipe hose thread spout, lockshield and removable key, and integral vacuum breaker.

2.06 WASHING MACHINE BOXES AND VALVES

A. Box Manufacturers:
   1. IPS Corporation/Guy Grey: www.ipscorp.com.
   2. Oatey: www.oatey.com.
   3. Substitutions: See Section 01 6000 - Product Requirements.

B. Description: Plastic preformed rough-in box with brass valves with single lever handle, socket for 2 inch waste, slip in finishing cover.

2.07 REFRIGERATOR VALVE AND RECESSED BOX

A. Box Manufacturers:
   1. IPS Corporation/Water-Tite: www.ipscorp.com.
   2. Oatey Supply Chain Services, Inc: www.oatey.com.
   3. Substitutions: See Section 01 6000 - Product Requirements.

B. Description: Plastic preformed rough-in box with brass valves with wheel handle, slip in finishing cover.

2.08 BACKFLOW PREVENTERS

A. Manufacturers:
   1. Watts Regulator Company: www.wattsregulator.com.
   2. Zurn Industries, Inc: www.zurn.com.

B. Reduced Pressure Backflow Preventers:
   1. ASSE 1013; bronze body with bronze internal parts and stainless steel springs; two independently operating, spring loaded check valves; diaphragm type differential pressure relief valve located between check valves; third check valve that opens under back pressure in case of diaphragm failure; non-threaded vent outlet; assembled with two gate valves, strainer, and four test cocks.

2.09 WATER HAMMER ARRESTORS

A. Manufacturers:
   1. Jay R. Smith Manufacturing Company: www.jayrsmith.com.
   2. Watts Regulator Company, a part of Watts Water Technologies: www.wattsregulator.com.
   3. Zurn Industries, LLC: www.zurn.com.
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Water Hammer Arrestors:
   1. Stainless steel construction, bellows type sized in accordance with PDI-WH 201, precharged suitable for operation in temperature range minus 100 to 300 degrees F and maximum 250 psi working pressure.

2.10 SUMPS

A. Glass fiber reinforced with required openings and drainage fittings.

B. Cover: 3/8 inch thick perforated (flush) plate with gasket seal frames and anchor bolts.

2.11 SANITARY WASTE INTERCEPTORS

A. Manufacturers:
   1. Zurn Industries, LLC: www.zurn.com.
   2. Substitutions: See Section 01 6000 - Product Requirements.

B. Grease Interceptors:
   1. Construction:
      a. Material: Precast concrete.
      b. Rough-in: Fully recessed below grade (deep rough-in), with grade rings and gravel base.
      c. Accessories: Multi-weir baffle assembly, integral deep seal trap, removable integral flow control, sediment bucket.
      d. Cover: Steel, epoxy coated, non-skid with gasket, securing handle, and enzyme injection port, recessed for floor finish.
   2. Unit Rating: gpm flow and lbs grease capacity per plans and local requirements (most stringent).

C. Lint/Sand/Sediment Interceptors:
   1. Epoxy coated cast iron body and secured cover with removable stainless steel sediment bucket.

2.12 MIXING VALVES

A. Thermostatic Mixing Valves:
   1. Manufacturers:
      a. Powers (Digital IntelliStation)
      b. Substitutions: See Section 01 6000 - Product Requirements.
   2. Valve: Chrome plated cast brass body, stainless steel or copper alloy bellows, integral temperature adjustment.
   3. Accessories:
      a. Check valve on inlets.
      b. Volume control shut-off valve on outlet.
      c. Stem thermometer on outlet.
      d. Strainer stop checks on inlets.
   4. Cabinet: 16 gage, 0.0598 inch prime coated steel, for recessed mounting with keyed lock.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. 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.

C. Encase exterior cleanouts in concrete flush with grade.

D. Install floor cleanouts at elevation to accommodate finished floor.

E. Install approved portable water protection devices on plumbing lines where contamination of domestic water may occur; on boiler feed water lines, janitor rooms, fire sprinkler systems, premise isolation, irrigation systems, flush valves, interior and exterior hose bibbs.

F. Pipe relief from backflow preventer to nearest drain.

G. Install water hammer arrestors complete with accessible isolation valve on hot and cold water supply piping to washing machine outlets.

END OF SECTION

SECTION 22 1319

SANITARY WASTE PIPING SPECIALTIES

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes the following sanitary drainage piping specialties:
   1. Backwater valves.
   2. Cleanouts.
   3. Drains.
   4. Roof flashing assemblies.
   5. Miscellaneous sanitary drainage piping specialties.
   6. Flashing materials.

1.02 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and accessories for grease interceptors.

1.03 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

PART 2 PRODUCTS

2.01 BACKWATER VALVES

A. Horizontal, Cast-Iron Backwater Valves:
   1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
      a. Josam Company; Josam Div.
      b. MIFAB, Inc.
      c. Smith, Jay R. Mfr. Co.; Division of Smith Industries, Inc.
      d. Tyler Pipe; Wade Div.
      e. Watts Drainage Products Inc.
      f. Zurn Plumbing Products Group; Specification Drainage Operation.
   2. Standard: ASME A112.14.1.
   3. Size: Same as connected piping.
   4. Body: Cast iron.
   5. Cover: Cast iron with bolted or threaded access check valve.
   6. End Connections: Hubless.
   7. Type Check Valve: Removable, bronze, swing check, factory assembled or field modified to hang closed.
   8. Extension: ASTM A 74, Service class; full-size, cast-iron, soil-pipe extension to field-installed cleanout at floor; replaces backwater valve cover.

B. Drain-Outlet Backwater Valves:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Josam Company; Josam Div.
      b. Smith, Jay R. Mfr. Co.; Division of Smith Industries, Inc.
      c. Watts Drainage Products Inc.
      d. Zurn Plumbing Products Group; Specification Drainage Operation.
   2. Size: Same as floor drain outlet.
   3. Body: Cast iron or bronze made for vertical installation in bottom outlet of floor drain.
   4. Check Valve: Removable ball float.
   5. Inlet: Threaded.
   6. Outlet: Threaded or spigot.

2.02 CLEANOUTS

A. Cleanouts:
   1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
      a. Sioux Chief Manufacturing Company, Inc.
      b. Josam Company; Josam Div.
      c. Oatey.
      d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
      e. Tyler Pipe; Wade Div.
      f. Watts Drainage Products Inc.
      g. Zurn Plumbing Products Group; Light Commercial Operation.
      h. Zurn Plumbing Products Group; Specification Drainage Operation.
   2. Standard: ASME A112.36.2M.
   3. Size: Same as connected branch.
   4. Type: Heavy-duty, adjustable housing.
   5. Body or Ferrule: Cast iron.
   6. Clamping Device: Not required.
   7. Outlet Connection: Threaded.
   8. Closure: Brass plug with tapered threads.
   9. Adjustable Housing Material: Cast iron with threads.
   10. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.
   11. Frame and Cover Shape: Round.
   12. Top Loading Classification: Extra Heavy Duty.
   13. Riser: ASTM A 74, Extra-Heavy class, cast-iron drainage pipe fitting and riser to cleanout.

B. Cast-Iron Wall Cleanouts:
   1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
      a. Josam Company; Josam Div.
      b. MIFAB, Inc.
      c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
      d. Tyler Pipe; Wade Div.
      e. Watts Drainage Products Inc.
      f. Zurn Plumbing Products Group; Specification Drainage Operation.
   2. Standard: ASME A112.36.2M. Include wall access.
   3. Size: Same as connected drainage piping.
   4. Body: Hubless, cast-iron soil pipe test tee as required to match connected piping.
   5. Closure: Countersunk, drilled-and-threaded brass plug.
   6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
   7. Wall Access: Round, flat, chrome-plated brass or stainless-steel cover plate with screw.
   8. Wall Access: Round, nickel-bronze, copper-alloy, or stainless-steel wall-installation frame and cover.

2.03 DRAINS

A. Cast-Iron Floor and Hub Drains:
   1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
      a. Sioux Chief Manufacturing Company, Inc.
      b. Commercial Enameling Co.
      c. Josam Company; Josam Div.
      d. MIFAB, Inc.
      e. Prier Products, Inc.
      f. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.

g. Tyler Pipe; Wade Div.
h. Watts Drainage Products Inc.
i. Zurn Plumbing Products Group; Light Commercial Operation.
j. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.6.3 with backwater valve.
3. Pattern: Floor drain.
4. Body Material: Gray iron.
5. Seepage Flange: Not required.
6. Anchor Flange: Required.
7. Clamping Device: Not required.
8. Outlet: Bottom.
9. Backwater Valve: Integral, ASME A112.14.1, swing-check type.
10. Coating on Interior and Exposed Exterior Surfaces: Not required.
11. Sediment Bucket: .
12. Top or Strainer Material: Nickel bronze unless shown otherwise on plan.
13. Top of Body and Strainer Finish: Nickel bronze unless shown otherwise on plan.
14. Top Shape: Round.
15. Top Loading Classification: Extra Heavy-Duty.
16. Funnel: Required where shown on plan.
17. Inlet Fitting: Gray iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection where applicable.
18. Trap Material: Cast iron.
19. Trap Pattern: Deep-seal P-trap.
20. Trap Features: Not required.

B. Cast-Iron Storm Drains:
1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
a. Sioux Chief Manufacturing Company, Inc.
b. Commercial Enameling Co.
c. Josam Company; Josam Div.
d. MIFAB, Inc.
e. Prier Products, Inc.
f. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
g. Tyler Pipe; Wade Div.
h. Watts Drainage Products Inc.
i. Zurn Plumbing Products Group; Light Commercial Operation.
j. Zurn Plumbing Products Group; Specification Drainage Operation.

2.04 ROOF FLASHING ASSEMBLIES

A. Roof Flashing Assemblies:
1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
a. Acorn Engineering Company; Elmdor/Stoneman Div.
b. Thaler Metal Industries Ltd.

B. Description: Manufactured assembly made of 6.0-lb/sq. ft., 0.0938-inch- thick, lead flashing collar and skirt extending at least 10 inches from pipe, with galvanized-steel boot reinforcement and counterflashing fitting.
1. Open-Top Vent Cap: Without cap.
2. Low-Silhouette Vent Cap: With vandal-proof vent cap.
3. Extended Vent Cap: With field-installed, vandal-proof vent cap.

2.05 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Open Drains:
   1. Description: Shop or field fabricate from ASTM A 74, Service class, hub-and-spigot, cast-iron, soil-pipe fittings. Include P-trap, hub-and-spigot riser section; and where required, increaser fitting joined with ASTM C 564, rubber gaskets.
   2. Size: Same as connected waste piping.

B. Deep-Seal Traps:
   1. Description: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap-seal primer valve connection.
   2. Size: Same as connected waste piping.
      a. NPS 2: 4-inch- minimum water seal.
      b. NPS 2-1/2 and Larger: 5-inch- minimum water seal.

C. Floor-Drain, Trap-Seal Primer Fittings:
   1. Description: Cast iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
   2. Size: Same as floor drain outlet with NPS 1/2 side inlet.

D. Air-Gap Fittings:
   1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
   2. Body: Bronze or cast iron.
   3. Inlet: Opening in top of body.
   4. Outlet: Larger than inlet.
   5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

E. Sleeve Flashing Device:
   1. Description: Manufactured, cast-iron fitting, with clamping device, that forms sleeve for pipe floor penetrations of floor membrane. Include galvanized-steel pipe extension in top of fitting that will extend 2 inches above finished floor and galvanized-steel pipe extension in bottom of fitting that will extend through floor slab.
   2. Size: As required for close fit to riser or stack piping.

F. Stack Flashing Fittings:
   1. Description: Counterflashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.
   2. Size: Same as connected stack vent or vent stack.

G. Vent Caps:
   1. Description: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and setscrews to secure to vent pipe.
   2. Size: Same as connected stack vent or vent stack.

2.06 FLASHING MATERIALS

A. Lead Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:
   1. General Use: 4.0-lb/sq. ft., 0.0625-inch thickness.
   2. Vent Pipe Flashing: 3.0-lb/sq. ft., 0.0469-inch thickness.
   3. Burning: 6-lb/sq. ft., 0.0938-inch thickness.

B. Fasteners: Metal compatible with material and substrate being fastened.

C. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.

D. Solder: ASTM B 32, lead-free alloy.

E. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install backwater valves in building drain piping. For interior installation, provide cleanout deck plate flush with floor and centered over backwater valve cover, and of adequate size to remove valve cover for servicing.

B. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
   1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
   2. Locate at each change in direction of piping greater than 45 degrees.
   3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
   4. Locate at base of each vertical soil and waste stack.

C. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

E. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.
   1. Position floor drains for easy access and maintenance.
   2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:
      a. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.
      b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.
      c. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1-inch total depression.
   3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
   4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

F. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.

G. Assemble open drain fittings and install with top of hub 2 inches above floor.

H. Install deep-seal traps on floor drains and other waste outlets, if indicated.

I. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.
   1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
   2. Size: Same as floor drain inlet.

J. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.

K. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.

L. Install vent caps on each vent pipe passing through roof.

M. Install grease interceptors, including trapping, venting, and flow-control fitting, according to authorities having jurisdiction and with clear space for servicing.
   1. Above-Floor Installation: Set unit with bottom resting on floor, unless otherwise indicated.

2. Flush with Floor Installation: Set unit and extension, if required, with cover flush with finished floor.
3. Recessed Floor Installation: Set unit in receiver housing having bottom or cradle supports, with receiver housing cover flush with finished floor.
4. Install cleanout immediately downstream from interceptors not having integral cleanout on outlet.

N. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

O. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

3.02 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

C. Grease Interceptors: Connect inlet and outlet to unit, and connect flow-control fitting and vent to unit inlet piping. Install valve on outlet of automatic drawoff-type unit.

3.03 FLASHING INSTALLATION

A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:
1. Lead Sheets: Burn joints of lead sheets 6.0-lb/sq. ft., 0.0938-inch thickness or thicker. Solder joints of lead sheets 4.0-lb/sq. ft., 0.0625-inch thickness or thinner.

B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.
1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.
2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm) around specialty.

C. Set flashing on floors and roofs in solid coating of bituminous cement.

D. Secure flashing into sleeve and specialty clamping ring or device.

E. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings.

F. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.

3.04 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each grease interceptor.

B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit.

3.05 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION

SECTION 22 1323
SANITARY WASTE INTERCEPTORS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Grease interceptors.
   2. Oil interceptors.

1.02 SUBMITTALS

A. Product Data: For each type of metal interceptor indicated.

B. Shop Drawings: For each type and size of precast-concrete interceptor indicated.

PART 2 PRODUCTS

2.01 GREASE INTERCEPTORS

A. Grease Interceptors: Precast concrete complying with ASTM C 913.
   1. Include rubber-gasketed joints, vent connections, manholes, compartments or baffles, and piping or openings to retain grease and to permit wastewater flow.
   2. Structural Design Loads:
      a. Light-Traffic Load: Comply with ASTM C 890, A-8 (ASSHTO HS10-44).
      b. Medium-Traffic Load: Comply with ASTM C 890, A-12 (ASSHTO HS15-44).
      c. Heavy-Traffic Load: Comply with ASTM C 890, A-16 (ASSHTO HS20-44).
      d. Walkway Load: Comply with ASTM C 890, A-03.
   3. Resilient Pipe Connectors: ASTM C 923 (ASTM C 923M), cast or fitted into interceptor walls, for each pipe connection.
   4. Steps: Individual FRP steps, FRP ladder, or ASTM A 615/A 615M, deformed, 1/2-inch (13-mm) steel reinforcing rods encased in ASTM D 4101, PP, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch (300- to 400-mm) intervals. Omit steps if total depth from floor of interceptor to finished grade is less than 60 inches (1500 mm).

B. Capacities and Characteristics:
   1. As per manufacturer recommendations unless shown on plans (request clarifications if needed).

2.02 OIL INTERCEPTORS

A. Oil Interceptors: Factory-fabricated, cast-iron or steel body; with removable sediment bucket or strainer, baffles, vents, and flow-control fitting on inlet.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
      a. Josam Company.
      b. MIFAB, Inc.
      c. Smith, Jay R. Mfg. Co.
      d. Watts Water Technologies, Inc.
      e. Zurn Plumbing Products Group; Zurn Specification Drainage Products.
   2. Inlet, Outlet, Vent, and Waste-Oil Outlet Piping Connections: Hub, hubless, or threaded, unless otherwise indicated.
   3. Extension: Cast-iron or steel shroud, full size of interceptor, extending from top of interceptor to grade.
   4. Cover: Cast iron or steel, with steel reinforcement to provide DOT and ASTM traffic rated.
   5. Comply with requirements in Division 23 Section "Facility Fuel-Oil Piping" for waste-oil storage tank and piping

B. Capacities and Characteristics:

1. Capacity: per manufacturer recommendations unless shown on plans.
2. Overall Dimensions: per manufacturer recommendations unless shown on plans.
3. Inlet and Outlet Pipe Size: match size shown on plans
    a. Inlet invert to Floor: per manufacturer recommendations unless shown on plans.
    b. Outlet invert to Floor: per manufacturer recommendations unless shown on plans.
4. Waste-Oil-Outlet Pipe Size: per manufacturer recommendations unless shown on plans.
    a. Centerline of Outlet to Floor: per manufacturer recommendations unless shown on plans.
5. Trapped Outlet Required: Integral.
6. Vent Pipe Size: 3" or as shown on plans.

2.03 PRECAST-CONCRETE MANHOLE RISERS, FRAME, COVER

A. Precast-Concrete Manhole Risers: ASTM C 478 or C 913, with rubber-gasket joints.
    1. Structural Design Loads:
        a. In parking area: Light-Traffic Load: ASTM C 890, A-8 (ASSHTO HS10-44).
        b. In parking circulation: Medium-Traffic Load: ASTM C 890, A-12 (ASSHTO HS15-44).
        c. In fire lane or trash area: Heavy-Traffic Load: ASTM C 890, A-16 (ASSHTO HS20-44).
        d. In grass areas: Walkway Load: ASTM C 890, A-03.
    2. Length: From top of underground concrete structure to grade.
    3. Riser Sections: 3-inch (75-mm) minimum thickness and 36 inch (915-mm) diameter.
    4. Top Section: Eccentric cone, unless otherwise indicated. Include top of cone to match grade ring size.
    5. Gaskets: ASTM C 443 (ASTM C 443M), rubber.
    6. Steps: Individual FRP steps, FRP ladder, or ASTM A 615/A 615M, deformed, 1/2-inch (13-mm) steel reinforcing rods encased in ASTM D 4101, PP, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch (300- to 400-mm) intervals.

B. Grade Rings: Reinforced-concrete rings, 6- to 9-inch (150- to 225-mm) total thickness, diameter matching manhole frame and cover, and height as required to adjust the manhole frame and cover to indicated elevation and slope.

C. Manhole Frames and Covers: Ferrous; 24-inch (610-mm) ID by 7- to 9-inch (175- to 225-mm) riser with 4-inch- (100-mm-) minimum width flange and 26-inch- (660-mm-) diameter cover.
    1. Ductile Iron: ASTM A 536, Grade 60-40-18, unless otherwise indicated.
    2. Gray Iron: ASTM A 48, Class 35, unless otherwise indicated.
    3. Include indented top design with lettering cast into cover, using wording equivalent to the following: "GREASE INTERCEPTOR", and/or "OIL INTERCEPTOR" as applicable.

PART 3 EXECUTION

3.01 EARTHWORK

A. Excavating, trenching, and backfilling as specified in Division 31 Section "Earth Moving."

3.02 INSTALLATION

A. Install precast-concrete interceptors according to ASTM C 891. Set level and plumb.

B. Install manhole risers from top of underground concrete interceptors to manholes and gratings at finished grade.

C. Set tops of manhole frames and covers flush with finished surface in pavements, unless otherwise indicated.

D. Set metal interceptors level and plumb.

E. Set tops of metal interceptor covers flush with finished surface in pavements, unless otherwise indicated.

F. Install piping and oil storage tanks according to Division 23 Section "Facility Fuel-Oil Piping."

3.03 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Make piping connections between interceptors and piping systems.

3.04 IDENTIFICATION

A. Identification materials and installation are specified in Division 31 Section "Earth Moving." Arrange for installation of green warning tapes directly over piping and at outside edges of underground interceptors.

1. Use warning tapes or detectable warning tape over ferrous piping.
2. Use detectable warning tape over nonferrous piping and over edges of underground structures.

END OF SECTION

SECTION 22 3000
PLUMBING EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. In-line circulator pumps.

B. Submersible sump pumps.

C. Water heaters.

D. Pumps.
   1. Circulators.
   2. Sump pumps.

1.02 REFERENCE STANDARDS

A. ANSI Z21.10.1 - Gas Water Heaters - Volume I - Storage Water Heaters with Input Ratings of 75,000 Btu per Hour or Less; 2014.

B. ANSI Z21.10.3 - Gas-Fired Water Heaters - Volume III - Storage Water Heaters with Input Ratings Above 75,000 Btu per Hour, Circulating and Instantaneous; 2015.

C. ASME BPVC-VIII-1 - Boiler and Pressure Vessel Code, Section VIII, Division 1 - Rules for Construction of Pressure Vessels; 2015.

D. UL 174 - Standard for Household Electric Storage Tank Water Heaters; Current Edition, Including All Revisions.

E. UL 778 - Standard for Motor-Operated Water Pumps; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

B. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittals 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. Project Record Documents: Record actual locations of components.

D. Operation and Maintenance Data: Include operation, maintenance, and inspection data, replacement part numbers and availability, and service depot location and telephone number.

E. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

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.

B. Identification: Provide pumps with manufacturer's name, model number, and rating/capacity identified by permanently attached label.

C. 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 DELIVERY, STORAGE, AND HANDLING

A. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide five year manufacturer warranty for domestic water heaters.

PART 2 PRODUCTS

2.01 WATER HEATER MANUFACTURERS

A. A.O. Smith Water Products Co: www.hotwater.com.

B. Rheem Manufacturing Company: www.rheem.com.

C. Substitutions: See Section 01 6000 - Product Requirements.

2.02 CERTIFICATIONS

A. Water Heaters: NSF approved.

B. Gas Water Heaters: Certified by CSA International to ANSI Z21.10.1 or ANSI Z21.10.3, as applicable, in addition to requirements specified elsewhere.

C. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

2.03 RESIDENTIAL GAS FIRED WATER HEATERS

A. Type: Automatic, natural gas-fired, vertical storage.

B. Tank: Glass lined welded steel with single flue passage, flue baffle and draft hood; thermally insulated and encased in corrosion-resistant steel jacket; baked-on enamel finish; floor shield and legs.

C. Controls: Automatic water thermostat and built-in gas pressure regulator; temperature range adjustable from 120 to 170 degrees F, cast iron or sheet metal burner, safety pilot and thermocouple.

D. Accessories: Provide:
   1. Water Connections: Brass.
   2. Dip Tube: Brass.
   3. Drain Valve.
   4. Anode: Magnesium.
   5. Temperature and Pressure Relief Valve: ASME labelled.

2.04 IN-LINE CIRCULATOR PUMPS

A. Manufacturers:
   1. Armstrong Pumps Inc: www.armstrongpumps.com.
   2. ITT Bell & Gossett: www.bellgossett.com.
   3. Taco: www.taco-hvac.com.
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Casing: Bronze, rated for 125 psig working pressure, with stainless steel rotor assembly.

C. Impeller: Bronze.

D. Shaft: Alloy steel with integral thrust collar and two oil lubricated bronze sleeve bearings.

E. Seal: Carbon rotating against a stationary ceramic seat.

F. Drive: Flexible coupling.

2.05 SUBMERSIBLE SUMP PUMPS

A. Manufacturers:
   1. Armstrong Pumps Inc: www.armstrongpumps.com.
   2. Goulds Pumps: www.goulds.com.
   3. Zoeller Pump Company: www.zoeller.com.
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Type: Completely submersible, vertical, centrifugal.

C. Casing: Cast iron pump body and oil filled motor chamber.

D. Impeller: Cast iron; open non-clog, stainless steel shaft.

E. Bearings: Ball bearings.

F. Sump: Fiberglass basin with steel cover plate; 24 inches diameter, 48 inches deep.

G. Accessories: Oil resistant 6 foot cord and plug with three-prong connector for connection to electric wiring system including grounding connector.

H. Servicing: Slide-away coupling consisting of discharge elbow secure to sump floor, movable bracket, guide pipe system, lifting chain and chain hooks.

I. Controls: Integral diaphragm type level controls with separate liquid level control high level alarm.

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. Coordinate with plumbing piping and related fuel piping work to achieve operating system.

C. Pumps:
   1. Ensure shaft length allows sump pumps to be located minimum 24 inches below lowest invert into sump pit and minimum 6 inches clearance from bottom of sump pit.
   2. Provide air cock and drain connection on horizontal pump casings.
   3. Provide line sized isolating valve and strainer on suction and line sized soft seated check valve and balancing valve on discharge.
   4. 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.
   5. 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.
   6. Align and verify alignment of base mounted pumps prior to start-up
   7. Provide electrical interlocking from cooling condensate pump safety switch to associated HVAC unit(s) furnished under other Sections.

END OF SECTION

SECTION 22 4000
PLUMBING FIXTURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Water closets.

B. Lavatories.

C. Sinks.

D. Electric water coolers.

E. Bathtubs.

F. Showers.

1.02 RELATED REQUIREMENTS

A. Section 07 9005 - Joint Sealers: Seal fixtures to walls and floors.

1.03 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

B. ANSI Z124.1.2 - American National Standard for Plastic Bathtub and Shower Units; 2005.

C. ANSI Z358.1 - American National Standard for Emergency Eyewash and Shower Equipment; 2014.

D. ASHRAE Std 18 - Methods of Testing for Rating Drinking-Water Coolers with Self-Contained Mechanical Refrigeration; 2008.

E. ASME A112.18.1 - Plumbing Supply Fittings; 2012.

F. ASME A112.19.2 - Ceramic Plumbing Fixtures; 2013.

G. ASSE 1070 - Performance Requirements for Water Temperature Limiting Devices; 2004.

H. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

I. ISFA 2-01 - Classification and Standards for Solid Surfacing Material; 2013.

J. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

K. NSF 61 - Drinking Water System Components - Health Effects; 2014 (Errata 2015).

L. NSF 372 - Drinking Water System Components - Lead Content; 2011.

1.04 SUBMITTALS

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

B. Product Data: Provide catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.

C. Samples: Submit two lavatory supply fittings.

D. Maintenance Data: Include fixture trim exploded view and replacement parts lists.

E. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Faucet Washers: One set of each type and size.
   3. Extra Shower Heads: 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.

1.06 MOCK-UP

A. Provide mock-up of typical bathroom group.

B. Mock-up may remain as part of the Work.

1.07 DELIVERY, STORAGE, AND HANDLING

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 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide five year manufacturer warranty for electric water cooler.

PART 2 PRODUCTS

2.01 GENERAL

A. Potable Water Systems: Provide plumbing fittings and faucets that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

B. Water Efficiency: EPA WaterSense label is required for all water closets, urinals, lavatory faucets, and showerheads.

2.02 TANK TYPE WATER CLOSETS

A. Tank Type Water Closet Manufacturers:
   1. American Standard, Inc: www.americanstandard-us.com.
   2. Kohler Company: www.kohler.com.
   3. Substitutions: See Section 01 6000 - Product Requirements.

B. Bowl: ASME A112.19.2; floor mounted, siphon jet, vitreous china, 16.5 inches high, close-coupled closet combination with elongated rim, insulated vitreous china closet tank with fittings and lever flushing valve, bolt caps, vandalproof cover locking device.

C. Seat Manufacturers:
   1. American Standard, Inc: www.americanstandard-us.com.
   2. Bemis Manufacturing Company: www.bemismfg.com.
   3. Church Seat Company: www.churchseats.com.
   4. Olsonite: www.olsonite.com.
   5. Substitutions: See Section 01 6000 - Product Requirements.

D. Seat: Solid white plastic, open front, brass bolts, with cover.

E. Handle Height: 44 inches or less.

2.03 LAVATORIES

A. Lavatory Manufacturers:
   1. Substitutions: See Section 01 6000 - Product Requirements.

B. Supply Faucet Manufacturers:
   1. American Standard, Inc: www.americanstandard-us.com.
   2. Kohler Company: www.kohler.com.
   3. Substitutions: See Section 01 6000 - Product Requirements.

2.04 SHOWER RECEPTORS

A. Solid Surfacing Shower Receptors: Solid plastic resin casting, self-supporting, for installation over conventional subfloor; complying with ANSI Z124.1.2.
   1. Material: Complying with ISFA 2-01 and NEMA LD 3; acrylic or polyester resin, renewable material filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.
   2. Surface Burning Characteristics: Flame spread index of 25 or less, and smoke developed index of 450 or less, Class A, when tested in accordance with ASTM E84.
   3. Finish on Exposed Surfaces: Provide satin or matte, gloss rating of 3 to 20.

B. Drain Trim: Removable chrome plated strainer and tail piece.

2.05 SHOWERS

A. Shower Head:
   1. ASME A112.18.1; chrome plated vandal-proof institutional head with integral wall bracket, built-in 2.5 gpm flow control.

B. Low-Flow Shower Head:
   1. ASME A112.18.1; chrome plated vandal-proof institutional head with integral wall bracket, built-in 1.5 gpm flow control.

C. Ultra-Low-Flow Shower Head:
   1. ASME A112.18.1; chrome plated vandal-proof institutional head with integral wall bracket, built-in 0.8 gpm flow control.

2.06 ELECTRIC WATER COOLERS

A. Electric Water Cooler Manufacturers:
   1. Elkay Manufacturing Company; _____: www.elkay.com.
   2. Haws Corporation; _____: www.hawsco.com.
   3. Substitutions: See Section 01 6000 - Product Requirements.

B. Water Cooler: Electric, mechanically refrigerated; surface handicapped mounted; stainless steel top, vinyl on steel body, elevated anti-squirt bubbler with stream guard, automatic stream regulator, push button, mounting bracket; integral air cooled condenser and stainless steel grille.
   1. Capacity: 8 gallons per hour of 50 degrees F water with inlet at 80 degrees F and room temperature of 90 degrees F, when tested in accordance with ASHRAE Std 18.
   2. Electrical: 115 V, 60 Hertz compressor, 6 foot cord and plug for connection to electric wiring system including grounding connector.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that walls and floor finishes are prepared and ready for installation of fixtures.

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.

C. Install components level and plumb.

D. Install and secure fixtures in place with wall supports and bolts.

E. Seal fixtures to wall and floor surfaces with sealant as specified in Section 07 9005, color to match fixture.

F. Provide two (2) sinks, faucets, and water closets of each type provided for attic stock.

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

A. Clean plumbing fixtures and equipment before substantial completion.

3.07 PROTECTION

A. Protect installed products from damage due to subsequent construction operations.

B. Do not permit use of fixtures by construction personnel.

C. Repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

SECTION 23 0050

HVAC EXECUTION

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes:
   1. Definitions
   2. Coordination
   3. Mechanical sleeve seals.
   4. Sleeves.
   5. Escutcheons.
   6. Grout.
   7. HVAC demolition.
   8. Equipment installation requirements common to equipment sections.
   9. Concrete bases.
   10. Supports and anchorages.

1.02 RELATED DOCUMENTS

A. Drawings, General Provisions of the Contract, including General Conditions, Supplementary General Conditions, other Division 00 & 01 Specification Sections, shall apply to this division.

B. These requirements apply to all Division 23 work.

1.03 DEFINITIONS

A. Approved" means approved by the Engineer and Owner.

B. Furnish" means to purchase, arrange for delivery to site, and to take delivery at the site.

C. Install" means to place in position for use.

D. Provide" means to furnish and install.

E. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.

F. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

G. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

H. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

I. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

1.04 COORDINATION

A. Coordination: Coordinate construction operations to ensure efficient and orderly installation of the Work.
   1. Coordinate construction operations, which depend on each other for proper installation, connection, and operation.
   2. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
   3. Coordinate installation of different components with other contractors to ensure maximum accessibility for required maintenance, service, and repair.
   4. Make adequate provisions to accommodate items scheduled for later installation.

5. Where availability of space is limited, coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair of all components.

B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
   1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.

C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
   1. Preparation of Construction Schedule.
   2. Preparation of the Schedule of Values.
   3. Installation and removal of temporary facilities and controls.
   4. Delivery and processing of submittals.
   5. Progress meetings.
   6. Pre-installation conferences.
   7. Project closeout activities.
   8. Startup and adjustment of systems.
   9. Project closeout activities.

1.05 PROJECT MEETINGS

A. General: Attend meetings and conferences at Project site, unless otherwise indicated.
   1. Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Engineer of scheduled meeting dates and times.
   2. Agenda: Request the meeting agenda if not furnished prior to meeting.
   3. Minutes: Record significant discussions and agreements achieved. Request the meeting minutes if not furnished. Note all discrepancies and notify Engineer of all changes to the Work or to the Contract Documents.

B. Preconstruction Conference: Attend the preconstruction conference before starting construction, no later than 15 days after execution of the Agreement to review responsibilities and personnel assignments.
   1. Attendees: Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
   2. Agenda: Discuss items of significance that could affect progress, including the following as applicable:
      a. Tentative construction schedule.
      b. Phasing.
      c. Critical work sequencing and long-lead items.
      d. Designation of key personnel and their duties.
      e. Procedures for processing field decisions and Change Orders.
      f. Procedures for requests for interpretations (RFIs).
      g. Procedures for testing and inspecting.
      h. Procedures for processing Applications for Payment.
      i. Distribution of the Contract Documents.
      j. Submittal procedures.
      k. LEED requirements.
      l. Preparation of Record Documents.
      m. Use of the premises.
      n. Work restrictions.

o. Owner's occupancy requirements.
p. Responsibility for temporary facilities and controls.
q. Construction waste management and recycling.
r. Parking availability.
s. Office, work, and storage areas.
t. Equipment deliveries and priorities.
u. First aid.
v. Security.
w. Progress cleaning.
x. Working hours.

C. Pre-installation Conferences: Attend a pre-installation conference at Project site before each construction activity that requires coordination with other construction.
1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect of scheduled meeting dates.
2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following as applicable:
a. The Contract Documents.
b. Options.
c. Related requests for interpretations (RFIs).
d. Related Change Orders.
e. Purchases, deliveries, submittals.
f. Review of mockups.
g. Possible conflicts.
h. Compatibility problems.
i. Time schedules.
j. Weather limitations.
k. Manufacturer's written recommendations.
l. Warranty requirements.
m. Compatibility of materials.
n. Acceptability of substrates.
o. Space and access limitations.
p. Regulations of authorities having jurisdiction.
q. Testing and inspecting requirements.
r. Installation procedures.
s. Coordination with other work.
t. Required performance results.
u. Protection of adjacent work.
v. Protection of construction and personnel.
3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
4. Reporting: Distribute minutes of the meeting to each party present, to parties who should have been present, and to the Engineer.
5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

1.06 SUBMITTALS

A. Alternate Products: Alternate manufacturers, equipment and /or products must be specified or approved prior to bid in writing via addendum to be accepted. All costs associated with deviations from the basis of design shall be borne by the contractor. Deviations shall include

alternate manufacturer and/or alternate product and shall include all significant dimensional, performance, electrical, or installation differences from the basis of design products. Costs for reimbursement shall include the costs of other trades affected, and shall include all engineering costs to evaluate such deviations.

B. Substitutions: Unspecified manufacturers shall be considered substitutions and shall be submitted for consideration under the specified substitution procedures. Substitutions shall be submitted to the engineer for evaluation. If approved by the engineer, substitution shall be offered to the owner for consideration. All costs associated with substitutions shall be borne by the contractor. Costs for reimbursement shall include the costs of other trades affected, and shall include all engineering costs to evaluate such deviations.

C. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home and office telephone numbers. Provide names, addresses, and telephone numbers of individuals assigned as standbys in the absence of individuals assigned to Project. Submit to Engineer before starting work.
   1. Post copies of list in Project meeting room, in temporary field office, and by each temporary telephone. Keep list current at all times.

D. Make all necessary field measurements and investigations to assure that the equipment and assemblies will meet contract requirements. If equipment is submitted which differs in arrangement from that shown, provide drawings that show the rearrangement of all associated systems. Approval will be given only if all features of the equipment and associated systems, including accessibility, are equivalent to that required by the contract.

E. Prior to submitting shop drawings for review, contractor shall certify in writing that manufacturers of all major items of equipment have each reviewed drawings and specifications, and have jointly coordinated and properly integrated their equipment and controls to provide a complete and efficient installation.

F. Welding certificates.

1.07 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
   1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
   2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Electrical Characteristics for HVAC Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified at contractor’s cost. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.08 WARRANTIES

A. All work shall include a parts and labor warranty on materials and workmanship for a period of 1 year. In addition to standard manufacturer product warranties, all equipment shall include a warranty on compressors and heat exchangers for a period of 10 years.

B. Refer to Division 01 for additional warranty requirements.

PART 2 PRODUCTS

2.01 SLEEVES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop.

C. Sleeves for Rectangular Openings: Galvanized sheet steel.
   1. Minimum Metal Thickness:
      a. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and no side more than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
      b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches (1270 mm) and 1 or more sides equal to, or more than, 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

2.02 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
   1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
   2. Design Mix: 5000-psi, 28-day compressive strength.
   3. Packaging: Premixed and factory packaged.

2.03 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
   1. Sealing Elements: EPDM-rubber or NBR interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
   2. Pressure Plates: Carbon steel.
   3. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements.

2.04 ESCUTCHEONS / TRIM RINGS

A. Description: Manufactured wall and ceiling escutcheons, floor plates, and duct trim rings, with an ID to closely fit around pipe/duct/insulation surface and with an OD that completely covers opening.

B. One-Piece, deep-drawn or cast metal with polished chrome plated finish and set screw.

C. Split, Cast metal with concealed hinge polished chrome plated finish and set screw.

D. Rectangular trim rings shall be formed metal with mitered corners.

PART 3 EXECUTION

3.01 HVAC DEMOLITION

A. Refer to Division 01 Section "Cutting and Patching" and Division 02 Section "Selective Structure Demolition" for general demolition requirements and procedures.

B. Contractor shall be responsible for all work and costs associated with demolition shown or noted on plans.

C. Verify exact requirements before bid and include direct and related indirect costs in estimate including permit application, fees, dust control, protection of existing, temporary HVAC, fuel usage, scaffolding, disconnection, disposal, cutting and patching.

D. Occupied Buildings: For occupied buildings, coordinate with local management for communication with building users, occupants, and/or residents regarding potential for disruption, and provide 72 hour advance notification for planned outages. Install new work to the fullest extent possible before interrupting existing services to minimize disruption to residents. Provide temporary heat/cooling equipment for disruptions lasting over 4 hours.

E. In performing the work:
   1. Coordinate with existing conditions and other trades before starting work.
   2. Remove portions of walls, floors, ceilings, etc. required for access to demolished and new work.
   3. Disconnect, demolish, and remove systems, equipment, and components indicated to be removed.
   4. Piping to Be Removed: Remove portion indicated to be removed and cap or plug remaining with same or compatible piping material.
   5. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
   6. Ducts to Be Removed: Remove portion of ducts indicated to be removed and cap remaining ducts with same or compatible duct material.
   7. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.
   8. Equipment to Be Removed: Arrange for disconnection of electrical power. Disconnect and cap services and remove equipment. Remove related supports, anchorages, and concrete bases.
   9. Equipment to Be Removed and Reinstalled: Arrange for disconnection of electrical power. Disconnect and cap services and remove, clean, and store equipment. When appropriate, reinstall, reconnect, arrange for power connection and make equipment operational.
   10. Equipment to Be Removed and Salvaged: Arrange for disconnection of electrical power. Disconnect and cap services, remove equipment and deliver to Owner.

F. If new or existing to remain products are damaged during demolition, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

G. Subcontract the General Contractor to perform patching, repair or replacement of walls floors, ceilings, etc.. removed for access to the work. General contractor shall repair finishes to match surrounding finishes.

3.02 PIPING/DUCT SYSTEMS - COMMON REQUIREMENTS

A. Install according to manufacturer requirements and other Division specification sections.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of systems. Indicated locations and arrangements were used to size and calculate friction loss, expansion, pump sizing, and other design considerations. Install as indicated unless deviations to layout are approved on Coordination Drawings.

C. Install in concealed locations, unless otherwise indicated and except in equipment rooms and service areas. Where located within walls and other concealed areas subject to damage, provide suitable protection.

D. If exposed, install at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Where above accessible ceiling, install tight to structure with sufficient space for ceiling panel removal.

F. Install to allow servicing.

G. Install piping at indicated slopes and free of sags and bends

H. Install fittings for changes in direction and branch connections.

I. Install piping to allow application of insulation.

J. Select system components with pressure rating equal to or greater than system operating pressure.

K. Install piping escutcheons/duct trim rings for exposed penetrations of walls, ceilings, and floors.

3.03 PENETRATIONS

A. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls. Sleeve ends shall be flush with both wall surfaces unless otherwise noted. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level. Concrete and masonry penetrations: seal space outside of sleeves with grout. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.

B. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants.".

C. Roof-Penetrations: Seal penetration of roof with flexible boot-type flashing units applied in coordination with roofing work.

D. Aboveground, Exterior-Wall Pipe Penetrations: Position pipe in center of sleeve. Maintain 1% outward slope, unless otherwise indicated. Seal penetrations using non-expanding foam. After cured, trim flush with sleeve end and paint with color to match surrounding finish.

E. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

F. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at. Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07." Comply with requirements in Division 07."

G. Apply radiation, fire and/or smoke dampers to ducted penetrations of fire and/or smoke rated floor and wall assemblies to restore original fire-resistance rating of assembly. Fire and smoke damper materials and installation requirements are specified in Division 23.

H. Apply firestopping to non-ducted penetrations of fire and/or smoke rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07.

I. Penetrations of membranes of rated walls shall be protected by UL listed products. Coordinate exact installation conditions with selected fire sealants supplier. For penetrations which do not have a standard UL installation detail, arrange for engineering determination from damper manufacturer and/or sealant supplier and provide modifications required to match detail.

3.04 INSTALLATION - COMMON REQUIREMENTS

A. Install equipment, devices, and specialties according to manufacturer installation instructions and recommendations.

B. Refer to other Sections of these Specifications for additional requirements.

C. Install to allow maximum possible headroom unless specific mounting heights are indicated. Provide warning markers for all work below 7'6" above walking surface.

D. Install work level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

E. Install work to facilitate service, maintenance, and repair or replacement of components. Connect for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

F. Install work to allow right of way for piping with required slope.

G. Contact equipment manufacturer's representative to visit site and observe installation in order to confirm installation requirements and warranty coverage. Document observation in writing and include in O&M manuals.

H. Provide service and maintenance for not less than one year from the Date of Substantial Completion or for the warranty period specified in Division 01, whichever is longer. Refer to Division 01 for additional service and requirements.

3.05 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
   1. Provide concrete bases which are plumb, level and fully supported to prevent shifting over time.
   2. Provide concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
   3. Place and secure anchorage devices. Install according to equipment manufacturer's recommendations, setting drawings, templates, diagrams, instructions, and directions for supported equipment. Provide anchor bolts according to anchor-bolt manufacturer's written instructions. Install anchor bolts to elevations required for proper attachment to supported equipment. Unless otherwise noted, install epoxy-coated anchor bolts to match equipment that extend through concrete base, and anchor into structural concrete.
   4. Where located on structural floor, provide dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
   5. Provide 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section "Cast-in-Place Concrete."

3.06 SUPPORTS AND ANCHORAGES

A. Provide supports to match construction type and adjacent assembly rating.

B. For combustible construction, provide wood supports and anchorages. Cut, fit, and place nailers, blocking, and anchorages to support, and anchor materials and equipment. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

C. For non-combustible building construction provide metal supports and anchorages. Refer to Division 05 Section "Metal Fabrications" for structural steel. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor HVAC materials and equipment. Field Welding shall comply with AWS D1.1.

D. Attach to substrates as required to support applied loads.

3.07 GROUTING

A. Clean surfaces that will come into contact with grout. Provide forms as required for placement of grout.

B. Mix and install grout for HVAC equipment base bearing surfaces, and anchors.

C. Place grout around anchors and completely filling equipment base and provide smooth bearing surface for equipment. Avoid air entrapment during placement of grout.

D. Allow grout to cure before loading or applying forces.

3.08 SLEEVE-SEAL INSTALLATION

A. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

END OF SECTION

SECTION 23 0513

COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General construction and requirements.

B. Applications.

C. Single phase electric motors.

1.02 REFERENCE STANDARDS

A. NEMA MG 1 - Motors and Generators; 2014.

B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.03 SUBMITTALS

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

B. Product Data: Provide wiring diagrams with electrical characteristics and connection requirements.

C. Manufacturer's Installation Instructions: Indicate setting, mechanical connections, lubrication, and wiring instructions.

D. Operation Data: Include instructions for safe operating procedures.

E. Maintenance Data: Include assembly drawings, bearing data including replacement sizes, and lubrication instructions.

1.04 QUALITY ASSURANCE

A. Conform to NFPA 70.

B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

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 GENERAL CONSTRUCTION AND REQUIREMENTS

A. Construction:
   1. Open drip-proof type except where specifically noted otherwise.
   2. Design for continuous operation in 104 degrees F environment.
   3. Design for temperature rise in accordance with NEMA MG 1 limits for insulation class, service factor, and motor enclosure type.

B. 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.

C. 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.

2.02 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, oil burners, and centrifugal pumps: Split phase type.

C. Single phase motors for shaft mounted fans or blowers: Permanent split capacitor type.

D. Single phase motors for fans, pumps, blowers, and air compressors: Capacitor start type.

E. Single phase motors for fans, blowers, and pumps: Capacitor start, capacitor run type.

2.03 SINGLE PHASE POWER - SPLIT PHASE MOTORS

A. Starting Torque: Less than 150 percent of full load torque.

B. Starting Current: Up to seven times full load current.

C. Breakdown Torque: Approximately 200 percent of full load torque.

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.

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 RELATED REQUIREMENTS

A. Section 01 4533 - Code-Required Special Inspections.

B. Section 03 3000 - Cast-in-Place Concrete.

1.03 REFERENCE STANDARDS

A. ASCE 7 - Minimum Design Loads for Buildings and Other Structures; 2010, with 2013 Supplements and Errata.

B. ASHRAE (HVACA) - ASHRAE Handbook - HVAC Applications; 2015.

1.04 SUBMITTALS

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

B. Product Data:
   1. Provide manufacturer's product literature documenting compliance with PART 2 PRODUCTS.
   2. Include seismic rating documentation for each isolator and restraint component accounting for horizontal, vertical, and combined loads.

C. Shop Drawings:
   1. Provide schedule of vibration isolator type with location and load on each.
   2. Fully dimensioned fabrication drawings and installation details for vibration isolation bases, member sizes, attachments to isolators, and supported equipment.
   3. Include auxiliary motor slide bases and rails, base weights, inertia bases, concrete weights, equipment static loads, support points, vibration isolators, and detailed layout of isolator location and orientation with static and dynamic load on each isolator.
   4. Include selections from prescriptive design tables that indicate compliance with the applicable building code and the vibration isolator manufacturer's requirements.
   5. Clearly indicate the load and capacity assumptions selected. Include copies of any calculations.
   6. Include delegated design calculations that indicate compliance with the applicable building code and the vibration isolator manufacturer's recommendations.

D. Manufacturer's Instructions: Indicate installation instructions with special procedures and setting dimensions.

1.05 QUALITY ASSURANCE

A. Perform delegated design and installation in accordance with applicable codes.

B. Designer Qualifications: Perform design under direct supervision of a Professional Engineer experienced in design of this type of work and registered and licensed in Ohio.

C. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.
   1. Member of Vibration Isolation and Seismic Control Manufacturers Association (VISCMA).

D. Installer Qualifications: Company specializing in performing the work of this section with minimum 5 years of experience.

E. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Kinetics Noise Control, Inc: www.kineticsnoise.com.

B. Mason Industries: www.mason-ind.com.

C. Vibro-Acoustics.

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.
   3. Steel springs to operate in the linear portion of the load versus deflection curve over deflection range of not less than 50 percent above specified deflection.
   4. Lateral to vertical stiffness ratio to not exceed 0.08 with spring deflection at minimum 75 percent of specified deflection.
   5. All equipment mounted on vibration isolated bases to have minimum operating clearance of 2 inches between the base and floor or support beneath unless noted otherwise.

2.03 EQUIPMENT SUPPORT BASES

A. Structural Bases:
   1. Construction: Engineered, structural steel frames with welded brackets for side mounting of the isolators.
   2. Frames: Square, rectangular or T-shaped.
   3. Design: Sufficiently rigid to prevent misalignment or undue stress on machine, and to transmit design loads to isolators and snubbers.
   4. Applications: Roof mounted equipment and adjustable motor slide rails for centrifugal fans.

B. Concrete Inertia Bases:
   1. Construction: Engineered, steel forms, with integrated isolator brackets and anchor bolts, welded or tied reinforcing bars running both ways in a single layer.
   2. Size: 6 inches minimum depth and sized to accommodate elbow supports.
   3. Mass: Minimum of 1.5 times weight of isolated equipment.
   4. Connecting Point: Reinforced to connect isolators and snubbers to base including template and fastening devices for equipment.
   5. Concrete: Filled on site with minimum 3000 psi concrete. See Section 03 3000 for additional requirements.
   6. Applications: Adjustable motor slide rails for centrifugal fans.

2.04 VIBRATION ISOLATORS

A. Non-Seismic Type:
   1. Spring Hanger:
      a. Housing: Steel construction containing stable steel spring and integral glass fiber or elastomeric element preventing metal to metal contact.
      b. Bottom Opening: Sized to allow plus/minus 15 degrees rod misalignment.

PART 3 EXECUTION

3.01 INSTALLATION - GENERAL

A. Install in accordance with manufacturer's instructions.

B. On closed spring isolators, adjust so side stabilizers are clear under normal operating conditions.

C. Prior to making piping connections to equipment with operating weights substantially different from installed weights, block up equipment with temporary shims to final height. When full load is applied, adjust isolators to load to allow shim removal.

D. Provide pairs of horizontal limit springs on fans with more than 6.0 inches WC static pressure, and on hanger supported, horizontally mounted axial fans.

E. For motorized equipment mounted on isolators, provide flexible connections and support using isolators or resilient hangers for scheduled distance.
   1. Up to 4 Inches Pipe Size: First three points of support.
   2. 5 to 8 Inches Pipe Size: First four points of support.
   3. 10 inches Pipe Size and Over: First six points of support.
   4. Select three hangers closest to vibration source for minimum 1.0 inch static deflection or static deflection of isolated equipment. Select remaining isolators for minimum 1.0 inch static deflection or 1/2 static deflection of isolated equipment.

3.02 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Inspect isolated equipment after installation and submit report. Include static deflections.

C. Perform testing and inspections of the installation in accordance with Section 01 4533.

3.03 SCHEDULE

A. Equipment Isolation Schedule.
   1. Suspended Air Handling Units, Fan Coils, Heat Pumps, and Unit Heaters.
      a. Base: Steel Frame.
      b. Base Thickness: 1.5" inches.
      c. Isolator Type: Spring hanger.
      d. Isolator Deflection:.75 inches up to 10 HP. Above 10 HP provide per ASHRAE Handbook.

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. ASTM D709 - Standard Specification for Laminated Thermosetting Materials; 2016.

1.03 SUBMITTALS

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

B. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.

C. Schedule: Submit schedules of equipment and valves including tag, location, function, and manufacturer's name and model number.

D. Product Data: Provide manufacturers catalog literature for each product required.

E. Manufacturer's Installation Instructions: Indicate special procedures, and installation.

F. Project Record Documents: Record locations of equipment, dampers and valves.

PART 2 PRODUCTS

2.01 IDENTIFICATION APPLICATIONS

A. Air Handling Units: Nameplates.

B. Condensing Units: Nameplates.

C. Thermostats: Nameplates.

2.02 NAMEPLATES

A. Manufacturers:
   1. Letter Color: White.
   2. Letter Height: 1/4 inch.
   3. Background Color: Black.
   4. Plastic: Conform to ASTM D709.

PART 3 EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.02 INSTALLATION

A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install in accordance with manufacturer's instructions.

END OF SECTION

SECTION 23 0593

TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Testing, adjustment, and balancing of air systems.

B. Measurement of final operating condition of HVAC systems.

1.02 RELATED REQUIREMENTS

A. Section 01 4000 - Quality Requirements: Employment of testing agency and payment for services.

1.03 REFERENCE STANDARDS

A. AABC (NSTSB) - AABC National Standards for Total System Balance, 7th Edition; 2016.

B. AABC MN-1 - AABC National Standards for Total System Balance; 2002.

C. ASHRAE Std 111 - Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems; 2008.

D. NEBB (TAB) - Procedural Standards for Testing Adjusting and Balancing of Environmental Systems; 2015, Eighth Edition.

E. SMACNA (TAB) - HVAC Systems Testing, Adjusting and Balancing; 2002.

1.04 SUBMITTALS

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

B. Installer Qualifications: Submit name of adjusting and balancing agency and TAB supervisor for approval within 30 days after award of Contract.

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. Submit to Architect.
   2. Submit six weeks prior to starting the testing, adjusting, and balancing work.
   3. Include certification that the plan developer has reviewed the contract documents, the equipment and systems, and the control system with the Architect and other installers to sufficiently understand the design intent for each system.
   4. Include at least the following in the plan:
      a. List of all air flow, water flow, sound level, system capacity and efficiency 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. Identification and types of measurement instruments to be used and their most recent calibration date.
      d. Discussion of what notations and markings will be made on the duct and piping drawings during the process.
      e. Final test report forms to be used.
      f. Details of how TOTAL flow will be determined; for example:
         1) Air: Sum of terminal flows via control system calibrated readings or via hood readings of all terminals, supply (SA) and return air (RA) pitot traverse, SA or RA flow stations.
         2) Water: Pump curves, circuit setter, flow station, ultrasonic, etc.
      g. Procedures for formal deficiency reports, including scope, frequency and distribution.

D. Final 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 to the Engineer within two weeks after completion of testing, adjusting, and balancing.
   3. Revise TAB plan to reflect actual procedures and submit as part of final report.
   4. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Architect and for inclusion in operating and maintenance manuals.
   5. Include actual instrument list, with manufacturer name, serial number, and date of calibration.
   6. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.
   7. Units of Measure: Report data in I-P (inch-pound) units only.
   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.

E. Project Record Documents: Record actual locations of all balancing devices.

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 (NSTSB), AABC National Standards for Total System Balance.
   2. ASHRAE Std 111, Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems.
   3. NEBB Procedural Standards for Testing Adjusting Balancing of Environmental Systems.
   4. SMACNA (TAB).

B. Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.

C. Where HVAC systems and/or components interface with life safety systems, including fire and smoke detection, alarm, and control, coordinate scheduling and testing and inspection procedures with the authorities having jurisdiction.

D. TAB Agency Qualifications:
   1. An independent company specializing in the testing, adjusting, and balancing of systems specified in this section.
   2. Having minimum of three years documented experience.
   3. Certified by one of the following:
      a. AABC, Associated Air Balance Council: www.aabc.com; upon completion submit AABC National Performance Guaranty.
      b. NEBB, National Environmental Balancing Bureau: www.nebb.org.
      c. TABB, The Testing, Adjusting, and Balancing Bureau of National Energy Management Institute: www.tabbcertified.org.

E. TAB Supervisor and Technician Qualifications: Certified by same organization as TAB agency.

3.02 EXAMINATION

A. 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. Final filters are clean and in place. If required, install temporary media in addition to final filters.
   5. Duct systems are clean of debris.
   6. Fans are rotating correctly.
   7. Fire and volume dampers are in place and open.
   8. Zone dampers and zone damper system is fully installed and operating properly.
   9. Air coil fins are cleaned and combed.
   10. Access doors are closed and duct end caps are in place.
   11. Air outlets are installed and connected.
   12. Duct system leakage is minimized.

B. Submit field reports. Report defects and deficiencies that will or could prevent proper system balance.

C. Beginning of work means acceptance of existing conditions.

3.03 PREPARATION

A. Hold a pre-balancing meeting at least one week prior to starting TAB work.

3.04 ADJUSTMENT TOLERANCES

A. Equipment: Adjust to within plus or minus 5 percent of design for supply systems.

B. Equipment: Adjust to within plus or minus 10 percent of design for return and exhaust systems.

C. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.

D. Hydronic Systems: Adjust to within plus or minus 10 percent of design.

3.05 RECORDING AND ADJUSTING

A. Field Logs: Maintain written logs including:
   1. Running log of events and issues.
   2. Discrepancies, deficient or uncompleted work by others.
   3. Contract interpretation requests.
   4. Lists of completed tests.

B. Ensure recorded data represents actual measured or observed conditions.

C. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

D. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

E. 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.

C. Measure air quantities at air inlets and outlets.

D. Use volume control devices to regulate air quantities only to extend that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.

E. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.

F. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.

G. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.

3.07 SCOPE

A. Test, adjust, and balance all equipment and systems installed or modified under this contract.

B. Test, adjust, and balance the following:
   1. Air Handling Units.
   2. Fans.
   3. Air Inlets and Outlets.

3.08 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.

B. Air Moving Equipment:
   1. Location.
   2. Manufacturer.
   3. Model number.
   4. Arrangement/Class/Discharge.
   5. Air flow, specified and actual.
   6. Return air flow, specified and actual.
   7. Outside air flow, specified and actual.
   8. Total static pressure, specified and actual
   9. Total external pressure, specified and actual
   10. Inlet pressure.
   11. Discharge pressure.
   12. Fan RPM.

C. 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.

D. Exhaust Fans:

1. Location.
2. Manufacturer.
3. Model number.
4. Air flow, specified and actual.
5. Total static pressure (total external), specified and actual.
6. Inlet pressure.
7. Discharge pressure.
8. Fan RPM.

E. 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.

F. Duct Leak Tests:
1. Description of ductwork under test.
2. Duct design operating pressure.
3. Duct design test static pressure.
4. Duct capacity, air flow.
5. Maximum allowable leakage duct capacity times leak factor.
6. Test static pressure.
7. Test orifice differential pressure.
8. Leakage.

G. Air Distribution Tests:
1. Room number/location.
2. Design velocity.
3. Design air flow.
4. Test (final) velocity.
5. Test (final) air flow.
6. Percent of design air flow.

END OF SECTION

SECTION 23 0713
DUCT INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Duct insulation.

B. Duct liner.

1.02 REFERENCE STANDARDS

A. ASTM C916 - Standard Specification for Adhesives for Duct Thermal Insulation; 2014.

B. ASTM C1071 - Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material); 2012.

C. ASTM C1338 - Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings; 2008.

D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

E. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2014.

F. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015.

G. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005 (Rev. 2009).

H. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative 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 necessary to ensure acceptable workmanship and that installation standards will be achieved.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section with not less than three years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labelled 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.

1.06 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 index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 GLASS FIBER, FLEXIBLE

A. Manufacturer:
   1. Knauf Insulation: www.knaufusa.com.
   2. Johns Manville: www.jm.com.
   3. Owens Corning Corporation: www.ocbuildingspec.com.
   4. CertainTeed Corporation: www.certainteed.com.

B. Vapor Barrier Jacket:
   1. Kraft paper with glass fiber yarn and bonded to aluminized film.
   2. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.
   3. Secure with pressure sensitive tape.

C. Vapor Barrier Tape:
   1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

2.03 DUCT LINER: RETURN AIR PLENUM BOXES.

A. Manufacturers:
   1. Knauf Insulation: www.knaufusa.com.
   2. Johns Manville: www.jm.com.
   3. Owens Corning Corp: www.owenscorning.com.
   4. CertainTeed Corporation: www.certainteed.com.

B. Insulation: Non-corrosive, incombustible glass fiber complying with ASTM C1071; rigid board; impregnated surface and edges coated with poly vinyl acetate polymer.
   1. Fungal Resistance: No growth when tested according to ASTM G21.
   2. Apparent Thermal Conductivity: Maximum of 0.23 at 75 degrees F.
   3. Service Temperature: Up to 250 degrees F.
   4. Rated Velocity on Coated Air Side for Air Erosion: 4,000 fpm, minimum.
   5. Minimum Noise Reduction Coefficients:
      a. 1 inch Thickness: 0.45.

C. Adhesive: Waterproof, fire-retardant type, ASTM C916.

D. Liner Fasteners: Galvanized steel, self-adhesive pad with integral 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. Insulated ducts conveying air below ambient temperature:
   1. Provide insulation with vapor barrier jackets.
   2. Finish with tape and vapor barrier jacket.
   3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
   4. Insulate entire system including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.

D. Insulated ducts conveying air above ambient temperature:
   1. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.

E. Exterior Applications: Provide closed cell foam elastomeric or polyisocyuranate insulation with weather barrier. On horizontal surfaces, provide tapered insulation to prevent ponding. Cover exterior with aluminum jacket and locate seams on bottom (12" and smaller) or in weatherboard fashion (larger than 12"), and seal seams with caulk.

F. External Duct Insulation Application:
   1. Secure insulation with vapor barrier with wires and seal jacket joints with vapor barrier adhesive or tape to match jacket.
   2. Install without sag on underside of duct. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift duct off trapeze hangers and insert spacers.
   3. Seal vapor barrier penetrations by mechanical fasteners with vapor barrier adhesive.
   4. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.

G. Duct and Plenum Liner Application:
   1. Secure insulation with mechanical liner fasteners. Refer to SMACNA (DCS) for spacing.
   2. Seal and smooth joints. Seal and coat transverse joints.
   3. Seal liner surface penetrations with adhesive.

3.03 SCHEDULES

A. Indoor, Concealed and Exposed, Outside Air Intake Ducts: Glass Fiber, Flexible, 1-1/2 inches thick, minimum installed R-value 4.2 and 0.75 lb/cu. ft. nominal density.

B. Supply plenums: Glass Fiber, Flexible, 1-1/2 inches thick, minimum installed R-value 4.2 and 0.75 lb/cu. ft. nominal density.

C. Indoor, Concealed Supply Ducts: Glass Fiber, Flexible, 1-1/2 inches thick, minimum installed R-value 4.2 and 0.75 lb/cu. ft. nominal density.

D. Indoor, Exposed Supply Ducts: Glass Fiber, Flexible, 1-1/2 inches thick, minimum installed R-value 4.2 and 0.75 lb/cu. ft. nominal density.

END OF SECTION

SECTION 23 2300
REFRIGERANT PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Piping.

B. Refrigerant.

C. Moisture and liquid indicators.

D. Valves.

E. Strainers.

F. Filter-driers.

1.02 RELATED REQUIREMENTS

A. Section 08 3100 - Access Doors and Panels.

1.03 REFERENCE STANDARDS

A. ASME B31.5 - Refrigeration Piping and Heat Transfer Components; 2013.

1.04 SYSTEM DESCRIPTION

A. Where more than one piping system material is specified ensure system components are compatible and joined to ensure the integrity of the system is not jeopardized. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

B. Provide pipe hangers and supports in accordance with ASME B31.5 unless indicated otherwise.

C. Liquid Indicators:

D. Filter-Driers:

1. Use a filter-drier immediately ahead of liquid-line controls, such as thermostatic expansion valves, solenoid valves, and moisture indicators.

PART 2 PRODUCTS

2.01 PIPING

2.02 REFRIGERANT

2.03 MOISTURE AND LIQUID INDICATORS

A. Indicators: Single port type, UL listed, with copper or brass body, flared or solder ends, sight glass, color coded paper moisture indicator with removable element cartridge and plastic cap; for maximum temperature of 200 degrees F and maximum working pressure of 500 psi.

2.04 VALVES

2.05 STRAINERS

2.06 FILTER-DRIERS

A. Cores: Molded or loose-fill molecular sieve desiccant compatible with refrigerant, activated alumina, activated charcoal, and filtration to 40 microns, with secondary filtration to 20 microns; of construction that will not pass into refrigerant lines.

B. Construction: UL listed.

1. Connections: As specified for applicable pipe type.

PART 3 EXECUTION

3.01 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.

3.02 INSTALLATION

A. Install refrigeration specialties in accordance with manufacturer's instructions.

B. Route piping in orderly manner, with plumbing parallel to building structure, and maintain gradient.

C. Install piping to conserve building space and avoid interference with use of space.

D. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

E. Pipe Hangers and Supports:

F. Arrange piping to return oil to compressor. Provide traps and loops in piping, and provide double risers as required. Slope horizontal piping 0.40 percent in direction of flow.

G. Provide access to concealed valves and fittings. Coordinate size and location of access doors with Section 08 3100.

H. Flood piping system with nitrogen when brazing.

I. Where pipe support members are welded to structural building frame, brush clean, and apply one coat of zinc rich primer to welding.

J. Insulate piping and equipment; refer to Section and Section 23 0716.

K. Provide replaceable cartridge filter-driers, with isolation valves and valved bypass.

L. Install flexible connectors at right angles to axial movement of compressor, parallel to crankshaft.

3.03 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Test refrigeration system in accordance with ASME B31.5.

C. Pressure test system with dry nitrogen to 200 psi. Perform final tests at 27 inches vacuum and 200 psi using halide torch. Test to no leakage.

END OF SECTION

SECTION 23 3100
HVAC DUCTS AND CASINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal ductwork.

B. Nonmetal ductwork.

C. Duct cleaning.

1.02 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

C. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.

D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

E. ICC-ES AC01 - Acceptance Criteria for Expansion Anchors in Masonry Elements; 2015.

F. ICC-ES AC106 - Acceptance Criteria for Predrilled Fasteners (Screw Anchors) in Masonry Elements; 2012.

G. ICC-ES AC193 - Acceptance Criteria for Mechanical Anchors in Concrete Elements; 2015.

H. ICC-ES AC308 - Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements; 2015.

I. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2015.

J. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005 (Rev. 2009).

K. SMACNA (LEAK) - HVAC Air Duct Leakage Test Manual; 2012, 2nd Edition.

1.03 SUBMITTALS

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

B. Product Data: Provide data for duct materials.

C. Shop Drawings: Indicate duct fittings, particulars such as gages, sizes, welds, and configuration prior to start of work for 2" pressure class and higher systems.

1.04 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.

1.05 REGULATORY REQUIREMENTS

A. Construct ductwork to NFPA 90A standards.

1.06 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.

PART 2 PRODUCTS

2.01 DUCT ASSEMBLIES

A. Regulatory Requirements: Construct ductwork to NFPA 90A standards.

B. Ducts: Galvanized steel, unless otherwise indicated.

C. Low Pressure Supply (Heating or Cooling Systems): 12 inch dimension and smaller: 1 inch w.g. pressure class, galvanized steel.
   1. Construct of 28 gage.

D. Low Pressure Supply (Heating or Cooling Systems): 12 inch dimension and larger: 2 inch w.g. pressure class, galvanized steel.
   1. Construct of 24 gage.

E. Return and Relief: 1 inch w.g. pressure class, galvanized steel.
   1. Construct of 26 gage.

F. General Exhaust: 1/2 inch w.g. pressure class, galvanized steel.
   1. Construct of 26 gage.

G. Outside Air Intake: 1 inch w.g. pressure class, galvanized steel.
   1. Construct of 26 gage.

2.02 MATERIALS

A. Galvanized Steel for Ducts: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G60/Z180 coating.

B. Stainless Steel for Ducts: ASTM A666, Type 304.

C. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.
   1. Type: Heavy mastic or liquid, 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. Confirm with green rater (if applicable).
   3. Surface Burning Characteristics: Flame spread index of zero and smoke developed index of zero, when tested in accordance with ASTM E84.
   4. For Use With Flexible Ducts: UL labeled.

D. Hanger Rod: ASTM A36/A36M; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.

E. Hanger Fasteners: Attach hangers to structure using appropriate fasteners, as follows:
   1. Concrete Wedge Expansion Anchors: Complying with ICC-ES AC193.
   2. Masonry Wedge Expansion Anchors: Complying with ICC-ES AC01.
   3. Concrete Screw Type Anchors: Complying with ICC-ES AC193.
   4. Masonry Screw Type Anchors: Complying with ICC-ES AC106.
   5. Concrete Adhesive Type Anchors: Complying with ICC-ES AC308.
   6. Other Types: As required.

2.03 DUCTWORK FABRICATION

A. Fabricate and support in accordance with SMACNA (DCS) and as indicated.

B. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

C. Construct T's, bends, and elbows with inside radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows must be used, provide air foil turning vanes of perforated metal.

D. Change duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

E. Fabricate continuously welded round and oval duct fittings in accordance with SMACNA (DCS).

F. Where ducts are connected to exterior wall louvers and duct outlet is smaller than louver frame, provide blank-out panels sealing louver area around duct. Use same material as duct, painted black on exterior side; seal to louver frame and duct.

2.04 MANUFACTURED DUCTWORK AND FITTINGS

A. Single Wall Round Ducts (concealed and mechanical areas): Round pre-formed duct with galvanized steel wall, longitudinal snap-lock seam and factory crimped male end. Fittings to include factory crimp on male end.

B. Flexible Ducts: Flexible ducts not to exceed 5'-0" in length. Two ply vinyl film supported by helically wound spring steel wire.
   1. Insulation: Fiberglass insulation with polyethylene vapor barrier film.
   2. Pressure Rating: 10 inches WG positive and 1.0 inches WG negative.
   3. Maximum Velocity: 4000 fpm.
   4. Temperature Range: Minus 10 degrees F to 160 degrees F.
   5. Insulation R-value: 4.2 within thermal envelope.
   6. Insulation R-value: 8.0 outside thermal envelope.
   7. Manufacturers:
      a. Hart & Cooley, Inc: www.hartandcooley.com.
      b. Flexmaster U.S.A., Inc.
      c. Thermaflex.
      d. Ward Industries, Inc.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install, support, and seal ducts in accordance with SMACNA (DCS).

B. Install in accordance with manufacturer's instructions.

C. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

D. Flexible Ducts: Flexible ducts not to exceed 5'-0" in length. Connect to metal ducts with liquid adhesive and draw bands.

E. Provide access panels where drywall ceiling is located below locations where duct access is required (dampers, duct smoke detectors, duct access panels, etc.). Access panel shall match ceiling rating. Refer to architectural specifications for additional requirements.

F. Duct sizes indicated are inside clear dimensions. For lined ducts, maintain sizes inside lining.

G. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

H. Use crimp joints with or without bead for joining round duct sizes 8 inch and smaller with crimp in direction of air flow.

I. Use double nuts and lock washers on threaded rod supports.

J. At exterior wall louvers, seal duct to louver frame and install blank-out panels.

K. Seal ducts to seal Level A: including transverse joints, longitudinal seams, branch fittings and duct wall penetrations.
   1. Spiral lock seams need not be sealed.
   2. Pressure sensitive tape shall not be used as the primary sealant, unless it has been certified to comply with UL-181A or UL181B by an independent testing laboratory and the tape is used in accordance with that certification.

3.02 CLEANING

A. Clean duct systems with high power vacuum machines. Protect equipment that could be harmed by excessive dirt with filters, or bypass during cleaning. Provide adequate access into ductwork for cleaning purposes.

END OF SECTION

SECTION 23 3300
AIR DUCT ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Air turning devices/extractors.

B. Flexible duct connections.

C. 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 (Rev. 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.

E. UL 555S - Standard for Smoke Dampers; Current Edition, Including All Revisions.

1.04 SUBMITTALS

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

B. Product Data: Provide for shop fabricated assemblies including volume control dampers and duct access doors. Include electrical characteristics and connection requirements.

C. Shop Drawings: Indicate for shop fabricated assemblies including volume control dampers and duct access doors.

D. Manufacturer's Installation Instructions: Provide instructions for fire dampers and combination fire and smoke dampers.

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 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.

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 AIR TURNING DEVICES/EXTRACTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following.
   1. Carlisle HVAC Products; Dynair Hollow Vane and Rail (Double Wall Vane): www.carlislehvac.com/sle.
   2. Elgen Manufacturing: www.elgenmfg.com.
   3. Krueger: www.krueger-hvac.com.
   4. Ruskin Company: www.ruskin.com.
   5. Titus: www.titus-hvac.com.
   6. Ward Industries by Commercial Products Group of Hart & Cooley, Inc: www.wardind.com.

B. Multi-blade device with blades aligned in short dimension; steel construction; with individually adjustable blades, mounting straps.

2.02 FLEXIBLE DUCT CONNECTIONS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following.
   1. Ductmate Industries, Inc:
   2. Duro Dyne Inc:
   3. Ventfabrics, Inc:
   4. Ward Industries, Inc:

B. Fabricate in accordance with SMACNA (DCS) and as indicated.

C. Flexible Duct Connections: Fabric crimped into metal edging strip.
   1. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A, minimum density 30 oz per sq yd.
      a. Net Fabric Width: Approximately 2 inches wide.
   2. Metal: 3 inches wide, 24 gage, 0.0239 inch thick galvanized steel.

D. Maximum Installed Length: 14 inch.

2.03 VOLUME CONTROL DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following.
   1. Air Balance Inc:
   2. American Warming and Ventilating:
   3. McGill AirFlow LLC:
   4. Greenheck Fan Corporation:
   5. Ruskin Company: www.ruskin.com.

B. Fabricate in accordance with SMACNA (DCS) and as indicated.

C. Single Blade Dampers: Fabricate for duct sizes up to 6 by 30 inch.
   1. Fabricate for duct sizes up to 6 by 30 inch.
   2. Blade: 24 gage, 0.0239 inch, minimum.

D. Multi-Blade Damper: Fabricate of opposed blade pattern with maximum blade sizes 8 by 72 inch. Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.
   1. Blade: 18 gage, 0.0478 inch, minimum.

E. End Bearings: Except in round ducts 12 inches and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon, thermoplastic elastomer, 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.

2.04 MISCELLANEOUS PRODUCTS

A. Duct Opening Closure Film: Mold-resistant, self-adhesive film to keep debris out of ducts during construction.
   1. Thickness: 2 mils.

PART 3 EXECUTION

3.01 PREPARATION

A. Coordinate and subcontract with electrical and fire alarm sub-contractors to include all power wiring, control wiring, smoke detector(s), fire alarm interface for complete working systems.

Detector(s) and/or fire alarm interface(s) shall match fire alarm system manufacturer to maintain listings on life safety systems. Coordinate power and control voltage, amperage, and other characteristics before selecting and submitting product data.

3.02 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. At fans and motorized equipment associated with ducts, provide flexible duct connections immediately adjacent to the equipment.

C. At equipment supported by vibration isolators, provide flexible duct connections immediately adjacent to the equipment.

D. Provide balancing dampers where accessible and at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum 2 duct widths from duct take-off.

E. Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.

END OF SECTION

SECTION 23 3423
HVAC POWER VENTILATORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Ceiling exhaust fans.

1.02 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 Compliance: Products shall comply with air and sound performance requirements and shall be lincensed to use the AMCA-Certified Ratings Seal.

E. AMCA 210 - Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating; 2007.

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.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative 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 Materials: Furnish the following for Owner's use in maintenance of project and attic stock.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Dwelling Unit Bathroom Exhaust Fans: Provide two extra bathroom exhaust fans.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.05 FIELD CONDITIONS

A. Permanent ventilators may not be used for ventilation during construction.

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. Electrical Components: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

2.02 CABINET AND CEILING EXHAUST FANS

A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on the equipment schedule or a comparable product by one of the following:
   1. Greenheck Fan Corporation.
   2. Loren Cook.
   3. Penn Barry Ventilation.

B. Centrifugal Fan Unit: V-belt or direct driven with galvanized steel housing lined with acoustic insulation, resilient mounted motor, gravity backdraft damper in discharge.

C. Disconnect Switch: Cord and plug in housing for thermal overload protected motor and wall mounted switch.

2.03 CEILING EXHAUST FANS (ENERGY STAR LABELED)

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on equipment schedule or a comparable product by one of the following:
   1. Broan.
   2. Greenheck Fan Corporation.
   3. Loren Cook.
   4. Nutone.
   5. Panasonic.

B. Description: Energy Star Rated, centrifugal fans designed for installing in ceiling or wall for concealed applications.

C. Housing: Steel lined with accoustical insulation.

D. Fan Wheel: Centrifugal wheel directly mounted on motor shaft. Fan shrouds, motor and fan wheel shall be removable for service.

E. Grille: Painted aluminum, louvered grille with flange on intake and thumbscrew attachment to fan housing.

F. Electrical Requirements: Junction box for electrical connection on housing and receptacle for motor plug-in.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide backdraft dampers on outlet from cabinet and ceiling exhaust fans.

END OF SECTION

SECTION 23 3700
AIR OUTLETS AND INLETS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Registers/grilles.

1.02 RELATED REQUIREMENTS

A. Section 09 9123 - Interior Painting: Painting of ducts visible behind outlets and inlets.

1.03 REFERENCE STANDARDS

A. ASHRAE Std 70 - Method of Testing the Performance of Air Outlets and Inlets; 2006 (R2011).

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative 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.

1.05 QUALITY ASSURANCE

A. Test and rate air outlet and inlet performance in accordance with ASHRAE Std 70.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on equipment schedule or comparable product by one of the following:
   1. Hart & Cooley, Inc: www.hartandcooley.com.
   2. Krueger: www.krueger-hvac.com.
   3. Price Industries: www.price-hvac.com.
   4. Titus: www.titus-hvac.com.
   5. Tuttle & Bailey:

2.02 CEILING SUPPLY REGISTERS/GRILLES

A. Type: Streamlined and individually adjustable curved blades to discharge air along face of grille, two-way deflection.

B. Frame: 1-1/4 inch margin with countersunk screw mounting and gasket.

C. Fabrication: Roll-formed steel with factory enamel finish.

D. Color: As indicated.

E. Damper: Integral, gang-operated, opposed blade type with removable key operator, operable from face. Provide dampers where specified on schedule.

2.03 CEILING EXHAUST AND RETURN REGISTERS/GRILLES

A. Type: Streamlined blades, 3/4 inch minimum depth, 3/4 inch maximum spacing, with blades set at 45 degrees, vertical face.

B. Frame: 1-1/4 inch margin with countersunk screw mounting.

C. Color: As indicated.

D. Damper: Integral, gang-operated, opposed blade type with operator, operable from face where not individually connected to exhaust fans. Provide dampers where specified on schedule.

2.04 WALL SUPPLY REGISTERS/GRILLES

A. Type: Streamlined and individually adjustable curved blades to discharge air along face of grille with two-way deflection.

B. Frame: 1-1/4 inch margin with countersunk screw mounting and gasket.

C. Color: As indicated.

D. Damper: Integral, gang-operated, opposed blade type with operator, operable from face. Provide dampers where specified on schedule.

2.05 WALL EXHAUST AND RETURN REGISTERS/GRILLES

A. Type: Streamlined blades, 3/4 inch minimum depth, 3/4 inch maximum spacing, with spring or other device to set blades, vertical face.

B. Frame: 1-1/4 inch margin with countersunk screw mounting.

C. Color: As indicated on the drawings.

D. Damper: Integral, gang-operated, opposed blade type with operator, operable from face. Provide damper where specified on schedule.

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.

D. Provide balancing dampers on duct take-off to diffusers, and grilles and registers, despite whether dampers are specified as part of the diffuser, or grille and register assembly.

E. Paint ductwork visible behind air outlets and inlets matte black. Refer to Section 09 9123.

END OF SECTION

SECTION 23 5400
FURNACES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Forced air furnaces.

B. Controls.

1.02 REFERENCE STANDARDS

A. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings; 2013, Including All Amendments and Errata.

B. ASHRAE Std 103 - Methods of Testing for Annual Fuel Utilization Efficiency of Residential Central Furnaces and Boilers; 2007, Including All Amendments.

C. NEMA MG 1 - Motors and Generators; 2014.

D. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2015.

E. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems; 2015.

1.03 SUBMITTALS

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

B. Product Data: Provide rated capacities, weights, accessories, electrical nameplate data, and wiring diagrams.

C. Shop Drawings: Indicate assembly, required clearances, and location and size of field connections.

D. Provide manufacturer's approved refrigerant piping schematic: Show layout of refrigerant piping and specialties, including pipe, tube, and fitting sizes, flow capacities, valve arrangements and locations, slopes of horizontal runs, oil traps, double risers, wall and floor penetrations, and equipment connection details. Show interface and spatial relationships between piping and equipment.

1. Refrigerant piping indicated on Drawings is schematic only. Size piping and design actual piping layout, including oil traps, double risers, Specialties and pipe and tube sizes to Accomodates, as a minimum, equipment provided, elevation difference between compressor and evaporator, and length of piping to ensue proper operation and compliance with warranties of connected equipment.

E. Manufacturer's Instructions: Indicate rigging, assembly, and installation instructions.

F. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listing.

G. Warranty: Submit manufacturers warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

H. 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 Filters: Two filters. One clean filter upon substantial completion and a spare set.
3. Provide the following “attic stock” additional product materials at the conclusion of construction for storage on site by the owner:
    a. One (1) box of replacement filters for all HVAC equipment.
    b. Thermostats: Provide two extra thermostats for the dwellin units and one extra for the common spaces.

1.04 REGULATORY REQUIREMENTS

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.05 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Special Warranty: manufacturers's standard form in which manufacturer agrees to repair or replace the following components of furnaces that fail in materials or workmanship within specified warranty period:

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on equipment schedule or a comparable product by one of the following:
   1. Carrier Corporation, a brand of United Technologies Corporation Building & Industrial Systems: www.carrier.com.
   2. Trane Inc, a subsidiary of Ingersoll Rand: www.trane.com.
   3. York International Corporation / Johnson Controls: www.york.com.

2.02 ELECTRIC FURNACES (AHU)

A. Units: Self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet, supply fan, heating element, controls, air filter, humidifier, and accessories; wired for single power connection with control transformer.
   1. Air Flow Configuration: Upflow or downflow as shown on equipment schedule.
   2. Heating: Electric.

B. Cabinet: Steel with baked enamel finish, easily removed and secured access doors, glass fiber insulation and reflective liner.

C. Supply Fan: Centrifugal type rubber mounted with direct drive motor.

D. Motor:
   1. 1750 rpm single-speed, permanently lubricated, hinge mounted.

E. Electric Heater: Helix wound bare nichrome wire heating elements arranged in incremental states of 5 kW each, with porcelain insulators.

F. Electric Heater Operating Controls:
   1. Low voltage adjustable room thermostat energized heater stages in sequence with pre-determined delay between heating stages.
   2. High limit temperature control de-energizes heating elements, automatic resets.

G. Air Filters: 1 inch thick glass fiber, disposable media in manufacturer's sheet metal frame, arranged for easy replacement. Manufacturer's filter box shall be airtight.

2.03 THERMOSTATS

A. Manufacturers: Basis-of-Design Product: Subject to compliance with requirements, provide Honeywell or a comparable product by one of the following:
   1. Carrier Corporation: www.carrier.com.
   2. Trane Inc: www.trane.com.
   3. York International Corporation / Johnson Controls: www.york.com.
   4. Robertshaw.
   5. White Rodgers.

B. Room Thermostat (Dwelling Units): Large easy to read digital display, non-programmable, low voltage, controlling heat and fan to maintain temperature setting; with system selector switch (heat-off) and fan control switch (auto-off).

C. Room Thermostat (Common Spaces): Large easy to read digital display, programmable, low voltage, electric solid state microcomputer based room thermostat with remote sensor:
   1. System selector switch (heat-off) and fan control switch (auto-on).
   2. Preferential rate control to minimize overshoot and deviation from setpoint.
   3. Programming based on weekdays, Saturday and Sunday.
   4. Battery replacement without program loss.
   5. Thermostat Display:
      a. Time of day.
      b. Actual room temperature.
      c. Programmed temperature.
      d. System Mode Indication: heating, cooling, fan auto, off, and on, auto or on, off.
      e. Verify thermostat compatibility with equipment manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrates are ready for installation of units and openings are as indicated on shop drawings.

B. Verify that proper power supply is available and located correctly.

C. Verify that proper fuel supply is available for connection.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions and requirements of authorities having jurisdiction.

B. Install in accordance with NFPA 90A.

END OF SECTION

SECTION 23 6213

PACKAGED AIR-COOLED REFRIGERANT COMPRESSOR AND CONDENSER UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Condensing unit package.

B. Charge of refrigerant and oil.

C. Controls and control connections.

D. Refrigerant piping connections.

E. Motor starters.

F. Electrical power connections.

1.02 REFERENCE STANDARDS

A. AHRI 210/240 - Standard for Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment; 2008, Including All Addenda.

B. ASHRAE Std 15 - Safety Standard for Refrigeration Systems; 2013.

C. ASHRAE Std 23.1 - Methods of Testing for Rating the Performance of Positive Displacement Refrigerant Compressors and Condensing Units that Operate at Subcritical Temperatures of the Refrigerant; 2010.

D. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings; 2013, Including All Amendments and Errata.

E. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.

1.03 SUBMITTALS

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

B. Product Data: Submit equipment sizing. Submit matched rated capacities per ARI, weights specialties and accessories, electrical nameplate data, and wiring diagrams. Include equipment served by condensing units in submittal, or submit at same time, to ensure capacities are complementary.

C. Shop Drawings: Submit plans with routing coordinated through walls and structure; Indicate components, assembly, dimensions, weights and loadings, required clearances, and location and size of field connections and specialties. Include schematic layouts showing condensing units, cooling coils, refrigerant piping, and accessories required for complete system.

D. Design Data: Indicate pipe and equipment sizing.

E. Manufacturer's Instructions: Submit manufacturer's complete installation instructions and approved refrigerant piping schematic with pipe sizes for lengths to be installed and riser isometric diagrams. Show layout of refrigerant piping and specialties including pipe and fitting sizes, flow capacities, valve arrangements and locations, slopes of horizontal runs, oil traps and double risers for oil management if required.

F. Sustainable Design Documentation: Submit manufacturer's product data on refrigerant used, showing compliance with specified requirements.

G. Operation and Maintenance Data: Include start-up instructions, maintenance instructions, parts lists, controls, and accessories.

H. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.

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 HANDLING

A. Comply with manufacturer's installation instructions for rigging, unloading, and transporting units.

1.06 WARRANTY

A. Provide 1 year maintenance agreement and contractor warranty.

B. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

C. Provide a five year warranty to include coverage for refrigerant compressors.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Carrier, a part of UTC Building and Industrial Systems, a unit of United Technologies Corp: www.carrier.com.

B. Trane, a brand of Ingersoll Rand: www.trane.com.

C. York International Corporation/Johnson Controls, Inc: www.york.com.

2.02 MANUFACTURED UNITS

A. Units: Self-contained, packaged, factory assembled and pre-wired units suitable for outdoor use consisting of cabinet, compressors, condensing coil and fans, integral sub-cooling coil, controls, liquid receiver, wind deflector, and screens.

B. Construction and Ratings: In accordance with AHRI 210/240. Test in accordance with ASHRAE Std 23.1.

C. Performance Ratings: Energy Efficiency Rating (EER) and Coefficient of Performance (COP) not less than prescribed by ASHRAE Std 90.1 I-P.

D. Refrigerant: Use only refrigerants that have ozone depletion potential (ODP) of zero and global warming potential (GWP) of less than 50.

2.03 CASING

A. House components in welded steel frame with galvanized steel panels with weather resistant, baked enamel finish.

B. Mount starters, disconnects, and controls in weatherproof panel provided with full opening access doors. Provide mechanical interlock to disconnect power when door is opened.

C. Provide removable access doors or panels with quick fasteners and piano hinges.

2.04 CONDENSER COILS

A. Coils: Aluminum fins mechanically bonded to seamless copper tubing. Provide sub-cooling circuits. Air test under water to 425 psig, and vacuum dehydrate. Seal with holding charge of nitrogen.

B. Coil Guard: Expanded metal with lint screens.

2.05 FANS AND MOTORS

A. Vertical discharge direct driven propeller type condenser fans with fan guard on discharge. Equip with roller or ball bearings with grease fittings extended to outside of casing.

2.06 COMPRESSORS: SINGLE STAGE:

A. Compressor: Hermetic scroll type.

B. Mounting: Statically and dynamically balance rotating parts.
   1. Internally isolate hermetic units on springs.

C. Lubrication System: Reversible, positive displacement oil pump with oil charging valve, oil level sight glass, and magnetic plug or strainer.

D. Motor: Constant speed 1800 rpm suction gas cooled with electronic sensor and winding over temperature protection, designed for across-the-line starting. Furnish with starter.

E. Capacity Reduction Equipment: Suction valve unloaders, with lifting mechanism operated by electrically actuated solenoid valve, with unloaded compressor start; controlled from suction pressure.

F. Sump Oil Heater: Evaporates refrigerant returning to sump during shut down. Energize heater continuously when compressor is not operating.

G. Low Ambient Kit: Permits operation down to 45 degrees F.

2.07 COMPRESSORS: TWO STAGE:

A. Compressor: Hermetic scroll type.

B. Mounting: Statically and dynamically balance rotating parts.
   1. Internally isolate hermetic units on springs.
   2. Refer to Section 22 0548

C. Lubrication System: Reversible, positive displacement oil pump with oil charging valve, oil level sight glass, and magnetic plug or strainer.

D. Motor: Two speed compressor motor shall have manual-reset high pressure switch and automatic-reset low-pressure switch.

E. Capacity Reduction Equipment: Suction valve unloaders, with lifting mechanism operated by electrically actuated solenoid valve, with unloaded compressor start; controlled from suction pressure.

F. Sump Oil Heater: Evaporates refrigerant returning to sump during shut down. Energize heater continuously when compressor is not operating.

G. Low Ambient Kit: Permits operation down to 30 degrees F.

2.08 REFRIGERANT CIRCUIT

A. Provide each unit with refrigerant circuits to match compressor quantity, factory supplied and piped. Refer to Section 23 2300.

B. For each refrigerant circuit, provide:
   1. Filter dryer replaceable core type.
   2. Liquid line sight glass and moisture indicator.
   3. Thermal expansion valve for maximum operating pressure.
   4. Insulated suction line.
   5. Suction and liquid line service valves and gage ports.
   6. Liquid line solenoid valve.
   7. Charging valve.
   8. Compressor discharge service valve.

C. For heat pump units, provide reversing valve, suction line accumulator, discharge muffler, flow control check valve, and solid-state defrost control utilizing thermistors.

2.09 CONTROLS

A. On unit, mount weatherproof steel control panel, NEMA 250, containing power and control wiring, molded case disconnect switch, factory wired with single point power connection.

B. For each compressor, provide across-the-line starter, non-recycling compressor overload, starter relay, and control power transformer or terminal for controls power. Provide manual reset current overload protection. For each condenser fan, provide across-the-line starter with starter relay.

C. Provide safety controls arranged so any one will shut down machine:
   1. High discharge pressure switch (manual reset) for each compressor.
   2. Low suction pressure switch (automatic reset) for each compressor.
   3. Oil Pressure switch (manual reset).

D. Provide the following operating controls:
   1. Refer to Section 23 0993.
   2. Thermostat located in room cycles compressors activates cylinder unloaders.
   3. One minute off timer prevents compressor from short cycling.
   4. Periodic pump-out timer to pump down on high evaporator refrigerant pressure.
   5. Low ambient temperature controls.
   6. Hot gas bypass sized for minimum compressor loading on one compressor only, bypasses hot refrigerant gas to evaporator.
   7. Lead-lag switch to alternate compressor operation.

E. Provide controls to permit operation down to 0 degrees F ambient temperature.
   1. Thermostat to cycle fan motors in response to outdoor ambient temperature.
   2. Head pressure switch to cycle fan motors in response to refrigerant condensing pressure.
   3. Solid state control to vary speed of one condenser fan motor in response to refrigerant condensing pressure.
   4. Electronic control consisting of mixing damper assembly, controlled to maintain constant refrigerant condensing pressure.

F. Gages: Prepiped for suction and discharge refrigerant pressures and oil pressure for each compressor.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's installation instructions.

B. Complete structural, mechanical, and electrical connections in accordance with manufacturer's installation instructions.

C. Provide for connection to electrical service. Refer to Section 26 0583.

D. If located on building structure, mount units on external restrained spring vibration isolators. Refer to Section 23 0548.

E. If located at grade, install units on concrete base as indicated. Through bolt unit interior to concrete slab to prevent theft. Refer to Section 03 3000.

F. Provide flexible connection to refrigeration piping system and evaporators. Refer to Section 23 2300. Comply with ASHRAE Std 15.

3.02 SYSTEM STARTUP

A. Supply initial charge of refrigerant and oil for each refrigeration system. Replace losses of oil or refrigerant prior to end of correction period.

B. Charge system with refrigerant and test entire system for leaks after completion of installation. Repair leaks, put system into operation, and test equipment performance.

C. Have manufacturer's local representative verify installation and accessories are correct and match manufacturer requirements. Document the inspection and sign off and include in Owner and Maintenance manual.

D. Provide cooling season start-up, and winter season shut-down for first year of operation.

END OF SECTION

SECTION 23 8127

SMALL SPLIT-SYSTEM HEATING AND COOLING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Air-source heat pumps.

B. Indoor ductless fan & coil units.

C. Controls.

1.02 REFERENCE STANDARDS

A. AHRI 210/240 - Standard for Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment; 2008, Including All Addenda.

B. AHRI 520 - Performance Rating of Positive Displacement Condensing Units; 2004.

C. ASHRAE Std 15 - Safety Standard for Refrigeration Systems; 2013.

D. ASHRAE Std 23.1 - Methods of Testing for Rating the Performance of Positive Displacement Refrigerant Compressors and Condensing Units that Operate at Subcritical Temperatures of the Refrigerant; 2010.

E. UL 207 - Standard for Refrigerant-Containing Components and Accessories, Nonelectrical; Current Edition, Including All Revisions.

1.03 SUBMITTALS

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

B. Product Data: Provide rated capacities, weights, accessories, electrical nameplate data, and wiring diagrams.Include equipment served by condensing units in submittal, or submit at same time, to ensure capacities are complementary.

C. Shop Drawings: Provide plans with routing coordinated through walls and structure. Indicate assembly, required clearances, and location and size of field connections.

D. Design Data: Indicate refrigerant pipe sizing.

E. Manufacturer's Instructions: Indicate rigging, assembly, and installation instructions. Provide manufacturer's approved refrigerant piping schematics indicating refrigerant pipe sizes for lengths to be installed; riser isomentric diagrams; double risers or traps for oil management if required.

F. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listing.

G. Warranty: Submit manufacturers warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. Provide the following “attic stock” additional product materials at the conclusion of construction for storage on site by the owner:
      a. Thermostats: Provide two extra thermostat for dwelling units.
      b. Thermostats: Provide one extra thermostat for common space units.
   2. See Section 01 6000 - Product Requirements, for additional provisions.

1.04 QUALITY ASSURANCE

A. Electrical Components, Devices and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2004, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

C. ASHRAE/IESNA 90.1-2004 Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004, Section 6 - "Heating, Ventilating, and Air-Conditioning."

1.05 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Special Warranty: Manufacturer's standard form on all parts for a period of 1 year from date of installation. The compressor shall have a warranty of 6 years from the date of the original installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on equipment schedule or comparable product by one of the following.
   1. Mitsubishi.
   2. Fujitsu
   3. Panasonic.

2.02 SYSTEM DESIGN

A. Split-System Heating and Cooling Units: Self-contained, packaged, matched factory-engineered and assembled, pre-wired indoor and outdoor units; UL listed.
   1. Heating and Cooling: Air-source electric heat pump located in outdoor unit with evaporator.
   2. Provide refrigerant lines internal to units and between indoor and outdoor units, factory cleaned, dried, pressurized and sealed, with insulated suction line.

B. Performance Requirements: See Drawings for additional requirements.

2.03 INDOOR UNITS FOR DUCTLESS SYSTEMS

A. Indoor Units: Self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet, supply fan, evaporator coil, and controls; wired for single power connection with control transformer.
   1. Location: High-wall.
   2. Cabinet: Galvanized steel.
      a. Finish: White.
   3. Fan: Line-flow fan direct driven by a single motor.

B. Evaporator Coils: Copper tube aluminum fin assembly, galvanized or polymer drain pan sloped in all directions to drain, drain connection, refrigerant piping connections, restricted distributor or thermostatic expansion valve.
   1. Construction and Ratings: In accordance with AHRI 210/240 and UL 207.
   2. Manufacturer: System manufacturer.

C. Remote Actuators:

2.04 OUTDOOR UNITS

A. Outdoor Units: Self-contained, packaged, pre-wired unit consisting of cabinet, with compressor and condenser.
   1. Comply with AHRI 210/240.
   2. Refrigerant: R-410A.
   3. Construction and Ratings: In accordance with AHRI 210/240 with testing in accordance with ASHRAE Std 23.1 and UL 207.

B. Compressor: AHRI 520; hermetic, variable speed inverter type, resiliently mounted integral with condenser, with positive lubrication, crankcase heater, high pressure control, motor overload protection, service valves and drier. Provide time delay control to prevent short cycling and rapid speed changes.

C. Air Cooled Condenser: Aluminum fin and copper tube coil, AHRI 520 with direct drive axial propeller fan resiliently mounted, galvanized fan guard.
   1. Condenser Fans: Direct-drive propeller type.
   2. Condenser Fan Motor: Enclosed, 1-phase type, permanently lubricated.

D. Coil: Air-cooled, aluminum fins bonded to copper tubes.

E. Accessories: Filter drier, high pressure switch (manual reset), low pressure switch (automatic reset), service valves and gage ports, thermometer well (in liquid line).
   1. Provide thermostatic expansion valves.
   2. Provide heat pump reversing valves.

F. Operating Controls:
   1. Control by room thermostat to maintain room temperature setting.

G. Mounting Pad: Poured concrete pad, minimum 4 inches thick and extend at least 4 inches beyond unit.

2.05 ACCESSORY EQUIPMENT

A. Room Thermostat: Wall-mounted, large easy to read digital display, electric solid state microcomputer based room thermostat with remote sensor to maintain temperature setting; low-voltage; with following features:
   1. System selector switch (heat-off-cool) and fan control switch (auto-on).
   2. Automatic switching from heating to cooling.
   3. Preferential rate control to minimize overshoot and deviation from setpoint.
   4. Programming based on weekdays, Saturday and Sunday.
   5. Thermostat Display:
      a. Time of day.
      b. Actual room temperature.
      c. Programmed temperature.
      d. Day of week.
      e. System Mode Indication: Heating, Cooling, Fan Auto, Off, and On, Auto or On, Off.
   6. Smart capabilities:
      a. Connect to the internet using wi-fi for remote control from a smart phone
      b. Self adjust using learning technologies, resident patterns and ambient conditions
      c. Provide resident access to energy consumption reports
   7. Manufacturers:
      a. Mitsubishi.
      b. Fujitsu.
      c. Panasonic.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrates are ready for installation of units and openings are as indicated on shop drawings.

B. Verify that proper power supply is available and in correct location.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions and requirements of local authorities having jurisdiction.

B. Install refrigeration systems in accordance with ASHRAE Std 15 and manufacturer installation instructions and recommendations.

C. Have manufacturer's local representative verify installation and accessories are correct and match manufacturer requirements. Document the inspection and signoff and include in Owner and Maintenance manual.

D. Pipe drain from condensate outlet to nearest floor drain.

END OF SECTION

SECTION 26 0050

ELECTRICAL EXECUTION

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Definitions
   2. Coordination
   3. Common electrical installation requirements.

1.02 RELATED DOCUMENTS

A. Drawings, General Provisions of the Contract, including General Conditions, Supplementary General Conditions, other Division 00 & 01 Specification Sections, shall apply to this division.

B. These requirements apply to all work in Divisions 26, 27 and 28.

1.03 DEFINITIONS

A. Approved" means approved by the Engineer and Owner.

B. Furnish" means to purchase, arrange for delivery to site, and to take delivery at the site.

C. Install" means to place in position for use.

D. Provide" means to furnish and install.

E. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.

F. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters, overhangs and attics.

G. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

H. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

I. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

1.04 COORDINATION

A. Coordination: Coordinate construction operations to ensure efficient and orderly installation of the Work.
   1. Coordinate construction operations, that depend on each other for proper installation, connection, and operation.
   2. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
   3. Coordinate installation of different components with other contractors to ensure maximum accessibility for required maintenance, service, and repair.
   4. Make adequate provisions to accommodate items scheduled for later installation.
   5. Where availability of space is limited, coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair of all components.

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

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

C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
   1. Preparation of Construction Schedule.
   2. Preparation of the Schedule of Values.
   3. Installation and removal of temporary facilities and controls.
   4. Delivery and processing of submittals.
   5. Progress meetings.
   6. Preinstallation conferences.
   7. Project closeout activities.
   8. Startup and adjustment of systems.
   9. Project closeout activities.

1.05 PROJECT MEETINGS

A. General: Attend meetings and conferences at Project site, unless otherwise indicated.
   1. Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Engineer of scheduled meeting dates and times.
   2. Agenda: Request the meeting agenda if not furnished prior to meeting.
   3. Minutes: Record significant discussions and agreements achieved. Request the meeting minutes if not furnished. Note all discrepancies and notify Engineer of all changes to the Work or to the Contract Documents.

B. Preconstruction Conference: Attend the preconstruction conference before starting construction, no later than 15 days after execution of the Agreement to review responsibilities and personnel assignments.
   1. Attendees: Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
   2. Agenda: Discuss items of significance that could affect progress, including the following as applicable:
      a. Tentative construction schedule.
      b. Phasing.
      c. Critical work sequencing and long-lead items.
      d. Designation of key personnel and their duties.
      e. Procedures for processing field decisions and Change Orders.
      f. Procedures for requests for interpretations (RFIs).
      g. Procedures for testing and inspecting.
      h. Procedures for processing Applications for Payment.
      i. Distribution of the Contract Documents.
      j. Submittal procedures.
      k. LEED requirements.
      l. Preparation of Record Documents.
      m. Use of the premises.
      n. Work restrictions.
      o. Owner's occupancy requirements.
      p. Responsibility for temporary facilities and controls.
      q. Construction waste management and recycling.
      r. Parking availability.
      s. Office, work, and storage areas.
      t. Equipment deliveries and priorities.

u. First aid.
v. Security.
w. Progress cleaning.
x. Working hours.

C. Preinstallation Conferences: Attend a preinstallation conference at Project site before each construction activity that requires coordination with other construction.
1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect of scheduled meeting dates.
2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following as applicable:
a. The Contract Documents.
b. Options.
c. Related requests for interpretations (RFIs).
d. Related Change Orders.
e. Purchases, deliveries, submittals.
f. Review of mockups.
g. Possible conflicts.
h. Compatibility problems.
i. Time schedules.
j. Weather limitations.
k. Manufacturer's written recommendations.
l. Warranty requirements.
m. Compatibility of materials.
n. Acceptability of substrates.
o. Space and access limitations.
p. Regulations of authorities having jurisdiction.
q. Testing and inspecting requirements.
r. Installation procedures.
s. Coordination with other work.
t. Required performance results.
u. Protection of adjacent work.
v. Protection of construction and personnel.
3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
4. Reporting: Distribute minutes of the meeting to each party present, to parties who should have been present, and to the Engineer.
5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

1.06 SUBMITTALS

A. Alternate Products: Alternate manufacturers, equipment and /or products must be specified or approved prior to bid in writing via addendum to be accepted. All costs associated with deviations from the basis of design shall be borne by the contractor. Deviations shall include alternate manufacturer and/or alternate product and shall include all significant dimensional, performance, electrical, or installation differences from the basis of design products. Costs for reimbursement shall include the costs of other trades affected, and shall include all engineering costs to evaluate such deviations.

B. Substitutions: Unspecified manufacturers shall be considered substitutions and shall be submitted for consideration under the specified substitution procedures. Substitutions shall be

submitted to the engineer for evaluation. If approved by the engineer, substitution shall be offered to the owner for consideration. All costs associated with substitutions shall be borne by the contractor. Costs for reimbursement shall include the costs of other trades affected, and shall include all engineering costs to evaluate such deviations.

C. Coordination Drawings: Prepare Coordination Drawings (coordinated shop drawings) to maximize utilization of space for efficient installation of different components and for installation of products and materials fabricated by separate entities. Submit to Engineer for review before starting work.
   1. Content: Project-specific information, drawn accurately to scale. Do not base Coordination Drawings on reproductions of the Contract Documents or standard printed data. Include the following information, as applicable:
      a. Indicate functional and spatial relationships of components of the work with all other systems and trades.
      b. Indicate required installation sequences.
      c. Indicate dimensions shown on the Contract Drawings and make specific note of dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide sketches of proposed alternate construction to Engineer for resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

D. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home and office telephone numbers. Provide names, addresses, and telephone numbers of individuals assigned as standbys in the absence of individuals assigned to Project. Submit to Engineer before starting work.
   1. Post copies of list in Project meeting room, in temporary field office, and by each temporary telephone. Keep list current at all times.

E. Make all necessary field measurements and investigations to assure that the equipment and assemblies will meet contract requirements.

F. If equipment is submitted which differs in arrangement from that shown, provide drawings that show the rearrangement of all associated systems. Approval will be given only if all features of the equipment and associated systems, including accessibility, are equivalent to that required by the contract.

G. Prior to submitting shop drawings for review, contractor shall certify in writing that manufacturers of all major items of equipment have each reviewed drawings and specifications, and have jointly coordinated and properly integrated their equipment and controls to provide a complete and efficient installation.

1.07 WARRANTIES

A. All work shall include a parts and labor warranty on materials and workmanship for a period of 1 year.

B. Refer to Division 01 for additional warranty requirements.

PART 2 PRODUCTS

2.01 MANUFACTURED CURBS

A. Manufactured Curbs, Equipment Rails, and Other Roof Mounting Assemblies:
   1. The Pate Company: www.patecurbs.com.
   2. Substitutions: See Section 01 6000 - Product Requirements.

B. General requirements: Factory-assembled hollow sheet metal construction with fully mitered and welded corners, integral counterflashing, internal reinforcing, and top side and edges formed to shed water.

1. Sheet Metal: Hot-dip zinc coated steel sheet complying with ASTM A653/A653M, SS Grade 33 ; G60 coating designation; 18 gage, 0.048 inch thick.
2. Roofing Cants: Provide integral sheet metal roofing cants dimensioned to begin slope at top of roofing insulation; 1:1 slope; minimum cant height 4 inches.
3. Manufacture curb bottom and mounting flanges for installation directly on roof deck, not on insulation; match slope and configuration of roof deck.
4. Provide the layouts and configurations shown on the drawings.

C. Equipment Rails: Two-sided curbs in straight lengths, with top horizontal for equipment mounting.
1. Provide preservative treated wood nailers along top of rails.
2. Height Above Finished Roof Surface: 6 inches, minimum.
3. Height Above Roof Deck: 14 inches, minimum.

D. Pipe, Duct, and Conduit Mounting Pedestals: Vertical posts, minimum 8 inches square unless otherwise indicated.
1. Provide preservative treated wood nailers over entire top surface, for supports to be provided by others.
2. Height Above Finished Roof Surface: 12 inches, minimum.
3. Height Above Roof Deck: 14 inches, minimum.

2.02 SLEEVES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop and 1% outward slope, unless otherwise indicated.

C. Sleeves for Rectangular Openings: Galvanized sheet steel.
1. Minimum Metal Thickness:
a. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and no side more than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches (1270 mm) and 1 or more sides equal to, or more than, 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

2.03 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi, 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

2.04 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

B. Sealing Elements: EPDM or NBR interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.

C. Pressure Plates: Steel. Include two for each sealing element.

D. Connecting Bolts and Nuts: Steel with corrosion-resistant coating or stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.05 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.

C. One-Piece, Cast-Brass Type: With set screw.
   1. Finish: Polished chrome-plated.

D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
   1. Finish: Polished chrome-plated.

PART 3 EXECUTION

3.01 ELECTRICAL DEMOLITION

A. Refer to Division 01 Section "Cutting and Patching" and Division 02 Section "Selective Structure Demolition" for general demolition requirements and procedures.

B. Contractor shall be responsible for all work and costs associated with demolition shown or noted on plans.

C. Verify exact requirements before bid and include direct and related indirect costs in estimate including permit application, fees, dust control, protection of existing, temporary power, fuel usage, scaffolding, disconnection, disposal, cutting and patching.

D. Occupied Buildings: For occupied buildings, coordinate with local management for communication with building users, occupants, and/or residents regarding potential for disruption, and provide 72 hour advance notification for planned outages. Install new work to the fullest extent possible before interrupting existing services to minimize disruption to residents. Provide temporary power for disruptions lasting over 15 minutes. Assume (midnight to 4am) premium labor rates for power shutdown, changeover and reconnection.

E. In performing the work:
   1. Coordinate with existing conditions and other trades before starting work.
   2. Remove portions of walls, floors, ceilings, etc. required for access to demolished and new work.
   3. Disconnect, demolish, and remove systems, equipment, and components indicated to be removed.
   4. Conduit / Wire to Be Removed: Remove portion indicated to be removed and cap or plug remaining with same or compatible material.
   5. Conduit / Wire Abandoned in Place: cap or plug with compatible material.
   6. Equipment to Be Removed: Disconnect electrical power. Disconnect and cap services and remove equipment. Remove related supports, anchorages, and concrete bases.
   7. Equipment to Be Removed and Reinstalled: Arrange for disconnection of electrical power. Disconnect and cap services and remove, clean, and store equipment. When appropriate, reinstall, reconnect, arrange for power connection and make equipment operational.
   8. Equipment to Be Removed and Salvaged: Arrange for disconnection of electrical power. Disconnect and cap services, remove equipment and deliver to Owner.

F. If new or existing to remain products are damaged during demolition, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

G. Subcontract the General Contractor to perform patching, repair or replacement of walls floors, ceilings, etc. removed for access to the work. General contractor shall repair finishes to match surrounding finishes.

3.02 COMMON REQUIREMENTS

A. Install according to requirements and other Division specification sections.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of systems. Indicated locations and arrangements were used for sizing, calculations and other design considerations. Install as indicated unless deviations to layout are approved on Coordination Drawings.

C. Install circuits in concealed locations, unless otherwise indicated and except in equipment rooms and service areas. Where located within walls and other concealed areas subject to damage, provide suitable protection.

D. Conduits indicated to be exposed and piping in equipment rooms and service areas shall be at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install conduits through (preferred) or tight to structure (if approved by architect). If above accessible ceiling, allow sufficient space for ceiling panel removal.

F. Install circuits and disconnects to permit servicing.

G. Install conduits free of sags and bends.

H. Install boxes for changes in direction and branch connections.

I. Install circuits to allow application of insulation.

J. Select system components with voltage rating equal to or greater than system operating voltage.

K. Install escutcheons for penetrations of walls, ceilings, and floors.

L. Comply with NECA 1 and NECA 100. Provide all work plumb, level, and in workmanlike manner.

M. Provide corrosion protection for all work (equipment, conduits, supports, and fasteners) located in exterior, underground, or damp environments.

N. Headroom Maintenance: Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items. If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

O. Right of Way: Give to piping systems installed at a required slope.

3.03 PENETRATIONS

A. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening. Size pipe sleeves to provide 1/4-inch (6.4-mm)] annular clear space between sleeve and raceway or cable, unless indicated otherwise.

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls. Sleeve ends shall be flush with both wall surfaces unless otherwise noted. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level. Concrete and masonry penetrations: seal space outside of sleeves with grout. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.

C. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants.".

D. Roof-Penetrations: Seal penetration of roof with flexible boot-type flashing units applied in coordination with roofing work.

E. Aboveground, Exterior-Wall Pipe Penetrations: Position pipe in center of sleeve. Maintain 1% outward slope, unless otherwise indicated. Seal penetrations using non-expanding foam. After cured, trim flush with sleeve end and paint with color to match surrounding finish.

F. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals.

G. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors. Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07." Comply with requirements in Division 07."

H. Apply firestopping to penetrations of fire and/or smoke rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07.

I. Penetrations of membranes of rated walls shall be protected by UL listed products. Coordinate exact installation conditions with selected fire sealants supplier. For penetrations which do not have a standard UL installation detail, arrange for engineering determination from sealant supplier and/or manufacturer and provide modifications required to match detail.

3.04 INSTALLATION - COMMON REQUIREMENTS

A. Install equipment, fixtures, devices, wiring and specialties according to manufacturer installation instructions and recommendations.

B. Refer to other Sections of these Specifications for additional requirements.

C. Install to allow maximum possible headroom unless specific mounting heights are indicated.

D. Install work level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

E. Install work to facilitate service, maintenance, and repair or replacement of components. Connect work for ease of disconnecting, with minimum interference to other installations. Install work to allow maximum possible headroom unless specific mounting heights are not indicated.

F. Install work to allow right of way for piping installed at required slope.

G. Contact equipment manufacturer's representative to visit site and observe installation in order to confirm installation requirements and warranty coverage. Document observation in writing and include in O&M manuals.

H. Provide service and maintenance for not less than one year from the Date of Substantial Completion or for the warranty period specified in Division 01, whichever is longer. Refer to Division 01 for additional service and requirements.

3.05 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.

1. Provide concrete bases which are plumb, level and fully supported to prevent shifting over time.
2. Provide concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
3. Place and secure anchorage devices. Install according to equipment manufacturer's recommendations, setting drawings, templates, diagrams, instructions, and directions for supported equipment. Provide anchor bolts according to anchor-bolt manufacturer's written instructions. Install anchor bolts to elevations required for proper attachment to supported equipment. Unless otherwise noted, install epoxy-coated anchor bolts to match equipment that extend through concrete base, and anchor into structural concrete.
4. Where located on structural floor, provide dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.

5. Provide 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section "Cast-in-Place Concrete."

3.06 SUPPORTS AND ANCHORAGES

A. Provide supports to match construction type and adjacent assembly rating.

B. For combustible construction, provide wood supports and anchorages. Cut, fit, and place nailers, blocking, and anchorages to support, and anchor materials and equipment. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

C. For non-combustible building construction provide metal supports and anchorages. Refer to Division 05 Section "Metal Fabrications" for structural steel. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor HVAC materials and equipment. Field Welding shall comply with AWS D1.1.

D. Attach to substrates as required to support applied loads.

3.07 GROUTING

A. Clean surfaces that will come into contact with grout. Provide forms as required for placement of grout.

B. Mix and install grout for equipment base bearing surfaces, and anchors.

C. Place grout around anchors and completely filling equipment base and provide smooth bearing surface for equipment. Avoid air entrapment during placement of grout.

D. Allow grout to cure before loading or applying forces.

3.08 SLEEVE-SEAL INSTALLATION

A. Install to seal below-grade exterior wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

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. Nonmetallic-sheathed cable.

C. Underground feeder and branch-circuit cable.

D. Service entrance cable.

E. Armored cable.

F. Metal-clad cable.

G. Wiring connectors.

H. Electrical tape.

I. Heat shrink tubing.

J. Oxide inhibiting compound.

K. Wire pulling lubricant.

L. Cable ties.

1.02 RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.

B. Section 26 0505 - Selective Demolition for Electrical: Disconnection, removal, and/or extension of existing electrical conductors and cables.

C. Section 26 0526 - Grounding and Bonding for Electrical Systems: Additional requirements for grounding conductors and grounding connectors.

D. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

E. Section 28 4600 - Fire Detection and Alarm: Fire alarm system conductors and cables.

F. Section 31 2316.13 - Trenching: Excavating, bedding, and backfilling.

1.03 REFERENCE STANDARDS

A. ASTM B3 - Standard Specification for Soft or Annealed Copper Wire; 2013.

B. ASTM B8 - Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft; 2011.

C. ASTM B33 - Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes; 2010 (Reapproved 2014).

D. ASTM B787/B787M - Standard Specification for 19 Wire Combination Unilay-Stranded Copper Conductors for Subsequent Insulation; 2004 (Reapproved 2014).

E. ASTM B800 - Standard Specification for 8000 Series Aluminum Alloy Wire for Electrical Purposes - Annealed and Intermediate Tempers; 2005 (Reapproved 2011).

F. ASTM B801 - Standard Specification for Concentric-Lay-Stranded Conductors of 8000 Series Aluminum Alloy Wire for Subsequent Covering of Insulation; 2007 (Reapproved 2012).

G. ASTM D3005 - Standard Specification for Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape; 2010.

H. ASTM D4388 - Standard Specification for Nonmetallic Semi-Conducting and Electrically Insulating Rubber Tapes; 2013.

I. FS A-A-59544 - Cable and Wire, Electrical (Power, Fixed Installation); Federal Specification; Revision A, 2008.

J. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

K. NECA 104 - Recommended Practice for Installing Aluminum Building Wire and Cable; 2012.

L. NECA 120 - Standard for Installing Armored Cable (AC) and Metal-Clad Cable (MC); 2012.

M. NECA 121 - Standard for Installing Nonmetallic-Sheathed Cable (Type NM-B) and Underground Feeder and Branch-Circuit Cable (Type UF); 2007.

N. NEMA WC 70 - Nonshielded Power Cable 2000 V or Less for the Distribution of Electrical Energy; 2009.

O. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2013.

P. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

Q. UL 4 - Armored Cable; Current Edition, Including All Revisions.

R. UL 44 - Thermoset-Insulated Wires and Cables; Current Edition, Including All Revisions.

S. UL 83 - Thermoplastic-Insulated Wires and Cables; Current Edition, Including All Revisions.

T. UL 486A-486B - Wire Connectors; Current Edition, Including All Revisions.

U. UL 486C - Splicing Wire Connectors; Current Edition, Including All Revisions.

V. UL 486D - Sealed Wire Connector Systems; Current Edition, Including All Revisions.

W. UL 493 - Thermoplastic-Insulated Underground Feeder and Branch-Circuit Cables; Current Edition, Including All Revisions.

X. UL 510 - Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape; Current Edition, Including All Revisions.

Y. UL 719 - Nonmetallic-Sheathed Cables; Current Edition, Including All Revisions.

Z. UL 854 - Service-Entrance Cables; Current Edition, Including All Revisions.

AA. UL 1569 - Metal-Clad Cables; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate sizes of raceways, boxes, and equipment enclosures installed under other sections with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
   2. Coordinate the installation of direct burial cable with other trades to avoid conflicts with piping or other potential conflicts.
   3. Coordinate with electrical equipment installed under other sections to provide terminations suitable for use with the conductors to be installed.
   4. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

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

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for conductors and cables, including detailed information on materials, construction, ratings, listings, and available sizes, configurations, and stranding.

C. Design Data: Indicate voltage drop and ampacity calculations for aluminum conductors substituted for copper conductors. Include proposed modifications to raceways, boxes, wiring gutters, enclosures, etc. to accommodate substituted conductors.

D. Field Quality Control Test Reports.

E. 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.

F. Project Record Documents: Record actual installed circuiting arrangements. Record actual routing for underground circuits.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conductors and cables in accordance with manufacturer's instructions.

1.08 FIELD CONDITIONS

A. Do not install or otherwise handle thermoplastic-insulated conductors at temperatures lower than 14 degrees F, unless otherwise permitted by manufacturer's instructions. When installation below this temperature is unavoidable, notify Architect and obtain direction before proceeding with work.

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.
   1. Where not otherwise restricted, may be used:
      a. For branch circuit wiring in dry locations within one- and two-family dwellings and their attached or detached garages, and their storage buildings.
      b. For branch circuit wiring in dry locations within multifamily dwellings permitted to be of Types III, IV, and V construction.
   2. In addition to other applicable restrictions, may not be used:
      a. Where exposed to view.
      b. Above suspended ceilings.
      c. Where exposed to damage.
      d. For damp, wet, or corrosive locations.

D. Underground feeder and branch-circuit cable is not permitted.
   1. Where not otherwise restricted, may be used:
      a. For damp, wet, or corrosive locations as a substitute for NFPA 70, Type NMC nonmetallic-sheathed cable, when nonmetallic-sheathed cable is permitted.
   2. In addition to other applicable restrictions, may not be used:
      a. Where exposed to view.

b. Where exposed to damage.

E. Service entrance cable is not permitted.
   1. Where not otherwise restricted, may be used:
      a. For overhead service drop, installed in raceway from service head.
      b. For underground service entrance, installed in raceway only if USE rated.
   2. In addition to other applicable restrictions, may not be used:
      a. Where exposed to damage.

F. Armored cable is not permitted.
   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.
      c. For general purpose, non-essential electrical systems in non-hazardous patient care areas of health care facilities, when provided with additional insulated grounding conductor for redundant grounding.
   2. In addition to other applicable restrictions, may not be used:
      a. Unless approved by Owner.
      b. Where not approved for use by the authority having jurisdiction.
      c. Where exposed to view.
      d. Where exposed to damage.
      e. For damp, wet, or corrosive locations.
      f. For isolated ground circuits.

G. Metal-clad cable is not permitted.
   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.
   2. In addition to other applicable restrictions, may not be used:
      a. Unless approved by Owner.
      b. Where not approved for use by the authority having jurisdiction.
      c. Where exposed to view.
      d. Where exposed to damage.
      e. For damp, wet, or corrosive locations, unless provided with a PVC jacket listed as suitable for those locations.
      f. For isolated ground circuits, unless provided with an additional isolated/insulated grounding conductor.
      g. For patient care areas of health care facilities requiring redundant grounding.

H. Emergency systems in high rise and assembly occupancies shall:
   1. Wiring shall remain entirely separate from other wiring and shall use entirely separate equipment, raceways and junction boxes.
   2. Feeder wiring shall use fire resistive cables:
      a. Products shall be listed under category FHJR and installed according to the listing.

b. Other means and methods may be used if permitted by code as determined by the AHJ.

2.02 CONDUCTOR AND CABLE MANUFACTURERS

A. Cerro Wire LLC: www.cerrowire.com.

B. Encore Wire Corporation: www.encorewire.com.

C. Southwire Company: www.southwire.com.

D. Substitutions: See Section 01 6000 - Product Requirements.

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. Provide new conductors and cables manufactured not more than one year prior to installation.

D. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.

E. Comply with NEMA WC 70.

F. Comply with FS A-A-59544 where applicable.

G. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.

H. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.

I. Conductors for Grounding and Bonding: Also comply with Section 26 0526.

J. Conductors and Cables Installed Where Exposed to Direct Rays of Sun: Listed and labeled as sunlight resistant.

K. Conductors and Cables Installed Exposed in Spaces Used for Environmental Air (only where specifically permitted): Plenum rated, listed and labeled as suitable for use in return air plenums.

L. Conductor Material:

1. Provide copper conductors except where aluminum conductors are specifically indicated or permitted for substitution. Conductor sizes indicated are based on copper unless specifically indicated as aluminum. Conductors designated with the abbreviation "AL" indicate aluminum.
    a. Substitution of aluminum conductors for copper is permitted, when approved by Owner and authority having jurisdiction, only for the following:
        1) Services: Copper conductors size 6 AWG and larger.
        2) Feeders: Copper conductors size 6 AWG and larger.
    b. Where aluminum conductors are substituted for copper, comply with the following:
        1) Size aluminum conductors to provide, when compared to copper sizes indicated, equivalent or greater ampacity and equivalent or less voltage drop.
        2) Increase size of raceways, boxes, wiring gutters, enclosures, etc. as required to accommodate aluminum conductors.
        3) Provide aluminum equipment grounding conductor sized according to NFPA 70.
        4) Equip electrical distribution equipment with compression lugs for terminating aluminum conductors.
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.
3. Tinned Copper Conductors: Comply with ASTM B33.

4. Aluminum Conductors (only where specifically indicated or permitted for substitution): AA-8000 series aluminum alloy conductors recognized by ASTM B800 and compact stranded in accordance with ASTM B801 unless otherwise indicated.

M. Minimum Conductor Size:
   1. Branch Circuits: 14 AWG permitted only for 15 Amp branch circuits less than 50 feet in length. Otherwise, 12 AWG conductors shall be used..
      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.
   2. Control Circuits: 14 AWG.

N. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

O. Conductor Color Coding:
   1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.
   2. Color Coding Method: Integrally colored insulation.
      a. Conductors size 4 AWG and larger may have black insulation color coded using vinyl color coding electrical tape.
   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. 240/120 V, 1 Phase, 3 Wire System:
         1) Phase A: Black.
         2) Phase B: Red.
         3) Neutral/Grounded: White.
      c. Equipment Ground, All Systems: Green.
      d. Travelers for 3-Way and 4-Way Switching: Pink.
      e. For control circuits, comply with manufacturer's recommended color code.

2.04 SINGLE CONDUCTOR BUILDING WIRE

A. Description: Single conductor insulated wire.

B. Conductor Stranding:
   1. Feeders and Branch Circuits:
      a. Size 10 AWG and Smaller: Solid.
      b. Size 8 AWG and Larger: Stranded.
   2. Control Circuits: Stranded.

C. Insulation Voltage Rating: 600 V.

D. Insulation:
   1. Copper Building Wire: Type THHN/THWN or THHN/THWN-2, except as indicated below.
   2. Aluminum Building Wire (only where specifically indicated or permitted for substitution): Type XHHW-2.

2.05 NONMETALLIC-SHEATHED CABLE

A. Description: NFPA 70, Type NM multiple-conductor cable listed and labeled as complying with UL 719, Type NM-B.

B. Conductor Stranding:

1. Size 10 AWG and Smaller: Solid.
2. Size 8 AWG and Larger: Stranded.

C. Insulation Voltage Rating: 600 V.

2.06 UNDERGROUND FEEDER AND BRANCH-CIRCUIT CABLE

A. Description: NFPA 70, Type UF multiple-conductor cable listed and labeled as complying with UL 493, Type UF-B.

B. Provide equipment grounding conductor unless otherwise indicated.

C. Conductor Stranding:
1. Size 10 AWG and Smaller: Solid.
2. Size 8 AWG and Larger: Stranded.

D. Insulation Voltage Rating: 600 V.

E. Cable Jacket: Listed and labeled as sunlight resistant.

2.07 ARMORED CABLE

A. Description: NFPA 70, Type AC cable listed and labeled as complying with UL 4, 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.

E. Grounding: Combination of interlocking armor and integral bonding wire.

F. Armor: Steel, interlocked tape.

2.08 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.
3. Connectors for Aluminum Conductors: Use 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.
6. Aluminum Conductors: Use compression connectors for all connections.

7. Stranded Conductors Size 10 AWG and Smaller: Use crimped terminals for connections to terminal screws.
8. Conductors for Control Circuits: Use crimped terminals for all connections.

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.

H. Mechanical Connectors: Provide bolted type or set-screw type.

I. Compression Connectors: Provide circumferential type or hex type crimp configuration.

J. Crimped Terminals: Nylon-insulated, with insulation grip and terminal configuration suitable for connection to be made.

2.09 WIRING ACCESSORIES

A. Electrical Tape:
1. Vinyl Color Coding Electrical Tape: Integrally colored to match color code indicated; listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; suitable for continuous temperature environment up to 221 degrees F.
a. Substitutions: See Section 01 6000 - Product Requirements.
2. 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.
3. 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.
4. Electrical Filler Tape: Rubber-based insulating moldable putty, minimum thickness of 125 mil; suitable for continuous temperature environment up to 176 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. Oxide Inhibiting Compound: Listed; suitable for use with the conductors or cables to be installed.

D. Wire Pulling Lubricant: Listed; suitable for use with the conductors or cables to be installed and suitable for use at the installation temperature.

E. 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 field measurements are as indicated.

E. 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.

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. Maintain separation of wiring for emergency systems in accordance with NFPA 70.
   5. Circuiting Adjustments: Unless otherwise indicated, when branch circuits are indicated as separate, combining them together in a single raceway is not permitted.
      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.
   6. Common Neutrals: Unless otherwise indicated, sharing of neutral/grounded conductors among up to three 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.
      a. Branch circuits fed from ground fault circuit interrupter (GFCI) circuit breakers.
      b. Branch circuits fed from feed-through protection of GFI receptacles.
      c. Branch circuits with dimming controls.
      d. Branch circuits with isolated grounding conductor.

B. Install products in accordance with manufacturer's instructions.

C. Perform work in accordance with NECA 1 (general workmanship).

D. Install aluminum conductors in accordance with NECA 104.

E. Install nonmetallic-sheathed cable (Type NM-B) in accordance with NECA 121.

F. Install underground feeder and branch-circuit cable (Type UF-B) in accordance with NECA 121.

G. Install armored cable (Type AC) in accordance with NECA 120.

H. Install metal-clad cable (Type MC) in accordance with NECA 120.

I. 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.

J. Exposed Cable Installation (only where specifically permitted):
   1. Route cables parallel or perpendicular to building structural members and surfaces.
   2. Protect cables from physical damage.

K. Direct Burial Cable Installation:
   1. Provide trenching and backfilling in accordance with Sections 31 2316 and 31 2323.
   2. Install cable with minimum cover of 36 inches unless otherwise indicated or required.
   3. Protect cables from damage in accordance with NFPA 70.
   4. Provide underground warning tape in accordance with Section 26 0553 along entire cable length.

L. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.

M. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by the authority having jurisdiction. Provide independent support from building structure. Do not provide support from raceways, piping, ductwork, or other systems.
   1. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conductors and cables to lay on ceiling tiles.
   2. Installation in Vertical Raceways: Provide supports where vertical rise exceeds permissible limits.

N. Terminate cables using suitable fittings.
   1. Armored Cable (Type AC):
      a. Use listed fittings and anti-short, insulating bushings.
      b. Cut cable armor only using specialized tools to prevent damaging conductors or insulation. Do not use hacksaw or wire cutters to cut armor.
      c. Do not use direct-bearing set-screw type fittings for cables with aluminum armor.
   2. 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.
      c. Do not use direct-bearing set-screw type fittings for cables with aluminum armor.

O. Install conductors with a minimum of 12 inches of slack at each outlet.

P. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.

Q. Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 70.

R. 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. Connections for Aluminum Conductors: Fill connectors with oxide inhibiting compound where not pre-filled by manufacturer.
   6. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
   7. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

S. 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.
   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.

T. Insulate ends of spare conductors using vinyl insulating electrical tape.

U. Field-Applied Color Coding: Where vinyl color coding electrical tape is used in lieu of integrally colored insulation as permitted in Part 2 under "Color Coding", apply half overlapping turns of tape at each termination and at each location conductors are accessible.

V. Identify conductors and cables in accordance with Section 26 0553.

W. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.

X. Life safety wiring/raceways shall be run within separate fire rated assemblies, protected by listed thermal barrier systems (FHIT), or other approved means and methods.

Y. 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.

3.04 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.3.2. The insulation resistance test is required for all conductors. The resistance test for parallel conductors listed as optional is not required.

D. Correct deficiencies and replace damaged or defective conductors and cables.

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 bars.

E. Ground rod electrodes.

F. Ground enhancement material.

1.02 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

B. NEMA GR 1 - Grounding Rod Electrodes and Grounding Rod Electrode Couplings; 2007.

C. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2013.

D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E. NFPA 780 - Standard for the Installation of Lightning Protection Systems; 2014.

F. UL 467 - Grounding and Bonding Equipment; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Verify exact locations of underground metal water service pipe entrances to building.
   2. Coordinate the work with other trades to provide steel reinforcement complying with specified requirements for concrete-encased electrode.
   3. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Do not install ground rod electrodes until final backfill and compaction is complete.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittals procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for grounding and bonding system components.

C. Field quality control test reports.

D. Project Record Documents: Record actual locations of grounding electrode system components and connections.

1.05 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 GROUNDING AND BONDING REQUIREMENTS

A. Existing Work: Where existing grounding and bonding system components are indicated to be reused, they may be reused only where they are free from corrosion, integrity and continuity are verified, and where acceptable to the authority having jurisdiction.

B. Do not use products for applications other than as permitted by NFPA 70 and product listing.

C. 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.

D. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

E. Grounding System Resistance:
   1. Achieve specified grounding system resistance under normally dry conditions unless otherwise approved by Architect. Precipitation within the previous 48 hours does not constitute normally dry conditions.

F. Grounding Electrode System:
   1. Provide connection to required and supplemental grounding electrodes indicated to form grounding electrode system.
      a. Provide continuous grounding electrode conductors without splice or joint.
      b. Install grounding electrode conductors in raceway where exposed to physical damage. Bond grounding electrode conductor to metallic raceways at each end with bonding jumper.
   2. Metal Underground Water Pipe(s):
      a. Provide connection to underground metal domestic and fire protection (where present) water service pipe(s) that are in direct contact with earth for at least 10 feet at an accessible location not more than 5 feet from the point of entrance to the building.
      b. Provide bonding jumper(s) around insulating joints/pipes as required to make pipe electrically continuous.
      c. Provide bonding jumper around water meter of sufficient length to permit removal of meter without disconnecting jumper.
   3. Metal In-Ground Support Structure:
      a. Provide connection to metal in-ground support structure that is in direct contact with earth in accordance with NFPA 70.
   4. Concrete-Encased Electrode:
      a. Provide connection to concrete-encased electrode consisting of not less than 20 feet of either steel reinforcing bars or bare copper conductor not smaller than 4 AWG embedded within concrete foundation or footing that is in direct contact with earth in accordance with NFPA 70.
   5. Ground Ring:
      a. If a lightning protection system is installed, provide a ground ring encircling the building or structure consisting of bare copper conductor not less than 2 AWG in direct contact with earth, installed at a depth of not less than 30 inches.
      b. Where location is not indicated, locate ground ring conductor at least 24 inches outside building perimeter foundation.
      c. Provide ground enhancement material around conductor.
      d. Provide connection from ground ring conductor to:
         1) Perimeter columns of metal building frame.
         2) Ground rod electrodes located at each corner of the building/structure.
   6. Ground Rod Electrode(s):

a. Where less than two other grounding electrodes are not present, provide three electrodes in an equilateral triangle configuration unless otherwise indicated or required.
b. Space electrodes not less than 10 feet from each other and any other ground electrode.
c. Where location is not indicated, locate electrode(s) at least 5 feet outside building perimeter foundation as near as possible to electrical service entrance; where possible, locate in softscape (uncovered) area.

7. Ground Bar: Provide ground bar, separate from service equipment enclosure, for common connection point of grounding electrode system bonding jumpers as permitted in NFPA 70. Connect grounding electrode conductor provided for service-supplied system grounding to this ground bar.
   a. Ground Bar Size: 1/4 by 2 by 12 inches unless otherwise indicated or required.

G. Bonding and Equipment Grounding:
1. Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing electrical conductors/equipment or likely to become energized as indicated and in accordance with NFPA 70.
2. Provide insulated equipment grounding conductor in each feeder and branch circuit raceway. Do not use raceways as sole equipment grounding conductor.
3. Where circuit conductor sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally in accordance with NFPA 70.
4. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
5. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) or isolated/insulated ground bus.
6. Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.
7. Provide bonding for interior metal piping systems in accordance with NFPA 70. This includes, but is not limited to:
   a. Metal water piping where not already effectively bonded to metal underground water pipe used as grounding electrode.
8. Provide bonding and equipment grounding for pools and fountains and associated equipment in accordance with NFPA 70.

H. Communications Systems Grounding and Bonding:
1. Provide intersystem bonding termination at service equipment or metering equipment enclosure and at disconnecting means for any additional buildings or structures in accordance with NFPA 70.
2. Provide bonding jumper in raceway from intersystem bonding termination to each communications room or backboard and provide ground bar for termination.
   a. Bonding Jumper Size: 6 AWG, unless otherwise indicated or required.
   b. Raceway Size: 3/4 inch trade size unless otherwise indicated or required.
   c. Ground Bar Size: 1/4 by 2 by 12 inches unless otherwise indicated or required.
   d. Ground Bar Mounting Height: 18 inches above finished floor unless otherwise indicated.

I. Lightning Protection Systems, in Addition to Requirements of Section 26 4113:
1. Do not use grounding electrode dedicated for lightning protection system for component of building grounding electrode system provided under this section.

2. Provide bonding of building grounding electrode system provided under this section and lightning protection grounding electrode system in accordance with NFPA 70 and NFPA 780.

2.02 GROUNDING AND BONDING COMPONENTS

A. General Requirements:
   1. Provide products listed, classified, and labeled 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 Bars:
   1. Description: Copper rectangular ground bars with mounting brackets and insulators.
   2. Size: As indicated.
   3. Holes for Connections: As indicated or as required for connections to be made.

E. 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.

F. Ground Enhancement Material:
   1. Description: Factory-mixed conductive material designed for permanent and maintenance-free improvement of grounding effectiveness by lowering resistivity.

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 indicated.

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. Perform work in accordance with NECA 1 (general workmanship).

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.
   1. Outdoor Installations: Unless otherwise indicated, install with top of rod 6 inches below finished grade.

2. Indoor Installations: Unless otherwise indicated, install with 4 inches of top of rod exposed.

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.

3.03 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Inspect and test in accordance with NETA ATS except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.13.

D. Perform ground electrode resistance tests under normally dry conditions. Precipitation within the previous 48 hours does not constitute normally dry conditions.

E. 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 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Concrete equipment pads.

B. Section 05 5000 - Metal Fabrications: Materials and requirements for fabricated metal supports.

C. Section 26 0533.13 - Conduit for Electrical Systems: Additional support and attachment requirements for conduits.

D. Section 26 0533.16 - Boxes for Electrical Systems: Additional support and attachment requirements for boxes.

E. Section 26 5100 - Interior Lighting: Additional support and attachment requirements for interior luminaires.

F. Section 26 5600 - Exterior Lighting: Additional support and attachment requirements for exterior luminaires.

1.03 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2015.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.

C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2013.

D. MFMA-4 - Metal Framing Standards Publication; 2004.

E. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components to be installed.
   2. Coordinate the work with other trades to provide additional framing and materials required for installation.
   3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
   4. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
   5. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 03 3000.

1.05 SUBMITTALS

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

1.06 QUALITY ASSURANCE

A. Comply with NFPA 70.

B. Comply with applicable building code.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

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.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive support and attachment components.

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. Perform work in accordance with NECA 1 (general workmanship).

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 Engineer.

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. Conduit Support and Attachment: Also comply with Section 26 0533.13.

I. Box Support and Attachment: Also comply with Section 26 0533.16.

J. Interior Luminaire Support and Attachment: Also comply with Section 26 5100.

K. Exterior Luminaire Support and Attachment: Also comply with Section 26 5600.

L. Secure fasteners according to manufacturer's recommended torque settings.

M. Remove temporary supports.

3.03 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Inspect support and attachment components for damage and defects.

C. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

D. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION

SECTION 26 0533.13
CONDUIT FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Galvanized steel rigid metal conduit (RMC).
B. Intermediate metal conduit (IMC).
C. PVC-coated galvanized steel rigid metal conduit (RMC).
D. Flexible metal conduit (FMC).
E. Liquidtight flexible metal conduit (LFMC).
F. Electrical metallic tubing (EMT).
G. Rigid polyvinyl chloride (PVC) conduit.
H. Electrical nonmetallic tubing (ENT).
I. Liquidtight flexible nonmetallic conduit (LFNC).
J. Conduit fittings.
K. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Concrete encasement of conduits.
B. Section 07 8400 - Firestopping.
C. Section 26 0526 - Grounding and Bonding for Electrical Systems.
    1. Includes additional requirements for fittings for grounding and bonding.
D. Section 26 0529 - Hangers and Supports for Electrical Systems.
E. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
F. Section 26 2100 - Low-Voltage Electrical Service Entrance: Additional requirements for electrical service conduits.
G. Section 27 1005 - Structured Cabling for Voice and Data - Inside-Plant: Additional requirements for communications systems conduits.
H. Section 31 2316 - Excavation.
I. Section 31 2323 - Fill: Bedding and backfilling.

1.03 REFERENCE STANDARDS

A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC); 2005.
B. ANSI C80.3 - American National Standard for Steel Electrical Metallic Tubing (EMT); 2005.
C. ANSI C80.6 - American National Standard for Electrical Intermediate Metal Conduit (EIMC); 2005.
D. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
E. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT); 2013.
F. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC); 2003.
G. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2012.
H. NEMA RN 1 - Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit; 2005.
I. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit; 2013.

J. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing; 2015.

K. NEMA TC 13 - Electrical Nonmetallic Tubing (ENT); 2014.

L. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

M. UL 1 - Flexible Metal Conduit; Current Edition, Including All Revisions.

N. UL 6 - Electrical Rigid Metal Conduit-Steel; Current Edition, Including All Revisions.

O. UL 360 - Liquid-Tight Flexible Steel Conduit; Current Edition, Including All Revisions.

P. UL 514B - Conduit, Tubing, and Cable Fittings; Current Edition, Including All Revisions.

Q. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings; Current Edition, Including All Revisions.

R. UL 797 - Electrical Metallic Tubing-Steel; Current Edition, Including All Revisions.

S. UL 1242 - Electrical Intermediate Metal Conduit-Steel; Current Edition, Including All Revisions.

T. UL 1653 - Electrical Nonmetallic Tubing; Current Edition, Including All Revisions.

U. UL 1660 - Liquid-Tight Flexible Nonmetallic Conduit; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate minimum sizes of conduits with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
   2. Coordinate the arrangement of conduits with structural members, ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
   3. Verify exact conduit termination locations required for boxes, enclosures, and equipment installed under other sections or by others.
   4. Coordinate the work with other trades to provide roof penetrations that preserve the integrity of the roofing system and do not void the roof warranty.
   5. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Do not begin installation of conductors and cables until installation of conduit is complete between outlet, junction and splicing points.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittals procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for conduits and fittings.

C. Shop Drawings:
   1. Indicate proposed arrangement for conduits to be installed within structural concrete slabs, where permitted.
   2. Include proposed locations of roof penetrations and proposed methods for sealing.

D. Project Record Documents: Record actual routing for conduits installed underground, conduits embedded within concrete slabs, and conduits 2 inch (53 mm) trade size and larger.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conduit and fittings in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 CONDUIT APPLICATIONS

A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70 and product listing.

B. Unless otherwise indicated and where not otherwise restricted, use the conduit types indicated for the specified applications. Where more than one listed application applies, comply with the most restrictive requirements. Where conduit type for a particular application is not specified, use galvanized steel rigid metal conduit.

C. Underground:
   1. Under Slab on Grade: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), PVC-coated galvanized steel rigid metal conduit, or rigid PVC conduit.
   2. Exterior, Direct-Buried: Use galvanized steel rigid metal conduit, intermediate metallic conduit (IMC), PVC-coated galvanized steel rigid metal conduit, or rigid PVC conduit.
   3. Exterior, Embedded Within Concrete: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), PVC-coated galvanized steel rigid metal conduit, or rigid PVC conduit.
   4. Where rigid polyvinyl (PVC) conduit is provided, transition to galvanized steel rigid metal conduit where emerging from underground.
   5. Where rigid polyvinyl (PVC) conduit larger than 2 inch (53 mm) trade size is provided, use galvanized steel rigid metal conduit elbows for bends.
   6. Where steel conduit is installed in direct contact with earth where soil has a resistivity of less than 2000 ohm-centimeters or is characterized as severely corrosive based on soils report or local experience, use corrosion protection tape to provide supplementary corrosion protection or use PVC-coated galvanized steel rigid metal conduit.
   7. Where steel conduit emerges from concrete into soil, use corrosion protection tape to provide supplementary corrosion protection for a minimum of 4 inches on either side of where conduit emerges or use PVC-coated galvanized steel rigid metal conduit.

D. Exposed, Exterior: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or PVC-coated galvanized steel rigid metal conduit.

E. Connections to Vibrating Equipment:
   1. Dry Locations: Use flexible metal conduit.
   2. Damp, Wet, or Corrosive Locations: Use liquidtight flexible metal conduit.
   3. Maximum Length: 6 feet unless otherwise indicated.

2.02 CONDUIT REQUIREMENTS

A. Electrical Service Conduits: Also comply with Section 26 2100.

B. Communications Systems Conduits: Also comply with Section 27 1005.

C. Fittings for Grounding and Bonding: Also comply with Section 26 0526.

D. Provide all conduit, fittings, supports, and accessories required for a complete raceway system.

E. Provide products listed, classified, and labeled as suitable for the purpose intended.

F. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.03 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

A. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.

B. Fittings:
   1. Non-Hazardous Locations: Use 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 threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

2.04 INTERMEDIATE METAL CONDUIT (IMC)

A. Description: NFPA 70, Type IMC galvanized steel intermediate metal conduit complying with ANSI C80.6 and listed and labeled as complying with UL 1242.

B. Fittings:
   1. Non-Hazardous Locations: Use 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 threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

2.05 PVC-COATED GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

A. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit with external polyvinyl chloride (PVC) coating complying with NEMA RN 1 and listed and labeled as complying with UL 6.

B. Exterior Coating: Polyvinyl chloride (PVC), nominal thickness of 40 mil.

C. PVC-Coated Fittings:
   1. Manufacturer: Same as manufacturer of PVC-coated conduit to be installed.
   2. Non-Hazardous Locations: Use fittings listed and labeled as complying with UL 514B.
   3. Material: Use steel or malleable iron.
   4. Exterior Coating: Polyvinyl chloride (PVC), minimum thickness of 40 mil.

D. PVC-Coated Supports: Furnish with exterior coating of polyvinyl chloride (PVC), minimum thickness of 15 mil.

2.06 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.

2.07 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.

2.08 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.

2.09 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.

2.10 ELECTRICAL NONMETALLIC TUBING (ENT)

A. Description: NFPA 70, Type ENT electrical nonmetallic tubing complying with NEMA TC 13 and listed and labeled as complying with UL 1653.

B. Fittings:
   1. Manufacturer: Same as manufacturer of ENT to be connected.
   2. Use solvent-welded type fittings.
   3. Solvent-Welded Fittings: Rigid PVC fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; suitable for use with ENT.

2.11 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.

2.12 ACCESSORIES

A. Corrosion Protection Tape: PVC-based, minimum thickness of 20 mil.

B. Conduit Joint Compound: Corrosion-resistant, electrically conductive; suitable for use with the conduit to be installed.

C. Solvent Cement for PVC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.

D. Pull Strings: Use nylon cord with average breaking strength of not less than 200 pound-force.

E. Sealing Compound for Sealing Fittings: Listed for use with the particular fittings to be installed.

F. Modular Seals for Conduit Penetrations: Rated for minimum of 40 psig; Suitable for the conduits to be installed.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive conduits.

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. Perform work in accordance with NECA 1 (general workmanship).

C. Install galvanized steel rigid metal conduit (RMC) in accordance with NECA 101.

D. Install intermediate metal conduit (IMC) in accordance with NECA 101.

E. Install PVC-coated galvanized steel rigid metal conduit (RMC) using only tools approved by the manufacturer.

F. Install rigid polyvinyl chloride (PVC) conduit in accordance with NECA 111.

G. Install electrical nonmetallic tubing (ENT) in accordance with NECA 111.

H. Install liquidtight flexible nonmetallic conduit (LFNC) in accordance with NECA 111.

I. Conduit Routing:
   1. Unless dimensioned, conduit routing indicated is diagrammatic.
   2. Conceal all conduits unless specifically indicated to be exposed.
   3. Conduits in the following areas may be exposed, unless otherwise indicated:
      a. Electrical rooms.
      b. Mechanical equipment rooms.
      c. Within joists in areas with no ceiling.
   4. Unless otherwise approved, do not route conduits exposed:
      a. Across floors.
      b. Across roofs.
      c. Across top of parapet walls.
      d. Across building exterior surfaces.
   5. Conduits installed underground or embedded in concrete may be routed in the shortest possible manner unless otherwise indicated. Route all other conduits parallel or perpendicular to building structure and surfaces, following surface contours where practical.
   6. Arrange conduit to maintain adequate headroom, clearances, and access.
   7. Arrange conduit to provide no more than the equivalent of four 90 degree bends between pull points.
   8. Arrange conduit to provide no more than 150 feet between pull points.
   9. Route conduits above water and drain piping where possible.

J. Conduit Support:
   1. Secure and support conduits in accordance with NFPA 70 and Section 26 0529 using suitable supports and methods approved by the authority having jurisdiction.
   2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
   3. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conduits to lay on ceiling tiles.

K. Connections and Terminations:
   1. Use approved zinc-rich paint or conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.
   2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.
   3. Use suitable adapters where required to transition from one type of conduit to another.
   4. Provide drip loops for liquidtight flexible conduit connections to prevent drainage of liquid into connectors.
   5. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.
   6. Provide insulating bushings or insulated throats at all conduit terminations to protect conductors.
   7. Secure joints and connections to provide maximum mechanical strength and electrical continuity.

L. Penetrations:
   1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.

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. Provide metal escutcheon plates for conduit penetrations exposed to public view.
9. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.

M. Underground Installation:
1. Provide trenching and backfilling in accordance with Sections 31 2316 and 31 2323.
2. Minimum Cover, Unless Otherwise Indicated or Required:
   a. as required by NFPA 70 (NEC)..
3. Provide underground warning tape in accordance with Section 26 0553 along entire conduit length for service entrance where not concrete-encased.

N. Concrete Encasement: Where conduits not otherwise embedded within concrete are indicated to be concrete-encased, provide concrete in accordance with Section 03 3000 with minimum concrete cover of 3 inches on all sides unless otherwise indicated.

O. 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.

P. 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.
3. Where conduits penetrate coolers or freezers.

Q. Provide pull string in all empty conduits and in conduits where conductors and cables are to be installed by others. Leave minimum slack of 12 inches at each end.

R. Provide grounding and bonding in accordance with Section 26 0526.

S. Identify conduits in accordance with Section 26 0553.

3.03 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

C. Where coating of PVC-coated galvanized steel rigid metal conduit (RMC) contains cuts or abrasions, repair in accordance with manufacturer's instructions.

D. Correct deficiencies and replace damaged or defective conduits.

3.04 CLEANING

A. Clean interior of conduits to remove moisture and foreign matter.

3.05 PROTECTION

A. Immediately after installation of conduit, use suitable manufactured plugs to provide protection from entry of moisture and foreign material and do not remove until ready for installation of conductors.

END OF SECTION

SECTION 26 0533.16
BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

A. Section 08 3100 - Access Doors and Panels: Panels for maintaining access to concealed boxes.

B. Section 26 0529 - Hangers and Supports for Electrical Systems.

C. Section 26 0533.13 - Conduit for Electrical Systems:
   1. Conduit bodies and other fittings.

D. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

E. Section 26 2726 - Wiring Devices:
   1. Wall plates.
   2. Floor box service fittings.
   3. Additional requirements for locating boxes for wiring devices.

F. Section 27 1005 - Structured Cabling for Voice and Data - Inside-Plant: Additional requirements for communications systems outlet boxes.

1.02 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

B. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2010.

C. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2012.

D. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports; 2013.

E. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.

F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

H. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

I. UL 508A - Industrial Control Panels; Current Edition, Including All Revisions.

J. UL 514A - Metallic Outlet Boxes; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
   2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   3. Coordinate minimum sizes of boxes with the actual installed arrangement of conductors, clamps, support fittings, and devices, calculated according to NFPA 70.
   4. Coordinate minimum sizes of pull boxes with the actual installed arrangement of connected conduits, calculated according to NFPA 70.
   5. Coordinate the placement of boxes with millwork, furniture, devices, equipment, etc. installed under other sections or by others.
   6. Coordinate the work with other trades to preserve insulation integrity.

7. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted boxes where indicated.
8. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.04 SUBMITTALS

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

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for cabinets and enclosures, boxes for hazardous (classified) locations, floor boxes, and underground boxes/enclosures.

C. Samples:
1. Floor Boxes: Provide one sample(s) of each floor box proposed for substitution upon request.

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, and installation of product.

E. Project Record Documents: Record actual locations for outlet and device boxes, pull boxes, cabinets and enclosures, floor boxes, and underground boxes/enclosures.

1.05 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

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 or fire rated 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. Minimum Box Size, Unless Otherwise Indicated:
    a. Wiring Devices (Other Than Communications Systems Outlets): 4 inch square by 1-1/2 inch deep (100 by 38 mm) trade size.
    b. Ceiling Outlets: 4 inch octagonal or square by 1-1/2 inch deep (100 by 38 mm) trade size.
13. Wall Plates: Comply with Section 26 2726.
14. Manufacturers:
    a. Cooper Crouse-Hinds, a division of Eaton Corporation: www.cooperindustries.com.
    b. Hubbell Incorporated; Bell Products; _____: www.hubbell-rtb.com.
    c. Hubbell Incorporated; RACO Products; _____: www.hubbell-rtb.com.
    d. O-Z/Gedney, a brand of Emerson Industrial Automation: www.emersonindustrial.com.
    e. Thomas & Betts Corporation: www.tnb.com.

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.
4. Finish for Painted Steel Enclosures: Primed and field painted with color selected by architect unless otherwise indicated.

D. Floor Boxes:
1. Description: Floor boxes compatible with floor box service fittings provided in accordance with Section 26 2726; with partitions to separate multiple services; furnished with all components, adapters, and trims required for complete installation.
2. Use cast iron floor boxes within slab on grade.
3. Metallic Floor Boxes: Fully adjustable (with integral means for leveling adjustment prior to and after concrete pour).
4. Manufacturer: Same as manufacturer of floor box service fittings.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install boxes in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards where mounting heights are not indicated.

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Flush-mount boxes in finished areas unless specifically indicated to be surface-mounted.

E. Unless otherwise indicated, boxes may be surface-mounted where exposed conduits are indicated or permitted.

F. Box Locations:
1. Locate boxes to be accessible. Provide access panels in accordance with Section 08 3100 as required where approved by the Architect.

2. Unless dimensioned, box locations indicated are approximate.
3. Locate boxes as required for devices installed under other sections or by others.
    a. Switches, Receptacles, and Other Wiring Devices: Comply with Section 26 2726.
    b. Communications Systems Outlets: Comply with Section 27 1005.
4. Locate boxes so that wall plates do not span different building finishes.
5. Locate boxes so that wall plates do not cross masonry joints.
6. Unless otherwise indicated, where multiple outlet boxes are installed at the same location at different mounting heights, install along a common vertical center line.
7. Do not install flush-mounted boxes on opposite sides of walls back-to-back. Provide minimum 24 inch horizontal separation unless otherwise listed and/or approved by the AHJ.
8. Acoustic-Rated Walls: Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches horizontal separation.
9. Fire Resistance Rated Walls: Install flush-mounted boxes such that the required fire resistance will not be reduced.
    a. Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches separation where wall is constructed with individual noncommunicating stud cavities or protect both boxes with listed putty pads, and/or use other listed and approved means or methods to maintain fire rating.
    b. Do not install flush-mounted boxes with area larger than 16 square inches or such that the total aggregate area of openings exceeds 100 square inches for any 100 square feet of wall area unless using other listed and approved means or methods to maintain fire rating.
10. Locate junction and pull boxes in the following areas, unless otherwise indicated or approved by the Architect:
    a. Concealed above accessible suspended ceilings.
    b. Within joists in areas with no ceiling.
    c. Electrical rooms.
    d. Mechanical equipment rooms.

G. Box Supports:
1. Secure and support boxes in accordance with NFPA 70 and Section 26 0529 using suitable supports and methods approved by the authority having jurisdiction.
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.

H. Install boxes plumb and level.

I. 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.

J. Install boxes as required to preserve insulation integrity.

K. Metallic Floor Boxes: Install box level at the proper elevation to be flush with finished floor.

L. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

M. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.

N. Close unused box openings.

O. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.

P. Provide grounding and bonding in accordance with Section 26 0526.

3.02 CLEANING

A. Clean interior of boxes to remove dirt, debris, plaster and other foreign material.

3.03 PROTECTION

A. Immediately after installation, protect boxes from entry of moisture and foreign material until ready for installation of conductors.

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. Wire and cable markers.

D. Underground warning tape.

E. 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. ANSI Z535.2 - American National Standard for Environmental and Facility Safety Signs; 2011.

B. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels; 2011.

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. NFPA 70E - Standard for Electrical Safety in the Workplace; 2015.

E. UL 969 - Marking and Labeling Systems; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Verify final designations for equipment, systems, and components to be identified prior to fabrication of identification products.

B. Sequencing:
   1. Do not conceal items to be identified, in locations such as above suspended ceilings, until identification products have been installed.
   2. Do not install identification products until final surface finishes and painting are complete.

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. Switchboards:
         1) Identify ampere rating.
         2) Identify voltage and phase.
         3) Identify power source and circuit number. Include location when not within sight of equipment.
         4) Use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.
      b. Panelboards:
         1) Identify power source and circuit number. Include location when not within sight of equipment.
         2) Use typewritten circuit directory (1/8" font minimum) to identify load(s) served for panelboards with a door. Identify spares and spaces using pencil.
      c. Transformers:

1) Identify kVA rating.
2) Identify voltage and phase for primary and secondary.
3) Identify load(s) served. Include location.

d. 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.

e. Time Switches:
1) Identify load(s) served and associated circuits controlled. Include location.

f. Enclosed Contactors:
1) Identify ampere rating.
2) Identify voltage and phase.
3) Identify configuration, e.g., E.O.E.H. (electrically operated, electrically held) or E.O.M.H. (electrically operated, mechanically held).
4) Identify coil voltage.
5) Identify load(s) and associated circuits controlled. Include location.

g. Transfer Switches:
1) Identify voltage and phase.
2) Identify power source and circuit number for both normal power source and standby power source. Include location when not within sight of equipment.
3) Identify load(s) served. Include location when not within sight of equipment.
4) Identify short circuit current rating based on the specific overcurrent protective device type and settings protecting the transfer switch.

2. Service Equipment:
a. Use identification nameplate to identify each service disconnecting means.
b. For buildings or structures supplied by more than one service, or any combination of branch circuits, feeders, and services, use identification nameplate or means of identification acceptable to authority having jurisdiction at each service disconnecting means to identify all other services, feeders, and branch circuits supplying that building or structure. Verify format and descriptions with authority having jurisdiction.

3. 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. Industrial control panels.
c. Motor control centers.
d. Elevator control panels.
e. Industrial machinery.

4. 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.

5. Use warning signs to identify electrical hazards for entrances to all rooms and other guarded locations that contain exposed live parts operating at 600 V nominal or less with

the word message "DANGER; Electrical hazard; Authorized personnel only" or approved equivalent.

6. Use warning labels, identification nameplates, or identification labels to identify electrical hazards for equipment where multiple power sources are present with the word message "DANGER; Hazardous voltage; Multiple power sources may be present; Disconnect all electric power including remote disconnects before servicing" 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. Use identification nameplate or identification label to identify color code for ungrounded and grounded power conductors inside door or enclosure 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.
   3. Use wire and cable markers to identify circuit number or other designation indicated for power, control, and instrumentation conductors and cables at the following locations:
      a. At each source and load connection.
      b. Within boxes when more than one circuit is present.
      c. Within equipment enclosures when conductors and cables enter or leave the enclosure.
   4. Use underground warning tape to identify direct buried cables.

C. Identification for Devices:
   1. Use identification label to identify fire alarm system devices.
      a. For devices concealed above suspended ceilings, provide additional identification on ceiling tile below device location.
   2. Use identification label to identify serving branch circuit for all receptacles.
      a. For receptacles in all locations, provide identification on inside surface of wallplate.

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.

C. Format for Equipment Identification:
   1. Minimum Size: 1 inch by 2.5 inches.
   2. Legend:
      a. Equipment designation or other approved description.
   3. Text: All capitalized unless otherwise indicated.

4. Minimum Text Height:
    a. Equipment Designation: 1/2 inch.
5. Color:
    a. Normal Power System: White text on black background.
        1) 208Y/120 V, 3 Phase Equipment: White text on _____ background.
    b. Emergency Power System: White text on red background.
    c. Fire Alarm System: White text on red background.

D. Format for Receptacle Identification:
1. Minimum Size: 3/8 inch by 1.5 inches.
2. Legend: Power source and circuit number or other designation indicated.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 3/16 inch.
5. Color: Black text on clear background.

2.03 WIRE AND CABLE MARKERS

A. Markers for Conductors and Cables: Use wrap-around self-adhesive vinyl cloth, wrap-around self-adhesive vinyl self-laminating, heat-shrink sleeve, plastic sleeve, plastic clip-on, or vinyl split sleeve type markers suitable for the conductor or cable to be identified.

B. Markers for Conductor and Cable Bundles: Use plastic marker tags secured by nylon cable ties.

C. Legend: Power source and circuit number or other designation indicated.

D. Text: Use factory pre-printed or machine-printed text, all capitalized unless otherwise indicated.

E. Minimum Text Height: 1/8 inch.

F. Color: Black text on white background unless otherwise indicated.

2.04 UNDERGROUND WARNING TAPE

A. Materials: Use non-detectable type polyethylene tape suitable for direct burial, unless otherwise indicated.

B. Non-detectable Type Tape: 6 inches wide, with minimum thickness of 4 mil.

C. Legend: Type of service, continuously repeated over full length of tape.

D. Color:

2.05 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 PREPARATION

A. Clean surfaces to receive adhesive products according to manufacturer's instructions.

3.02 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. Interior Components: Legible from the point of access.
   6. Conductors and Cables: Legible from the point of access.
   7. Devices: Inside face of cover.

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.
   1. Do not use adhesives on exterior surfaces except where substrate cannot be penetrated.

E. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.

F. Install underground warning tape above buried lines with one tape per trench at 3 inches below finished grade.

G. Secure rigid signs using stainless steel screws.

H. Mark all handwritten text, where permitted, to be neat and legible.

3.03 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Replace self-adhesive labels and markers that exhibit bubbles, wrinkles, curling or other signs of improper adhesion.

END OF SECTION

SECTION 26 0583
WIRING CONNECTIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electrical connections to equipment.

1.02 RELATED REQUIREMENTS

A. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables.

B. Section 26 0533.13 - Conduit for Electrical Systems.

C. Section 26 0533.16 - Boxes for Electrical Systems.

D. Section 26 2726 - Wiring Devices.

E. Section 26 2816.16 - Enclosed Switches.

1.03 REFERENCE STANDARDS

A. NEMA WD 1 - General Color Requirements for Wiring Devices; 1999 (R 2010).

B. NEMA WD 6 - Wiring Devices - Dimensional Specifications; 2012.

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Obtain and review shop drawings, product data, manufacturer's wiring diagrams, and manufacturer's instructions for equipment furnished under other sections.
   2. Determine connection locations and requirements.

1.05 SUBMITTALS

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

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Products: Listed, classified, and labeled as suitable for the purpose intended.

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. Disconnect Switches: As specified in Section 26 2816.16 and in individual equipment sections.

C. Wiring Devices: As specified in Section 26 2726.

D. Flexible Conduit: As specified in Section 26 0533.13.

E. Wire and Cable: As specified in Section 26 0519.

F. Boxes: As specified in Section 26 0533.16.

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 equipment using flexible conduit. Use liquidtight flexible conduit with watertight connectors in damp or wet locations.

C. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.

D. 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.

J. Coolers and Freezers: Cut and seal conduit openings in freezer and cooler walls, floor, and ceilings.

END OF SECTION

SECTION 26 0919
ENCLOSED CONTACTORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Lighting contactors.

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. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts; 2000 (R2005), with errata, 2008.

B. NEMA ICS 6 - Industrial Control and Systems: Enclosures; 1993 (R2011).

C. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2013.

D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 SUBMITTALS

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

B. Product Data: Provide dimensions, size, voltage ratings and current ratings.

C. 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.

D. Maintenance Data: Include instructions for replacing and maintaining coil and contacts.

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 and with service facilities within 100 miles of Project.

C. Products: Listed, classified, and labeled as suitable for the purpose intended.

PART 2 PRODUCTS

2.01 LIGHTING CONTACTORS

A. Description: NEMA ICS 2, magnetic lighting contactor.

B. Configuration: Mechanically held, 2 wire control.

C. Coil operating voltage: 120 volts, 60 Hertz.

D. Poles: One pole per controlled circuit plus two spare poles, with additional as needed to match circuit configuration and control function.

E. Contact Rating: Match branch circuit overcurrent protection, considering derating for continuous loads.

F. Enclosure: NEMA ICS 6, Type 1.

G. Accessories:
   1. Selector Switch: ON/OFF.
   2. Indicating Light: RED.

3. Auxiliary Contacts: One, normally open.

2.02 ACCESSORIES

A. Auxiliary Contacts: NEMA ICS 2, 2 normally open contacts in addition to seal-in contact.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install enclosed contactors where indicated, in accordance with manufacturer's instructions.

B. Install enclosed contactors plumb. Provide supports in accordance with Section 26 0529.

3.02 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform applicable inspections and tests listed in NETA ATS, Section 7.16.1.

END OF SECTION

SECTION 26 0923

LIGHTING CONTROL DEVICES

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

A. Section 26 0529 - Hangers and Supports for Electrical Systems.

B. Section 26 0533.16 - Boxes for Electrical Systems.

C. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

D. Section 26 2726 - Wiring Devices: Devices for manual control of lighting, including wall switches, wall dimmers, and fan speed controllers.

1.02 REFERENCE STANDARDS

A. ANSI C136.10 - American National Standard for Roadway and Area Lighting Equipment - Locking-Type Photocontrol Devices and Mating Receptacles - Physical and Electrical Interchangeability and Testing; 2010.

B. ANSI C136.24 - American National Standard for Roadway and Area Lighting Equipment - Nonlocking (Button) Type Photocontrols; 2004 (R2010).

C. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

D. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2010.

E. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.

F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. UL 773 - Plug-in, Locking Type Photocontrols for Use with Area Lighting; Current Edition, Including All Revisions.

H. UL 773A - Nonindustrial Photoelectric Switches for Lighting Control; Current Edition, Including All Revisions.

I. UL 916 - Energy Management Equipment; Current Edition, Including All Revisions.

J. UL 917 - Clock-Operated Switches; Current Edition, Including All Revisions.

PART 2 PRODUCTS

2.01 LIGHTING CONTROL DEVICES - GENERAL REQUIREMENTS

A. Provide products listed, classified, and labeled as suitable for the purpose intended.

B. Unless specifically indicated to be excluded, provide all required conduit, wiring, connectors, hardware, components, accessories, etc. as required for a complete operating system.

2.02 TIME SWITCHES

A. Digital Electronic Time Switches:
   1. Description: Factory-assembled solid state programmable controller with LCD display, listed and labeled as complying with UL 916 or UL 917.
   2. Program Capability:
      a. Astronomic Time Switches (outdoor circuits): Single channel, capable of different schedule for each day of the week with additional holiday schedule available to override normal schedule for selected days and field-configurable astronomic feature to automatically adjust for seasonal changes in sunrise and sunset times.
   3. Schedule Capacity: Not less than 16 programmable on/off operations.
   4. Provide automatic daylight savings time and leap year compensation.
   5. Provide power outage backup to retain programming and maintain clock.

6. Manual override: Capable of overriding current schedule both permanently and temporarily until next scheduled event.
7. Provide remote photocell input with light level adjustment.
8. Input Supply Voltage: As indicated on the drawings.

B. Electromechanical Time Switches:
1. Description: Factory-assembled controller with motor-operated timing dial mechanism and adjustable trippers for setting on/off operations, listed and labeled as complying with UL 917.
2. Program Capability:
   a. 24-Hour Time Switches (indoor circuits): With same schedule for each day of the week and skip-a-day feature to omit selected days.
3. Schedule Capacity:
   a. 24-Hour Time Switches: Accommodating not less than 12 pairs of selected on/off operations per day.
4. Manual override: Capable of overriding current schedule both permanently and temporarily until next scheduled event.
5. Input Supply Voltage: As indicated on the drawings.
6. Provide lockable enclosure; environmental type per NEMA 250 as specified for the following installation locations:

2.03 OUTDOOR PHOTO CONTROLS

A. Stem-Mounted Outdoor Photo Controls:
1. Description: Direct-wired photo control unit with threaded conduit mounting stem and field-adjustable swivel base, listed and labeled as complying with UL 773A.
2. Housing: Weatherproof, impact resistant polycarbonate.
3. Photo Sensor: Cadmium sulfide.
4. Provide external sliding shield for field adjustment of light level activation.
5. Light Level Activation: 1 to 5 footcandles turn-on and 3 to 1 turn-off to turn-on ratio with delayed turn-off.
6. Voltage: As required to control the load indicated on the drawings.
7. Failure Mode: Fails to the on position.
8. Load Rating: As required to control the load indicated on the drawings.

B. Locking Receptacle-Mounted Outdoor Photo Controls
1. Description: Plug-in locking type photo control unit complying with ANSI C136.10 for mounting on a compatible receptacle, listed and labeled as complying with UL 773.
2. Housing: Weatherproof, impact resistant UV stabilized polypropylene, color to be selected.
3. Photo Sensor: Cadmium sulfide.
4. Light Level Activation: 1 to 3 footcandles turn-on and 1.5 to 1 turn-off to turn-on ratio with instant turn-on and delayed turn-off.
5. Voltage: As required to control the load indicated on the drawings.
6. Failure Mode: Fails to the on position.
7. Load Rating: As required to control the load indicated on the drawings.
8. Surge Protection: 160 joule metal oxide varistor.

C. Button Type Outdoor Photo Controls
1. Description: Direct-wired photo control unit complying with ANSI C136.24 with weatherproof gasketed wall plate where required or indicated, listed and labeled as complying with UL 773A.
2. Housing: Weather resistant polycarbonate.
3. Photo Sensor: Cadmium sulfide.
4. Light Level Activation: 1 to 3 footcandles turn-on and 3 to 1 turn-off to turn-on ratio with delayed turn-off.

5. Voltage: As required to control the load indicated on the drawings.
6. Failure Mode: Fails to the on position.
7. Load Rating: As required to control the load indicated on the drawings.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

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 openings for outlet boxes are neatly cut and will be completely covered by devices or 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 lighting control devices.

F. Verify that the service voltage and ratings of lighting control devices are appropriate for the service voltage and load requirements at the location to be installed.

G. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install lighting control devices in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.

B. Coordinate locations of outlet boxes provided under Section 26 0533.16 as required for installation of lighting control devices provided under this section.

C. Install lighting control devices in accordance with manufacturer's instructions.

D. Unless otherwise indicated, connect lighting control device grounding terminal or conductor to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

E. Install lighting control devices plumb and level, and held securely in place.

F. Where required and not furnished with lighting control device, provide wall plate in accordance with Section 26 2726.

G. Provide required supports in accordance with Section 26 0529.

H. Where applicable, install lighting control devices and associated wall plates to fit completely flush to mounting surface 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.

I. Identify lighting control devices in accordance with Section 26 0553.

J. Outdoor Photo Control Locations:
   1. Where possible, locate outdoor photo controls with photo sensor facing north. If north facing photo sensor is not possible, install with photo sensor facing east, west, or down.
   2. Locate outdoor photo controls so that photo sensors do not face artificial light sources, including light sources controlled by the photo control itself.

K. Install outdoor photo controls so that connections are weatherproof. Do not install photo controls with conduit stem facing up in order to prevent infiltration of water into the photo control.

3.03 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Inspect each lighting control device for damage and defects.

C. Test time switches to verify proper operation.

D. Test outdoor photo controls to verify proper operation, including time delays where applicable.

E. Correct wiring deficiencies and replace damaged or defective lighting control devices.

3.04 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

B. Adjust time switch settings to achieve desired operation schedule as indicated or as directed by Architect. Record settings in written report to be included with submittals.

C. Adjust external sliding shields on outdoor photo controls under optimum lighting conditions to achieve desired turn-on and turn-off activation as indicated or as directed by Architect.

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. Training: Train Owner's personnel on operation, adjustment, programming, and maintenance of lighting control devices.
   1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
   2. Location: At project site.

END OF SECTION

SECTION 26 2416
PANELBOARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Power distribution panelboards.

B. Lighting and appliance panelboards.

C. Load centers.

D. Overcurrent protective devices for panelboards.

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 0573 - Power System Studies: Additional criteria for the selection and adjustment of equipment and associated protective devices specified in this section.

F. Section 26 2813 - Fuses: Fuses for fusible switches and spare fuse cabinets.

G. Section 26 4300 - Surge Protective Devices.

1.03 REFERENCE STANDARDS

A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service; Federal Specification; Revision E, 2013.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

C. NECA 407 - Standard for Installing and Maintaining Panelboards; 2009.

D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.

E. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts; 2000 (R2005), with errata, 2008.

F. NEMA KS 1 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum); 2013.

G. NEMA PB 1 - Panelboards; 2011.

H. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less; 2013.

I. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2013.

J. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

K. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

L. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

M. UL 67 - Panelboards; Current Edition, Including All Revisions.

N. UL 98 - Enclosed and Dead-Front Switches; Current Edition, Including All Revisions.

O. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.

P. UL 869A - Reference Standard for Service Equipment; Current Edition, Including All Revisions.

Q. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

R. UL 1699 - Arc-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
   2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   3. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted panelboards where indicated.
   4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
   5. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

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

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for panelboards, enclosures, overcurrent protective devices, and other installed components and accessories.
   1. Include characteristic trip curves for each type and rating of overcurrent protective device upon request.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store panelboards in accordance with manufacturer's instructions and NECA 407.

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 written instructions to avoid damage to panelboard internal components, enclosure, and finish.

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.

E. Substitutions: See Section 01 6000 - Product Requirements.

F. Source Limitations: Furnish panelboards and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

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 not less than the available fault current at the installed location as determined by short circuit study performed in accordance with Section 26 0573.
   2. Listed series ratings are acceptable, except where not permitted by motor contribution according to NFPA 70.
   3. Label equipment utilizing series ratings as required by NFPA 70.

D. Panelboards Used for Service Entrance: Listed and labeled as suitable for use as service equipment according to UL 869A.

E. Mains: Configure for top or bottom incoming feed as indicated or as required for the installation.

F. Branch Overcurrent Protective Devices: Replaceable without disturbing adjacent devices.

G. Bussing: Sized in accordance with UL 67 temperature rise requirements.
   1. Provide fully rated neutral bus unless otherwise indicated, with a suitable lug for each feeder or branch circuit requiring a neutral connection.
   2. Provide solidly bonded equipment ground bus in each panelboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.

H. Conductor Terminations: Suitable for use with the conductors to be installed.

I. 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.
   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.

J. Future Provisions: Prepare all unused spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.

K. Surge Protective Devices: Where factory-installed, internally mounted surge protective devices are provided in accordance with Section 26 4300, list and label panelboards as a complete assembly including surge protective device.

L. Panelboard Contactors: Where panelboard contactors are indicated, provide electrically operated, mechanically held magnetic contactor complying with NEMA ICS 2.
   1. Ampere Rating: Not less than ampere rating of panelboard bus.
   2. Short Circuit Current Rating: Not less than the panelboard short circuit current rating.
   3. Coil Voltage: As required for connection to control system indicated.

M. Provide the following features and accessories where indicated or where required to complete installation:

1. Feed-through lugs.
2. Sub-feed lugs.

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.

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. Fronts: Provide lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
   3. Provide clear plastic circuit directory holder mounted on inside of door.

2.05 LOAD CENTERS

A. Description: Circuit breaker type load centers listed and labeled as complying with UL 67; ratings, configurations, and features as indicated on the drawings.

B. Bussing:
   1. Phase Bus Connections: Arranged for sequential phasing of overcurrent protective devices.
   2. Bus Material: Aluminum or copper.

C. Circuit Breakers: Thermal magnetic plug-in type.

D. Enclosures:
   1. Provide flush-mounted enclosures unless otherwise indicated.

2. Fronts: Provide hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
3. Provide circuit directory label on inside of door or individual circuit labels adjacent to circuit breakers.

2.06 OVERCURRENT PROTECTIVE DEVICES

A. Fusible Switches:
1. Description: Quick-make, quick-break, dead-front fusible switch units complying with NEMA KS 1, and listed and labeled as complying with UL 98; ratings, configurations, and features as indicated on the drawings.
2. Fuse Clips: As required to accept indicated fuses.
   a. Where NEMA Class R fuses are installed, provide rejection feature to prevent installation of fuses other than Class R.
3. Provide externally operable handle with means for locking in the OFF position. Provide means for locking switch cover in the closed position. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.
4. Conductor Terminations:
   a. Provide mechanical lugs unless otherwise indicated.
   b. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.

B. 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, but not less than:
   b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
   c. Series Rated Systems: Provide circuit breakers listed in combination with upstream devices to provide interrupting rating not less than the short circuit current rating indicated.
3. Conductor Terminations:
   a. Provide mechanical lugs unless otherwise indicated.
   b. 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. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units.
   a. Provide the following field-adjustable trip response settings:
      1) Long time pickup, adjustable by setting dial.
      2) Long time delay.
      3) Short time pickup and delay.
      4) Instantaneous pickup.
6. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.
7. Provide the following circuit breaker types where indicated:
   a. Ground Fault Circuit Interrupter (GFCI) Circuit Breakers: Listed as complying with UL 943, class A for protection of personnel.
   b. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: Combination type listed as complying with UL 1699.
   c. 100 Percent Rated Circuit Breakers: Listed for application within the panelboard where installed at 100 percent of the continuous current rating.

d. Current Limiting Circuit Breakers: Without using fusible elements, designed to limit the let-through energy to a value less than the energy of a one-half cycle wave of the symmetrical prospective current when operating within its current limiting range.

8. Provide listed high intensity discharge lighting rated circuit breakers with HID marking for all branch circuits serving HID lighting.
9. Do not use handle ties in lieu of multi-pole circuit breakers.
10. Provide multi-pole circuit breakers for multi-wire branch circuits as required by NFPA 70.
11. Provide the following features and accessories where indicated or where required to complete installation:
    a. Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.
    b. Handle Pad-Lock Provision: For locking circuit breaker handle in OFF position.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings and configurations of the panelboards and associated components are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive panelboards.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).

B. Install products in accordance with manufacturer's instructions.

C. Install panelboards in accordance with NECA 407 and NEMA PB 1.1.

D. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

E. Provide required supports in accordance with Section 26 0529.

F. Install panelboards plumb.

G. Install flush-mounted panelboards so that trims fit completely flush to wall with no gaps and rough opening completely covered.

H. Mount floor-mounted power distribution panelboards on properly sized 3 inch high concrete pad constructed in accordance with Section 03 3000.

I. Provide minimum of six spare 1 inch trade size conduits out of each flush-mounted panelboard stubbed into accessible space above ceiling and below floor.

J. Provide grounding and bonding in accordance with Section 26 0526.
   1. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on isolated/insulated ground bus.

K. Install all field-installed branch devices, components, and accessories.

L. Provide fuses complying with Section 26 2813 for fusible switches as indicated.

M. Multi-Wire Branch Circuits: Group grounded and ungrounded conductors together in the panelboard as required by NFPA 70.

N. Set field-adjustable circuit breaker tripping function settings as determined by overcurrent protective device coordination study performed according to Section 26 0573.

O. Provide filler plates to cover unused spaces in panelboards.

P. Provide circuit breaker lock-on devices to prevent unauthorized personnel from de-energizing essential loads where indicated. Also provide for the following:
   1. Emergency and night lighting circuits.
   2. Fire detection and alarm circuits.

3. Communications equipment circuits.
4. Video surveillance system circuits.

Q. Identify panelboards in accordance with Section 26 0553.

3.03 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Fusible Switches: Perform inspections and tests listed in NETA ATS, Section 7.5.1.1.

D. Molded Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for all main circuit breakers and circuit breakers larger than 50 amperes. Tests listed as optional are not required.

E. Ground Fault Protection Systems: Test in accordance with manufacturer's instructions as required by NFPA 70.

F. Test GFCI circuit breakers to verify proper operation.

G. Test AFCI circuit breakers to verify proper operation.

H. Test shunt trips to verify proper operation.

I. Procure services of a qualified manufacturer's representative to observe installation and assist in inspection, testing, and adjusting. Include manufacturer's reports with field quality control submittals.

J. Correct deficiencies and replace damaged or defective panelboards or associated components.

3.04 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

B. Adjust alignment of panelboard fronts.

C. Load Balancing: For each panelboard, rearrange circuits such that the difference between each measured steady state phase load does not exceed 20 percent and adjust circuit directories accordingly. Maintain proper phasing for multi-wire branch circuits.

3.05 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 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 0533.16 - Boxes for Electrical Systems.

B. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

1.03 REFERENCE STANDARDS

A. FS W-C-596 - Connector, Electrical, Power, General Specification for; Federal Specification; Revision G, 2001.

B. FS W-S-896 - Switches, Toggle (Toggle and Lock), Flush-mounted (General Specification); Federal Specification; Revision F, 1999.

C. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

D. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2010.

E. NEMA WD 1 - General Color Requirements for Wiring Devices; 1999 (R 2010).

F. NEMA WD 6 - Wiring Devices - Dimensional Specifications; 2012.

G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H. UL 20 - General-Use Snap Switches; Current Edition, Including All Revisions.

I. UL 498 - Attachment Plugs and Receptacles; Current Edition, Including All Revisions.

J. UL 514D - Cover Plates for Flush-Mounted Wiring Devices; Current Edition, Including All Revisions.

K. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

1.04 SUBMITTALS

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

1.05 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Products: Listed, classified, and labeled as suitable for the purpose intended.

1.06 DELIVERY, STORAGE, AND PROTECTION

A. Store in a clean, dry space in original manufacturer's packaging until ready for installation.

PART 2 PRODUCTS

2.01 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 GFI protection for all receptacles installed in kitchens.

G. Provide GFCI protection for receptacles serving electric drinking fountains.

2.02 WIRING DEVICE FINISHES

A. Finish selected by owner and architectural representative..

2.03 WALL SWITCHES

A. Manufacturers:
   1. Hubbell Incorporated: www.hubbell-wiring.com.
   2. Leviton Manufacturing Company, Inc: www.leviton.com.
   3. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us

B. General Use Switches (only where specifically noted): 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 and where applicable, FS W-S-896; 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.

C. Accessible Wall Switches (all public and private exposed locations): Industrial specification grade, 20 A, 120/277 V with decorator style rocker type switch actuator and maintained contacts; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.

D. Lighted Wall Switches: (concealed locations and mechanical / electrical spaces); and Industrial specification grade, 20 A, 120/277 V with illuminated decorator style rocker type switch actuator and maintained contacts; illuminated with load off; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.

E. Pilot Light Wall Switches: (for use with contactors) Industrial specification grade, 20 A, 120/277 V with _____ illuminated standard toggle type switch actuator and maintained contacts and illuminated with load on. Provide single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.

F. Momentary Contact Wall Switches (for use with mechanically held contactors, door controllers, and where shown on plan): Industrial specification grade, 20 A, 120/277 V with toggle type three position switch actuator and momentary contacts; single pole double throw, off with switch actuator in center position.

2.04 RECEPTACLES

A. Manufacturers:
   1. Hubbell Incorporated: www.hubbell-wiring.com.
   2. Leviton Manufacturing Company, Inc: www.leviton.com.
   3. Lutron Electronics Company, Inc; Designer Style: www.lutron.com/sle.
   4. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us
   5. Source Limitations: Where wall controls are furnished as part of lighting control system, provide accessory matching receptacles and wallplates by the same manufacturer in locations indicated.

B. Receptacles - General Requirements: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498, and where applicable, FS W-C-596; 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.

3. Hospital Grade Receptacles (healthcare locations): Listed as complying with UL 498 Supplement SD, with green dot hospital grade mark on device face.

C. Convenience Receptacles:
   1. Standard Convenience Receptacles (common areas): Industrial specification grade, 20A, 125V, NEMA 5-20R; single or duplex as indicated on the drawings.
   2. Tamper Resistant Convenience Receptacles (dwelling units): Industrial specification grade, 20A, 125V, NEMA 5-20R, , listed and labeled as tamper resistant type; single or duplex as indicated on the drawings.

D. 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. Weather Resistant GFCI Receptacles: Industrial 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.

2.05 COMMUNICATIONS OUTLETS

A. Telephone Outlet:
   1. Single RJ-45 jack for terminating 100-ohm, balanced, four-pair UTP; TIA/EIA-568-B.1 complying with Category 5e. Comply with UL 1863.
   2. Outlet color to be verified with owners IT personnel.

B. Data Outlet:
   1. Single RJ-45 jack for terminating 100-ohm, balanced, four-pair UTP; TIA/EIA-568-B.1 complying with Category 5e. Comply with UL 1863.
   2. Outlet color to be verified with owners IT personnel.

C. TV Outlet:
   1. Type F coaxial cable connector

D. Combination Outlet:
   1. Any combination of telephone, data, or television outlets as noted on plans. Provide in a common box with a common faceplate.

2.06 WALL PLATES

A. Manufacturers:
   1. Hubbell Incorporated: www.hubbell-wiring.com.
   2. Leviton Manufacturing Company, Inc: www.leviton.com.
   3. Lutron Electronics Company, Inc; _____: www.lutron.com/sle.
   4. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us
   5. Substitutions: See Section 01 6000 - Product Requirements.

B. Wall Plates: Comply with UL 514D.
   1. Configuration: One piece cover as required for quantity and types of corresponding wiring devices.
   2. Size: Standard; do not use oversized plates without architect approval.
   3. Screws: Metal with slotted heads finished to match wall plate finish.

C. Nylon Wall Plates: Smooth finish, high-impact thermoplastic.

D. 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.

E. Wall plates shall be uniform in color, style and material within an area for all receptacle, switch and communications devices.

F. For wall mounted telephones (above 36” AFF), wall plate shall have telephone mounting studs.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

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 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.

B. Coordinate locations of outlet boxes provided under Section 26 0533.16 as required for installation of wiring devices provided under this section.
   1. Mounting Heights: As indicated on the drawings. If not indicated, install as follows:
      a. Wall Switches: box top 48 inches above finished floor.
      b. Wall Dimmers: box top 48 inches above finished floor.
      c. Receptacles: box bottom 18 inches above finished floor or 6 inches above counter.
   2. Orient outlet boxes for vertical installation of wiring devices unless otherwise indicated.
   3. Where multiple receptacles, wall switches, or wall dimmers are installed at the same location and at the same mounting height, gang devices together under a common wall plate.
   4. Locate wall switches on strike side of door with edge of wall plate 3 inches from edge of door frame. Where locations are indicated otherwise, notify Architect to obtain direction prior to proceeding with work.
   5. Locate receptacles for electric drinking fountains concealed behind drinking fountain according to manufacturer's instructions.

C. Install wiring devices in accordance with manufacturer's instructions.

D. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

E. Where required, connect wiring devices using pigtails not less than 6 inches long. Do not connect more than one conductor to wiring device terminals.

F. 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.

G. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

H. Provide GFI receptacles with integral GFI protection at each location indicated (exterior, isolated or remote locations). Do not use feed-through wiring to protect downstream devices.

I. Unless otherwise indicated, GFI receptacles may be connected to provide feed-through protection to downstream devices in immediate vicinity (same room). Label such devices to indicate they are protected by upstream GFI protection.

J. Install wiring devices plumb and level with mounting yoke held rigidly in place.

K. Install wall switches with OFF position down.

L. Install vertically mounted receptacles with grounding pole on top and horizontally mounted receptacles with grounding pole on left.

M. 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.

N. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.

3.03 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, wall dimmer, and fan speed controller with circuit energized to verify proper operation.

D. Test each receptacle to verify operation and proper polarity.

E. Test each GFCI receptacle for proper tripping operation according to manufacturer's instructions.

F. Correct wiring deficiencies and replace damaged or defective wiring devices.

3.04 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

B. Adjust presets for wall dimmers according to manufacturer's instructions as directed by Architect.

3.05 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 RELATED REQUIREMENTS

A. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

1.02 REFERENCE STANDARDS

A. NEMA FU 1 - Low Voltage Cartridge Fuses; 2012.

B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. UL 248-1 - Low-Voltage Fuses - Part 1: General Requirements; Current Edition, Including All Revisions.

D. UL 248-12 - Low-Voltage Fuses - Part 12: Class R Fuses; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate fuse clips furnished in equipment provided under other sections for compatibility with indicated fuses.
   2. Coordinate fuse requirements according to manufacturer's recommendations and nameplate data for actual equipment to be installed.
   3. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.04 SUBMITTALS

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

B. Product Data: Provide manufacturer's standard data sheets including voltage and current ratings, interrupting ratings, time-current curves, and current limitation curves.
   1. Spare Fuse Cabinet: Include dimensions.

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. Extra Fuses: One set(s) of three for each type and size installed.
   3. Fuse Pullers: One set(s) compatible with each type and size installed.
   4. Spare Fuse Cabinet Keys: Two.

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.

C. 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. Bussmann, a division of Eaton Corporation; _____: www.cooperindustries.com.

B. Littelfuse, Inc; _____: www.littelfuse.com.

C. Substitutions: See Section 01 6000 - Product Requirements.

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. Unless otherwise indicated, provide cartridge type fuses complying with NEMA FU 1, Class and ratings as indicated.

F. Voltage Rating: Suitable for circuit voltage.

G. Class R Fuses: Comply with UL 248-12.
   1. Class RK1, Time-Delay Fuses:
   2. Class RK5, Time-Delay Fuses:

H. Provide the following accessories where indicated or where required to complete installation:
   1. Fuseholders: Compatible with indicated fuses.
   2. Fuse Reducers: For adapting indicated fuses to permit installation in switch designed for fuses with larger ampere ratings.

2.03 SPARE FUSE CABINET

A. Description: Wall-mounted sheet metal cabinet with shelves and hinged door with cylinder lock, suitably sized to store spare fuses and fuse pullers specified.

B. Finish: Manufacturer's standard, factory applied grey finish unless otherwise indicated.

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 mounting surfaces are ready to receive spare fuse cabinet.

C. 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. Install fuses with label oriented such that manufacturer, type, and size are easily read.

C. Install spare fuse cabinet where indicated.

D. Identify spare fuse cabinet in accordance with Section 26 0553.

END OF SECTION

SECTION 26 2816.13
ENCLOSED CIRCUIT BREAKERS

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

A. Section 26 0526 - Grounding and Bonding for Electrical Systems.

B. Section 26 0529 - Hangers and Supports for Electrical Systems.

1.02 REFERENCE STANDARDS

A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service; Federal Specification; Revision E, 2013.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.

D. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2013.

E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

G. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

H. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.

I. UL 869A - Reference Standard for Service Equipment; Current Edition, Including All Revisions.

J. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

K. UL 1053 - Ground-Fault Sensing and Relaying Equipment; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate work with other trades. Avoid placement of ductwork, piping, equipment, or other potential obstructions within dedicated equipment spaces and within working clearances for electrical equipment required by NFPA 70.
   2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   3. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted enclosed circuit breakers where indicated.
   4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
   5. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.04 SUBMITTALS

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

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for circuit breakers, enclosures, and other installed components and accessories.
   1. Include characteristic trip curves for each type and rating of circuit breaker upon request.

C. Shop Drawings: Indicate outline and support point dimensions, voltage and current ratings, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.

1. Include dimensioned plan and elevation views of enclosed circuit breakers and adjacent equipment with all required clearances indicated.
2. Include wiring diagrams showing all factory and field connections.
3. Clearly indicate whether proposed short circuit current ratings are fully rated or, where acceptable, series rated systems.

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. Project Record Documents: Record actual installed locations of enclosed circuit breakers.

F. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

1.05 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

1.06 DELIVERY, STORAGE, AND HANDLING

A. 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.

B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to enclosed circuit breaker internal components, enclosure, and finish.

1.07 FIELD CONDITIONS

A. Maintain ambient temperature between 23 degrees F and 104 degrees F during and after installation of enclosed circuit breakers.

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. Substitutions: See Section 01 6000 - Product Requirements.

E. Source Limitations: Furnish enclosed circuit breakers and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

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 not less than the available fault current at the installed location indicated on the drawings.
2. Listed series ratings are acceptable, except where not permitted by motor contribution according to NFPA 70.
3. Label equipment utilizing series ratings as required by NFPA 70.

E. Enclosed Circuit Breakers Used for Service Entrance: Listed and labeled as suitable for use as service equipment according to UL 869A.

F. Conductor Terminations: Suitable for use with the conductors to be installed.

G. Provide thermal magnetic circuit breakers unless otherwise indicated.

H. Provide electronic trip circuit breakers for circuit breaker frame sizes 225 amperes and above.

I. Provide insulated, groundable fully rated solid neutral assembly where a neutral connection is required, with a suitable lug for terminating each neutral conductor.

J. 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.

K. Provide externally operable handle with means for locking in the OFF position.

L. Ground Fault Protection: Where ground-fault protection is indicated, provide system listed and labeled as complying with UL 1053.
   1. Where electronic circuit breakers equipped with integral ground fault protection are used, provide separate neutral current sensor where applicable.
   2. Where accessory ground fault sensing and relaying equipment is used, equip companion circuit breakers with ground-fault shunt trips.
      a. Use zero sequence ground fault detection method unless otherwise indicated.
      b. Provide test panel and field-adjustable ground fault pick-up and delay settings.
      c. Provide zone selective interlocking capability where indicated, capable of communicating with other electronic trip circuit breakers and external ground fault sensing systems to control ground fault delay functions for system coordination purposes.

M. Selectivity: Where the requirement for selectivity is indicated, furnish products as required to achieve selective coordination.

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 indicated, but not less than:
      a. 10,000 rms symmetrical amperes at 240 VAC or 208 VAC.
   2. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
   3. Series Rated Systems: Provide circuit breakers listed in combination with upstream devices to provide interrupting rating not less than the short circuit current rating indicated.

C. Conductor Terminations:
   1. Provide mechanical lugs unless otherwise indicated.
   2. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.

D. 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.
   1. Provide field-adjustable magnetic instantaneous trip setting for circuit breaker frame sizes 225 amperes and larger.
   2. Provide interchangeable trip units where indicated.

E. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units.
   1. Provide the following field-adjustable trip response settings:

a. Long time pickup, adjustable by replacing interchangeable trip unit or by setting dial.
b. Long time delay.
c. Short time pickup and delay.
d. Instantaneous pickup.
e. Ground fault pickup and delay where ground fault protection is indicated.

2. Provide zone selective interlocking capability where indicated, capable of communicating with other electronic trip circuit breakers and external ground fault sensing systems to control short time delay and ground fault delay functions for system coordination purposes.
3. Provide communication capability where indicated: Compatible with system indicated.

F. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.

G. Provide the following circuit breaker types where indicated:
1. Ground Fault Circuit Interrupter (GFCI) Circuit Breakers: Listed as complying with UL 943, class A for protection of personnel.

H. Provide listed switching duty rated circuit breakers with SWD marking for all branch circuits serving fluorescent lighting.

I. Provide listed high intensity discharge lighting rated circuit breakers with HID marking for all branch circuits serving HID lighting.

J. Provide the following features and accessories where indicated or where required to complete installation:
1. Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings of the enclosed circuit breakers are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive enclosed circuit breakers.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

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 circuit breakers plumb.

F. Install flush-mounted enclosed circuit breakers so that trims fit completely flush to wall with no gaps and rough opening completely covered.

G. 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.

H. Provide grounding and bonding in accordance with Section 26 0526.

I. Set field-adjustable ground fault protection pickup and time delay settings as indicated.

3.03 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Inspect and test in accordance with manufacturer's instructions and NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for circuit breakers used for service entrance and for circuit breakers larger than 400 amperes. Tests listed as optional are not required.
   1. Perform insulation-resistance tests on all control wiring with respect to ground.
   2. Test functions of the trip unit by means of secondary injection.

D. Ground Fault Protection Systems: Test in accordance with manufacturer's instructions as required by NFPA 70.

E. Test GFCI circuit breakers to verify proper operation.

F. Test shunt trips to verify proper operation.

G. Correct deficiencies and replace damaged or defective enclosed circuit breakers.

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 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 2816.16
ENCLOSED SWITCHES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Enclosed safety 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 0553 - Identification for Electrical Systems: Identification products and requirements.

D. Section 26 2813 - Fuses.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.

C. NEMA KS 1 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum); 2013.

D. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2013.

E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

G. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

H. UL 98 - Enclosed and Dead-Front Switches; Current Edition, Including All Revisions.

I. UL 869A - Reference Standard for Service Equipment; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the work with other trades. Avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and within working clearances for electrical equipment required by NFPA 70.
   2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
   4. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative 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.

C. Shop Drawings: Indicate outline and support point dimensions, voltage and current ratings, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
   1. Include dimensioned plan and elevation views of enclosed switches and adjacent equipment with all required clearances indicated.

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. Project Record Documents: Record actual locations of enclosed switches.

F. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. See Section 26 2813 for requirements for spare fuses and spare fuse cabinets.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

A. 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.

B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to enclosed switch internal components, enclosure, and finish.

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.

E. Substitutions: See Section 01 6000 - Product Requirements.

F. Source Limitations: Furnish enclosed switches and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

2.02 ENCLOSED SAFETY SWITCHES

A. Description: Quick-make, quick-break enclosed safety switches listed and labeled as complying with UL 98; heavy duty; ratings, configurations, and features as indicated on the drawings.

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 -22 degrees F and 104 degrees F.

D. Horsepower Rating: Suitable for connected load.

E. Voltage Rating: Suitable for circuit voltage.

F. Short Circuit Current Rating:
   1. Provide enclosed safety switches, when protected by the fuses or supply side overcurrent protective devices to be installed, with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.
   2. Minimum Ratings:

a. Heavy Duty Single Throw Switches Protected by Class R, Class J, Class L, or Class T Fuses: 200,000 rms symmetrical amperes.

G. Enclosed Safety Switches Used for Service Entrance: Listed and labeled as suitable for use as service equipment according to UL 869A.

H. Provide with switch blade contact position that is visible when the cover is open.

I. Fuse Clips for Fusible Switches: As required to accept fuses indicated.
   1. Where NEMA Class R fuses are installed, provide rejection feature to prevent installation of fuses other than Class R.

J. Conductor Terminations: Suitable for use with the conductors to be installed.

K. Provide insulated, groundable fully rated solid neutral assembly where a neutral connection is required, with a suitable lug for terminating each neutral conductor.

L. Provide solidly bonded equipment ground bus in each enclosed safety switch, with a suitable lug for terminating each equipment grounding conductor.

M. 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.
   2. Finish for Painted Steel Enclosures: Where exposed, color as selected by architect unless otherwise indicated.

N. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.

O. Heavy Duty Switches:
   1. Comply with NEMA KS 1.
   2. Conductor Terminations:
      a. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
   3. Provide externally operable handle with means for locking in the OFF position, capable of accepting three padlocks.

P. Provide the following features and accessories where indicated or where required to complete installation:
   1. Hubs: As required for environment type; sized to accept conduits to be installed.
   2. Integral fuse pullers.

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 products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

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 fuses complying with Section 26 2813 for fusible switches as indicated or as required by equipment manufacturer's recommendations.

I. Identify enclosed switches in accordance with Section 26 0553.

3.03 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.5.1.1.

D. 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. Where exposed to view, subcontract GC to paint (before mounting) to match adjacent finish.

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.

F. Luminaire accessories.

1.02 RELATED REQUIREMENTS

A. Section 26 0533.16 - Boxes for Electrical Systems.

1.03 REFERENCE STANDARDS

A. 47 CFR 15 - Radio Frequency Devices; current edition.

B. ANSI C82.4 - American National Standard for Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps (Multiple-Supply Type); 2002.

C. ANSI C82.11 - American National Standard for Lamp Ballasts - High Frequency Fluorescent Lamp Ballasts - Supplements; 2011.

D. IEEE C62.41.2 - Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits; 2002 (Cor 1, 2012).

E. IES LM-79 - Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products; 2008.

F. IES LM-80 - Approved Method: Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays, and Modules; Illuminating Engineering Society; 2015.

G. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

H. NECA/IESNA 500 - Standard for Installing Indoor Commercial Lighting Systems; 2006.

I. NECA/IESNA 502 - Standard for Installing Industrial Lighting Systems; 2006.

J. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility; 2012.

K. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

L. NFPA 101 - Life Safety Code; 2015.

M. UL 924 - Emergency Lighting and Power Equipment; Current Edition, Including All Revisions.

N. UL 935 - Fluorescent-Lamp Ballasts; Current Edition, Including All Revisions.

O. UL 1029 - High-Intensity-Discharge Lamp Ballasts; Current Edition, Including All Revisions.

P. UL 1598 - Luminaires; Current Edition, Including All Revisions.

Q. 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 01 3000 - Administrative Requirements, for submittal procedures.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. 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), NECA/IESNA 502 (industrial 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. Provide two year manufacturer warranty for all linear fluorescent ballasts.

D. Provide five year pro-rata warranty for batteries for emergency lighting units.

E. Provide ten year pro-rata warranty for batteries for self-powered exit signs.

F. Provide three year full warranty for fluorescent emergency power supply units.

PART 2 PRODUCTS

2.01 MANUFACTURERS - LUMINAIRES

A. Acuity Brands, Inc: www.acuitybrands.com.

B. Cooper Lighting, a division of Cooper Industries: www.cooperindustries.com.

C. Hubbell Lighting, Inc: www.hubbelllighting.com.

2.02 LUMINAIRE TYPES

A. Furnish products as indicated in luminaire schedule included on the drawings.

B. Substitutions: See Section 01 6000 - Product Requirements, except where individual luminaire types are designated with substitutions not permitted.

2.03 LUMINAIRES

A. Manufacturers:
1. Acuity Brands, Inc: www.acuitybrands.com.
2. Cooper Lighting, a division of Cooper Industries: www.cooperindustries.com.
3. Hubbell Lighting, Inc: www.hubbelllighting.com.

4. Lutron Electronics Company, Inc; www.lutron.com/sle.
5. Progress.
6. Substitutions: See Section 01 6000 - Product Requirements.

B. Provide products that comply with requirements of NFPA 70.

C. Provide products that are listed and labeled as complying with UL 1598, where applicable.

D. Provide products listed, classified, and labeled as suitable for the purpose intended.

E. 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.

F. 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.

G. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

H. Provide (1) extra of each type Common area and resident fixtures.

I. 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.

J. Fluorescent Luminaires:
1. Provide ballast disconnecting means complying with NFPA 70 where required.
2. Fluorescent Luminaires Controlled by Occupancy Sensors: Provide programmed start ballasts.
3. Fluorescent Luminaires Controlled by Dual-Level Switching: Provide with two ballasts.

K. LED Luminaires:
1. Components: UL 8750 recognized or listed as applicable.
2. Tested in accordance with IES LM-79 and IES LM-80.
3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.

L. LED Luminaire Components: UL 8750 recognized or listed as applicable.

M. 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.

N. Luminaires Mounted in Continuous Rows: Provide quantity of units required for length indicated, with all accessories required for joining and aligning.

2.04 EMERGENCY LIGHTING UNITS

A. Manufacturers:
1. Acuity Brands, Inc: www.acuitybrands.com.
2. Cooper Lighting, a division of Cooper Industries: www.cooperindustries.com.
3. Hubbell Lighting, Inc: www.hubbelllighting.com.
4. Substitutions: See Section 01 6000 - Product Requirements.

B. Description: Emergency lighting units complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.

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. 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.

2.05 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.

2.06 BALLASTS AND DRIVERS

A. Ballasts/Drivers - 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.

B. Fluorescent Ballasts:
   1. All Fluorescent Ballasts: Unless otherwise indicated, provide high frequency electronic ballasts complying with ANSI C82.11 and listed and labeled as complying with UL 935.
      a. Input Voltage: Suitable for operation at voltage of connected source, with variation tolerance of plus or minus 10 percent.
      b. Total Harmonic Distortion: Not greater than 20 percent.
      c. Power Factor: Not less than 0.95.
      d. Ballast Factor: Normal ballast factor between 0.85 and 1.15, unless otherwise indicated.
      e. Thermal Protection: Listed and labeled as UL Class P, with automatic reset for integral thermal protectors.
      f. Sound Rating: Class A, suitable for average ambient noise level of 20 to 24 decibels.
      g. Lamp Compatibility: Specifically designed for use with the specified lamp, with no visible flicker.
      h. Lamp Operating Frequency: Greater than 20 kHz, except as specified below.
      i. Lamp Current Crest Factor: Not greater than 1.7.
      j. Provide automatic restart capability to restart replaced lamp(s) without requiring resetting of power.
      k. Provide end of lamp life automatic shut down circuitry for T5 and smaller diameter lamp ballasts.
      l. Surge Tolerance: Capable of withstanding characteristic surges according to IEEE C62.41.2, location category A.
      m. Electromagnetic Interference/Radio Frequency Interference (EMI/RFI) Limits: Comply with FCC requirements of 47 CFR 15, for Class A, non-consumer application.
      n. Ballast Marking: Include wiring diagrams with lamp connections.
   2. Non-Dimming Fluorescent Ballasts:
      a. Lamp Starting Method:
         1) T8 Lamp Ballasts: Instant start unless otherwise indicated.
         2) T5 Lamp Ballasts: Programmed start unless otherwise indicated.
         3) Compact Fluorescent Lamp Ballasts: Programmed start unless otherwise indicated.

b. Lamp Starting Temperature: Capable of starting standard lamp(s) at a minimum of 0 degrees F, and energy saving lamp(s) at a minimum of 60 degrees F unless otherwise indicated.

C. High Intensity Discharge (HID) Ballasts: Complying with ANSI C82.4 and listed and labeled as complying with UL 1029.
   1. Electronic Metal Halide Ballasts:
      a. All Electronic Metal Halide Ballasts:
         1) Input Voltage: Suitable for operation at voltage of connected source, with variation tolerance of plus or minus 10 percent.
         2) Total Harmonic Distortion: Not greater than 15 percent.
         3) Power Factor: Not less than 0.90.
         4) Provide thermal protection with automatic reset.
         5) Sound Rating: Class A, suitable for average ambient noise level of 20 to 24 decibels.
         6) Lamp Operating Frequency: Less than 200 Hz or as required to avoid acoustic resonance in lamp arc tube.
         7) Lamp Current Crest Factor: Not greater than 1.5.
         8) Lamp Starting Temperature: Capable of starting standard lamp(s) at a minimum of -22 degrees F.
         9) Provide end of lamp life automatic shut down circuitry.
         10) Surge Tolerance: Capable of withstanding characteristic surges according to IEEE C62.41.2, location category A.
         11) Electromagnetic Interference/Radio Frequency Interference (EMI/RFI) Limits: Comply with FCC requirements of 47 CFR 15, for Class A, non-consumer application.

2.07 LAMPS

A. Manufacturers:
   1. General Electric Company/GE Lighting: www.gelighting.com.
   2. Osram Sylvania: www.sylvania.com.
   3. Philips Lighting Company: www.lighting.philips.com.
   4. Substitutions: See Section 01 6000 - Product Requirements.

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.
   5. Provide (1) box (6) lamps/bulbs of each type.

C. Lamps - Sustainable Design Requirements:
   1. Maximum Mercury Content:
      a. T8 Linear Fluorescent, 96 Inch: 10 mg.
      b. T8 Linear Fluorescent, 48 Inch: 3.5 mg.
      c. T8 Linear Fluorescent, 36 Inch and 24 Inch: 3.5 mg.
      d. T8 Linear Fluorescent, U-Bent: 6 mg.
      e. T5 Linear Fluorescent: 2.5 mg.
      f. T5 Circular Fluorescent: 9 mg.
      g. Compact Fluorescent, Nonintegral Ballast: 3.5 mg.
      h. Compact Fluorescent, Integral Ballast: 3.5 mg (ENERGY STAR qualified).

i. High Pressure Sodium, Up to 400 W: 10 mg.
j. High Pressure Sodium, Greater Than 400 W: 32 mg.

2. Minimum Rated Lamp Life:
   a. T8 Linear Fluorescent, 96 Inch: 24,000 hours for standard output lamps on instant start ballasts; 18,000 hours for high output lamps on instant start or programmed start ballasts; based on three hours per start.
   b. T8 Linear Fluorescent, 48 Inch: 30,000 hours for standard and high output lamps on instant start ballasts; 36,000 hours on programmed start ballasts; based on three hours per start.
   c. T8 Linear Fluorescent, 36 Inch and 24 Inch: 24,000 hours on instant start or programmed start ballasts; based on three hours per start.
   d. T8 Linear Fluorescent, U-Bent: 18,000 hours on instant start ballasts; 24,000 hours on programmed start ballasts; based on three hours per start.
   e. T5 Linear Fluorescent: 25,000 hours for standard and high output lamps on programmed start ballasts.
   f. T5 Circular Fluorescent: 25,000 hours for standard and high output lamps on programmed start ballasts.
   g. Compact Fluorescent, Nonintegral Ballast: 12,000 hours.
   h. Compact Fluorescent, Integral Ballast: 10,000 hours for bare bulbs; 8,000 hours for covered models such as globes, reflectors, and A-19 lamps.
   i. High Pressure Sodium: Use only non-cycling type lamps.

D. Incandescent Lamps: Wattage and bulb type as indicated, with base type as required for lighting fixture.
   1. Reflector Type Incandescent Lamps: Beam pattern as indicated.
   2. Non-Reflector Type Incandescent Lamps: Inside frosted lamp finish unless otherwise indicated.

E. Compact Fluorescent Lamps: Wattage and bulb type as indicated, with base type as required for luminaire.
   1. Low Mercury Content: Provide lamps that pass the EPA Toxicity Characteristic Leaching Procedure (TCLP) test for characteristic hazardous waste.
   2. Correlated Color Temperature (CCT): 3,500 K unless otherwise indicated.
   3. Color Rendering Index (CRI): Not less than 80.
   4. Average Rated Life: Not less than 10,000 hours for an operating cycle of three hours per start.

F. Linear Fluorescent Lamps: Wattage and bulb type as indicated, with base type as required for luminaire.
   1. Low Mercury Content: Provide lamps that pass the EPA Toxicity Characteristic Leaching Procedure (TCLP) test for characteristic hazardous waste.
   2. T8 Linear Fluorescent Lamps:
      a. Correlated Color Temperature (CCT): 3,500 K unless otherwise indicated.
      b. Color Rendering Index (CRI): Not less than 80.
      c. Average Rated Life: Not less than 20,000 hours for an operating cycle of three hours per start.
   3. T5 Linear Fluorescent Lamps:
      a. Correlated Color Temperature (CCT): 3,500 K unless otherwise indicated.
      b. Color Rendering Index (CRI): Not less than 80.
      c. Average Rated Life: Not less than 20,000 hours for an operating cycle of three hours per start.

G. High Intensity Discharge (HID) Lamps: Wattage as indicated, with bulb type, burning position, and base type as required for luminaire.
   1. Metal Halide Lamps:

a. Non-Reflector Type Metal Halide Lamps: Phosphor coated lamp finish unless otherwise indicated.
b. Provide ANSI type O-rated protected metal halide lamps where required for open luminaires provided with compatible exclusionary sockets.
c. Ceramic Metal Halide Lamps:
1) Correlated Color Temperature (CCT): 3,000 K unless otherwise indicated.
2) Color Rendering Index (CRI): Not less than 80.

H. LED (Light Emitting Diode) Lamps
1. Correlated Color Temperature (CCT): 3,000 K unless otherwise indicated.
2. Color Rendering Index (CRI): Not less than 80.
3. Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

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 0533.16 as required for installation of luminaires provided under this section.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Install products in accordance with manufacturer's instructions.

D. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 500 (commercial lighting) and NECA 502 (industrial lighting).

E. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.

F. Suspended Ceiling Mounted Luminaires:
1. Do not use ceiling tiles to bear weight of luminaires.
2. Do not use ceiling support system to bear weight of luminaires unless ceiling support system is certified as suitable to do so.
3. Secure surface-mounted and recessed luminaires to ceiling support channels or framing members or to building structure.
4. Secure pendant-mounted luminaires to building structure.
5. Secure lay-in luminaires to ceiling support channels using listed safety clips at four corners.
6. See appropriate Division 9 section where suspended grid ceiling is specified for additional requirements.

G. 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.

H. 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. Provide minimum of two supports for each luminaire equal to or exceeding 4 feet nominal length, with no more than 4 feet between supports.
   4. Install canopies tight to mounting surface.
   5. Unless otherwise indicated, support pendants from swivel hangers.

I. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire.

J. Install accessories furnished with each luminaire.

K. Bond products and metal accessories to branch circuit equipment grounding conductor.

L. Fluorescent Luminaires Controlled by Dual-Level Switching: Connect such that each switch controls the same corresponding lamps in each luminaire.

M. Emergency Lighting Units:
   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.
   2. For every 10 fixtures installed, include 1 spare fixture with wiring and installation labor.
   3. Install lock-on device on branch circuit breaker serving units.

N. 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.
   2. For every 10 fixtures installed, include 1 spare fixture with wiring and installation labor.
   3. Install lock-on device on branch circuit breaker serving units.

O. Install lamps in each luminaire.

3.04 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Inspect each product for damage and defects.

C. Operate each luminaire after installation and connection to verify proper 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 or authority having jurisdiction.

C. Exit Signs with Field-Selectable Directional Arrows: Set as indicated or as required to properly designate egress path as directed by Architect or authority having jurisdiction.

3.06 CLEANING

A. Clean surfaces according to NECA 500 (commercial lighting), NECA 502 (industrial lighting), and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

3.07 CLOSEOUT ACTIVITIES

A. See Section 01 7800 - Closeout Submittals, for closeout submittals.

B. See Section 01 7900 - Demonstration and Training, for additional requirements.

C. Demonstration: Demonstrate proper operation of luminaires to Architect, and correct deficiencies or make adjustments as directed.

D. 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 5600
EXTERIOR LIGHTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Exterior luminaires.

B. Ballasts.

C. Lamps.

D. Poles and accessories.

E. Luminaire accessories.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Materials and installation requirements for concrete bases for poles.

B. Section 26 0526 - Grounding and Bonding for Electrical Systems.

C. Section 26 0533.16 - Boxes for Electrical Systems.

D. Section 26 2726 - Wiring Devices: Receptacles for installation in poles.

E. Section 26 2813 - Fuses.

1.03 REFERENCE STANDARDS

A. AASHTO LTS - Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals; American Association of State Highway and Transportation Officials; 6th Edition, with 2015 Interim Revisions.

B. IEEE C2 - National Electrical Safety Code; 2012.

C. IESNA LM-63 - ANSI Approved Standard File Format for Electronic Transfer of Photometric Data and Related Information; 2002 (Reaffirmed 2008).

D. IES LM-79 - Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products; 2008.

E. IES LM-80 - Approved Method: Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays, and Modules; Illuminating Engineering Society; 2015.

F. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

G. NECA/IESNA 501 - Standard for Installing Exterior Lighting Systems; 2006.

H. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

I. UL 1598 - Luminaires; Current Edition, Including All Revisions.

J. 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 placement of poles and associated foundations with utilities, curbs, sidewalks, trees, walls, fences, striping, etc. installed under other sections or by others. Coordinate elevation to obtain specified foundation height.
2. 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 01 3000 - Administrative 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.
   3. Provide structural calculations for each pole proposed for substitution.

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, weight, effective projected area (EPA), and installed accessories; 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.
      b. Include IES LM-79 test report upon request.
   2. Provide electronic files of photometric data certified by a National Voluntary Laboratory Accreditation Program (NVLAP) lab or independent testing agency in IESNA LM-63 standard format upon request.
   3. Lamps: Include rated life and initial and mean lumen output.
   4. Poles: Include information on maximum supported effective projected area (EPA) and weight for the design wind speed.

D. Sustainable Design Documentation: Submit manufacturer's product data on lamp mercury content and rated lamp life, showing compliance with specified requirements.

E. Samples:
   1. Provide one sample(s) of each luminaire proposed for substitution upon request.
   2. Provide one sample of each product finish illustrating color and texture upon request.

F. Certificates for Poles and Accessories: Manufacturer's documentation that products are suitable for the luminaires to be installed and comply with designated structural design criteria.

G. Field Quality Control Reports.
   1. Include test report indicating measured illumination levels.

H. 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.

I. Operation and Maintenance Data: Instructions for each product including information on replacement parts.

J. 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 Lamps: Ten percent of total quantity installed for each type, but not less than two of each type.
   3. Extra Ballasts: Two percent of total quantity installed for each type, but not less than one of each type.
   4. Extra Fuses: Five percent of total quantity installed for each type, but not less than two of each type.
   5. Touch-Up Paint: 2 gallons, to match color of pole finish.

K. Project Record Documents: Record actual connections and locations of pole foundations, luminaires, and any pull or junction boxes.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, handle, and store products according to NECA/IESNA 501 and manufacturer's written instructions.

B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

1.08 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide three year manufacturer warranty for all LED luminaires, including drivers.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acuity Brands, Inc: www.acuitybrands.com.

B. Cooper Lighting, a division of Cooper Industries: www.cooperindustries.com.

C. Hubbell Lighting, Inc: www.hubbelllighting.com.

D. Progress Lighting.

E. Substitutions: See Section 01 6000 - Product Requirements.

2.02 LUMINAIRE TYPES

A. Furnish products as indicated in luminaire schedule included on the drawings.

B. Substitutions: See Section 01 6000 - Product Requirements.

2.03 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, poles, foundations, 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. Provide luminaires listed and labeled as suitable for wet locations unless otherwise indicated.

H. HID Luminaires:
   1. HID High Bay Luminaires: Provide safety chain or power hook unless otherwise indicated.
   2. HID Luminaires with Quartz Restrike Systems: Factory-installed supplementary quartz lamp automatically switches on when power interruption causes primary HID lamp to drop out or during cold startup.

I. LED Luminaires:
   1. Components: UL 8750 recognized or listed as applicable.
   2. Tested in accordance with IES LM-79 and IES LM-80.
   3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.

J. LED Luminaire Components: UL 8750 recognized or listed as applicable.

K. Exposed Hardware: Stainless steel.

2.04 BALLASTS

A. Ballasts/Drivers - 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.

2.05 LAMPS

A. Manufacturers:
   1. General Electric Company/GE Lighting: www.gelighting.com.
   2. Osram Sylvania: www.sylvania.com.
   3. Philips Lighting Company: www.lighting.philips.com.
   4. Substitutions: See Section 01 6000 - Product Requirements.
   5. Manufacturer Limitations: Where possible, provide lamps 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. 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.

C. High Intensity Discharge (HID) Lamps: Wattage as indicated, with bulb type, burning position, and base type as required for luminaire.
   1. Metal Halide Lamps:
      a. Non-Reflector Type Metal Halide Lamps: Clear lamp finish unless otherwise indicated.
      b. Provide ANSI type O-rated protected metal halide lamps where required for open luminaires provided with compatible exclusionary sockets.
      c. Ceramic Metal Halide Lamps:
         1) Correlated Color Temperature (CCT): 3,000 K unless otherwise indicated.
         2) Color Rendering Index (CRI): Not less than 80.

2.06 POLES

A. All Poles:
   1. Provide poles and associated support components suitable for the luminaire(s) and associated supports and accessories to be installed.
   2. Structural Design Criteria:
      a. Comply with AASHTO LTS.
      b. Wind Load: Include effective projected area (EPA) of luminaire(s) and associated supports and accessories to be installed.
         1) Design Wind Speed: 110 miles per hour, with gust factor of 1.3.
      c. Dead Load: Include weight of proposed luminaire(s) and associated supports and accessories.
      d. Include structural calculations demonstrating compliance with submittals.
   3. Material: Steel, unless otherwise indicated.
   4. Shape: Square straight, unless otherwise indicated.
   5. Finish: Match luminaire finish, unless otherwise indicated.
   6. Mounting Height: 20', unless otherwise indicated.
   7. Mounting: Install on concrete foundation, height as indicated on the drawings, unless otherwise indicated.
   8. Unless otherwise indicated, provide with the following features/accessories:
      a. Top cap.

b. Handhole, 2"w x 6"h size.
c. Anchor bolts with leveling nuts or leveling shims.
d. Anchor base cover.
e. Provision for pole-mounted weatherproof GFI receptacle where indicated.
f. Hinged base.
g. Pole-top tenon, _____ inch.

2.07 ACCESSORIES

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

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 0533.16 as required for installation of luminaires provided under this section.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Install products in accordance with manufacturer's instructions.

D. Install luminaires in accordance with NECA/IESNA 501.

E. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.

F. Recessed Luminaires:
1. Install trims tight to mounting surface with no visible light leakage.

G. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire.

H. Pole-Mounted Luminaires:
1. Maintain the following minimum clearances:
a. Comply with IEEE C2.
b. Comply with utility company requirements.
2. Foundation-Mounted Poles:
a. Provide cast-in-place concrete foundations for poles as indicated, in accordance with Section 03 3000.
1) Install anchor bolts plumb per template furnished by pole manufacturer.
2) Position conduits to enter pole shaft.
b. Install foundations plumb.
c. Install poles plumb, using leveling nuts or shims as required to adjust to plumb.
d. Tighten anchor bolt nuts to manufacturer's recommended torque.
e. Install non-shrink grout between pole anchor base and concrete foundation, leaving small channel for condensation drainage.
f. Install anchor base covers or anchor bolt covers as indicated.
3. Embedded Poles: Install poles plumb as indicated.

4. Grounding:
    a. Bond luminaires, metal accessories, metal poles, and foundation reinforcement to branch circuit equipment grounding conductor.
    b. Provide supplementary ground rod electrode as specified in Section 26 0526 at each pole bonded to grounding system as indicated.
5. Install separate service conductors, 12 AWG copper, from each luminaire down to handhole for connection to branch circuit conductors.
6. Install breakaway in-line fuse holders and fuses complying with Section 26 2813 in pole handhole or transformer base for each ungrounded conductor.
7. Install weather resistant GFI duplex receptacle with weatherproof cover as specified in Section 26 2726 in designated poles.

I. Install accessories furnished with each luminaire.

J. Bond products and metal accessories to branch circuit equipment grounding conductor.

K. Install lamps in each luminaire.

3.04 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Inspect each product for damage and defects.

C. Operate each luminaire after installation and connection to verify proper operation.

D. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Architect.

E. Measure illumination levels at night with calibrated meters to verify conformance with performance requirements. Record test results in written report to be included with submittals.

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. Luminaires with Field-Rotatable Optics: Position optics according to manufacturer's instructions to achieve lighting distribution as indicated or as directed by Architect.

3.06 CLEANING

A. Clean surfaces according to NECA/IESNA 501 and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

3.07 CLOSEOUT ACTIVITIES

A. See Section 01 7800 - Closeout Submittals, for closeout submittals.

B. See Section 01 7900 - Demonstration and Training, for additional requirements.

C. Demonstration: Demonstrate proper operation of luminaires to Architect, and correct deficiencies or make adjustments as directed.

D. 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 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. Communications equipment room fittings.

E. Communications outlets.

F. Communications identification.

1.02 RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.

B. Section 26 0533.13 - Conduit for Electrical Systems.

C. Section 26 0533.16 - Boxes for Electrical Systems.

D. Section 26 2726 - Wiring Devices.

1.03 REFERENCE STANDARDS

A. EIA/ECA-310 - Cabinets, Racks, Panels, and Associated Equipment; Electronic Industries Alliance/Electrical Components Association; Revision E, 2005.

B. NECA/BICSI 568 - Standard for Installing Building Telecommunications Cabling; National Electrical Contractors Association; 2006.

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. TIA-568 (SET) - Commercial Building Telecommunications Cabling Standard Set; 2015.

E. TIA-568-C.2 - Balanced Twisted-Pair Telecommunications Cabling and Components Standards; Rev C, 2009 (with Addenda; 2014).

F. TIA-569-C - Commercial Building Standard for Telecommunications Pathways and Spaces; Rev C, 2012 (with Addenda; 2013).

G. TIA-606-B - Administration Standard for the Telecommunications Infrastructure; Rev B, 2012.

H. TIA-607-B - Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises; Rev B, 2012 (with Addenda; 2013).

I. UL 444 - Communications Cables; Current Edition, Including All Revisions.

J. UL 514C - Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers; Current Edition, Including All Revisions.

K. UL 1863 - Communications-Circuit Accessories; Current Edition, Including All Revisions.

1.04 SUBMITTALS

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

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.

C. 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).

D. Evidence of qualifications for installer.

E. Field Test Reports.

F. Project Record Documents: Prepared and approved by BICSI Registered Communications Distribution Designer (RCDD).
   1. Record actual locations of outlet boxes and distribution frames.
   2. Show as-installed color coding, pair assignment, polarization, and cross-connect layout.
   3. Identify distribution frames and equipment rooms by room number on contract drawings.

G. 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.

1.05 QUALITY ASSURANCE

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Keep stored products clean and dry.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a 2 year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 SYSTEM DESIGN

A. Provide a complete permanent system of cabling and pathways for voice and data communications, including cables, conduits and wireways, pull wires, support structures, enclosures and cabinets, and outlets.
   1. 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.
   2. 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.
   3. In this project, the term plenum is defined as return air spaces above ceilings, inside ducts, under raised floors, and other air-handling spaces.

B. System Description:
   1. Building Entrance Cable: Copper, 100-pair.
   2. Offices and Work Areas: Provide one voice outlet and one data outlet in each work area minimum. Refer to plans for locations and additional requirements.

C. Main Distribution Frame (MDF): Centrally located support structure for terminating horizontal cables that extend to telecommunications outlets, 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.

D. Intermediate Distribution Frames (IDF): Support structures for terminating horizontal cables that extend to telecommunications outlets.
   1. Locate intermediate distribution frames as indicated on the drawings.

E. Backbone Cabling: Cabling, pathways, and terminal hardware connecting intermediate distribution frames (IDF's) with main distribution frame (MDF), wired in star topology with main distribution frame at center hub of star.

F. Cabling to Outlets: Specified horizontal cabling, wired in star topology to distribution frame located at center hub of star; also referred to as "links".

2.02 PATHWAYS

A. Conduit: As specified in Section 26 0533.13; provide pull cords in all conduit.

2.03 COPPER CABLE AND TERMINATIONS

A. Copper Horizontal Cable:
   1. Description: 100 ohm, balanced twisted pair cable complying with TIA-568-C.2 and listed and labeled as complying with UL 444.
   2. Cable Type - Voice and Data: TIA-568-C.2 Category 5e UTP (unshielded twisted pair); 24 AWG.
   3. Cable Capacity: 4-pair.
   4. Cable Applications:
      a. Riser Applications: Use listed NFPA 70 Type CMR riser cable or Type CMP plenum cable.
      b. General Purpose Applications: Use listed NFPA 70 Type CM/CMG general purpose cable, Type CMR riser cable, or Type CMP plenum cable.
   5. Cable Jacket Color -Data Cable: Blue.
   6. Cable Jacket Color - Voice Cable: White.

B. Copper Cable Terminations: Insulation displacement connection (IDC) type using appropriate tool; use screw connections only where specifically indicated.

C. 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. Voice and Data Jacks: 8-position modular jack, color-coded for both T568A and T568B wiring configurations.

2.04 COMMUNICATIONS EQUIPMENT ROOM FITTINGS

A. Copper Cross-Connection Equipment:
   1. Connector Blocks for Category 5e and Up Cabling: Type 110 insulation displacement connectors; capacity sufficient for cables to be terminated plus 25 percent spare.
   2. Patch Panels for Copper Cabling: Sized to fit EIA/ECA-310 standard 19 inch wide equipment racks; 0.09 inch thick aluminum; cabling terminated on Type 110 insulation displacement connectors; printed circuit board interface.
      a. Jacks: Non-keyed RJ-45, suitable for and complying with same standard as cable to be terminated; maximum 48 ports per standard width panel.
      b. Capacity: Provide ports sufficient for cables to be terminated plus 25 percent spare.
      c. Labels: Factory installed laminated plastic nameplates above each port, numbered consecutively; comply with TIA-606-B.
      d. Provide incoming cable strain relief and routing guides on back of panel.

B. Backboards: Interior grade plywood without voids, 3/4 inch thick; UL-labeled fire-retardant.
   1. Do not paint over UL label.

C. Equipment Racks and Cabinets: EIA/ECA-310 standard 19 inch wide component racks.
   1. Wall Mounted Racks: Steel construction, hinged to allow access to back of installed components.
   2. Wall Mounted Cabinets: Front doors with locks, louvered side panels, top and bottom cable access, and ground lug.
   3. Cabinets: Steel construction with corrosion resistant finish.
   4. Locks: Keyed alike.

2.05 COMMUNICATIONS OUTLETS

A. Outlet Boxes: Comply with Section 26 0533.16.

1. Provide depth as required to accommodate cable manufacturer's recommended minimum conductor bend radius.

B. Wall Plates:
   1. Comply with system design standards and UL 514C.
   2. Accepts modular jacks/inserts.
   3. Capacity:
      a. Voice Only Outlets: 2 ports.
      b. Data or Combination Voice/Data Outlets: 4 ports.
   4. Wall Plate Material/Finish - Flush-Mounted Outlets: Match wiring device and wall plate finishes specified in Section 26 2726. All line and low voltage device and wall plate color and finish shall match within each area.

2.06 IDENTIFICATION PRODUCTS

A. Comply with TIA-606-B.

2.07 SOURCE QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Factory test cables according to TIA-568.

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. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.

3.02 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, in Addition to Requirements of Section 26 0533.13:

C. Outlet Boxes:
   1. Coordinate locations of outlet boxes provided under Section 26 0533.16 as required for installation of telecommunications outlets provided under this section.
      a. Orient outlet boxes for vertical installation of wiring devices unless otherwise indicated.
      b. Provide minimum of 24 inches horizontal separation between flush mounted outlet boxes installed on opposite sides of fire rated walls.
      c. Unless otherwise indicated, provide separate outlet boxes for line voltage and low voltage devices.

3.03 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 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. When installing in conduit, use only lubricants approved by cable manufacturer and do not chafe or damage outer jacket.

B. Service Loops (Slack or Excess Length): Provide the following minimum extra length of cable, looped neatly:
1. At Distribution Frames: 120 inches.
2. At Outlets - Copper: 12 inches.
3. At Outlets - Optical Fiber: 39 inches.

C. Copper Cabling:
1. Category 5e and Above: Maintain cable geometry; do not untwist more than 1/2 inch from point of termination.
2. For 4-pair cables in conduit, do not exceed 25 pounds pull tension.
3. Use T568B wiring configuration.

D. Wall-Mounted Racks and Enclosures:
1. Install to plywood backboards only, unless otherwise indicated.
2. Mount so height of topmost panel does not exceed 78 inches above floor.

E. Identification:
1. Use wire and cable markers to identify cables at each end.
2. Use manufacturer-furnished label inserts, identification labels, or engraved wallplate to identify each jack at communications outlets with unique identifier.
3. Use identification nameplate to identify cross-connection equipment, equipment racks, and cabinets.

3.04 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.

D. Testing - Copper Cabling and Associated Equipment:
1. Test operation of shorting bars in connection blocks.
2. Category 5e and Above Backbone: Perform near end cross talk (NEXT) and attenuation tests.
3. Category 5e and Above Links: Perform tests for wire map, length, attenuation, NEXT, and propagation delay.

E. Final Testing: After all work is complete, including installation of telecommunications outlets, and telephone dial tone service is active, test each voice jack for dial tone.

END OF SECTION

SECTION 27 4133

MASTER ANTENNA TELEVISION SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Television antenna.

B. Television service entrance.

C. Cable and accessories.

1.02 RELATED REQUIREMENTS

A. Section 26 0526 - Grounding and Bonding for Electrical Systems.

B. Section 26 0533.13 - Conduit for Electrical Systems.

C. Section 26 0533.16 - Boxes for Electrical Systems.

1.03 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 SYSTEM DESCRIPTION

A. Broadband type master antenna system.

B. Service entrance from local cable utility.

C. Premises wiring for broadband distribution of television signal, including individual outlets.

D. Signal at each outlet: 3 dBmV across 75 ohms, minimum, plus 5 dB, minus 0 dB.

1.05 SUBMITTALS

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

B. Product Data: Provide showing electrical characteristics and connection requirements for each component.

C. Operation Data: Instructions for setting and tuning channels.

D. Maintenance Data: Basic trouble-shooting procedures.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70 and cable television utility company.

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. Installer Qualifications: Authorized installer of specified manufacturer with service facilities within 100 miles of the project.

D. Products: Listed, classified and labeled as suitable for the purpose intended.

E. 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 RECEIVING COMPONENTS

A. Antenna: Provide broadband digital antenna for all local television channels.

B. Antenna: Provide one single channel antenna for each channel required.
   1. Impedance: 75 ohm, gamma match.
   2. Antenna Type: 5 element Yagi type.
   3. Gain: 13 dB over tuned dipole.

4. Front-to-Back Ratio: 20 dB, minimum.
5. Beam Width: 52 degrees vertical x 63 degrees horizontal, minus 3 dB.
6. Return Loss: 17 dB, minimum over entire channel.

2.02 AMPLIFIERS AND CONVERTERS

A. Preamplifier: Provide broadband preamplifier for channels required.
   1. Impedance: 75 ohm.
   2. Bandpass: 6 MHz, plus or minus 0.25 dB.
   3. Gain: 24 dB, minimum.
   4. Signal-to-Noise Ratio: 3 db maximum.
   5. Power Supply: Remote, impedance matched for 22 dB return loss, 0.2 dB through loss. Provide 120 volt, single phase input.

2.03 ACCESSORIES

A. Splitter:
   1. Inline, all channel, back-matched splitter.
   2. Through Loss: 3.5 dB for two-way; 6.7 dB for four-way.
   3. Isolation: 16 dB, minimum.

B. Antenna Cable:
   1. Description: RG 59/F.

C. Main Distribution Cable:
   1. Description: RG 11/F.

D. Branch Distribution Cable:
   1. Description: RG 6/F.

E. Cabinet: Provide free-standing equipment rack with hinged door.
   1. Size: Selected by equipment manufacturer.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Connect cable television service in accordance with cable utility instructions.

C. Provide proper grounding of television system components and wiring.

3.02 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Measure signal level at each outlet.

3.03 ADJUSTING

A. Adjust work under supervision of manufacturer's field service personnel.

B. Adjust each antenna using field strength meter to orient it for maximum signal reception.

C. Adjust amplifier gain and make other system adjustments to achieve specified output levels at each outlet.

D. Adjust traps to eliminate spurious interference.

3.04 CLOSEOUT ACTIVITIES

A. See Section 01 7900 - Demonstration and Training, for additional requirements.

B. 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.
   3. Include demonstration of television operation specified signal level at two outlets selected by Owner.

3.05 MAINTENANCE

A. See Section 01 7000 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.

B. Provide service and maintenance of television system for one year from Date of Substantial Completion.

END OF SECTION

SECTION 27 5124
TELEPHONE ACCESS SYSTEM

PART 1 GENERAL

1.01 GENERAL

A. The contractor shall provide and install all equipment, accessories and materials necessary for a complete operating system in accordance with the following specifications.

B. The equipment furnished under this specification shall be the standard product of one manufacture.

C. The contractor shall guarantee availability of local service and available stock of the manufactures standard parts.

D. The contractor shall be responsible for providing a complete functional system including all necessary components, whether included in this specification or not.

1.02 SHOP DRAWINGS

A. The electrical contractor shall submit shop drawings to the electrical engineer for approval. The contractor must have approved shop drawings in his possession before installation.

1.03 WARRANTY

A. Each piece of equipment shall be warranted by the equipment manufacturer to be free of defects in material and workmanship for a period of 12 months from date of shipment from the factory.

PART 2 PRODUCTS

2.01 CONFIGURATION

A. The telephone entry system shall consist of a surface mounted cabinet with integral weather hood, speaker/microphone, keypad with integral LCD display, directory (100 name), postal lock release and transformers. The system shall be located in a lobby or a well-protected alcove away from direct exposure to weather.

2.02 SYSTEM OPERATING REQUIREMENTS

A. The desired name is found on the directory and associated numerical code.

B. The code is entered on the keypad and the unit shall ring the tenant using the standard telephone service.

C. Upon answering the apartment telephone, the tenant presses a single digit to allow entry or hangs up to cancel communication and deny entry.

D. Tenant access shall be allowed via a pre-programmed personal identification numbers which when entered will engage the electric door release.

2.03 MINIMUM FEATURES

A. All programming done through system keypad

B. Activation of a secondary relay (i.e. activation of parking gate)

C. Night service feature will transfer all calls to one pre-programmed telephone number (guard or manager)

D. Fire Alarm input to pulse door strike in the event of an emergency

E. Door timer cut-off (prevents tailgating)

F. Postal lock release (standard)

G. Battery back-up option

H. Telephone handset option

I. High contrast LCD display

J. Multiple unit interface

K. Wiegand data output for interface with a card reader door release

L. Call waiting tone (a double tone, flash hook switch to connect then again to return to previous call)

2.04 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements.
   1. Mircom
   2. Chamberlain Sentex
   3. Or approved Equal
   4. Door King

2.05 ENTRY PANEL

A. The system control unit shall be a modular type extruded aluminum panel, which accommodates the display, keypad and optional postal release. Included will be the control unit which mounts separately in the housing.
   1. Provide TTY interface.

2.06 TRANSFORMER

A. One transformer shall be supplied for system operation and one shall be supplied for door release functions.

2.07 NO-PHONE LINE EQUIPMENT

A. The No-Phone line control equipment shall be modular.

B. Relay cabinet each accommodating 8 relay cards

C. Relay cards each accommodating 16 relay cards

D. Relay card connector for interconnect to the telephone blocks

2.08 APARTMENT HANDSET

A. Bright visual ring indicator

B. Heraring Aid compatible

C. Amplifies incoming sound to 26 decibels

D. Loud ringer Volume

E. Large, backlit keypad

F. Basis of Design Clarity Products Model C200

PART 3 EXECUTION

3.01 INSTALLATION

A. The assembly is surface mounted with an integral hinged access door.

3.02 WIRING

A. Wiring Method: Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters, and except in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used. Conceal raceway and cables except in unfinished spaces.
   1. Install plenum cable in environmental air spaces, including plenum ceilings.
   2. Comply with requirements for raceways and boxes.

B. Wiring Method: Conceal conductors and cables in ceilings, walls, and floors where possible.

C. Wiring within Enclosures: Bundle, lace, and train cables to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

END OF SECTION

SECTION 28 0513

CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. UTP cabling.
   2. Coaxial cabling.
   3. RS-232 cabling.
   4. RS-485 cabling.
   5. Low-voltage control cabling.
   6. Control-circuit conductors.
   7. Fire alarm wire and cable.
   8. Identification products.

1.02 DEFINITIONS

A. BICSI: Building Industry Consulting Service International.

B. EMI: Electromagnetic interference.

C. IDC: Insulation displacement connector.

D. Open Cabling: Passing telecommunications cabling through open space (e.g., between the studs of a wall cavity).

E. RCDD: Registered Communications Distribution Designer.

1.03 SUBMITTALS

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

B. Shop Drawings: Cable tray layout, showing cable tray route to scale, with relationship between the tray and adjacent structural, electrical, and mechanical elements.

C. Qualification Data: For qualified layout technician, installation supervisor, and field inspector.

D. Source quality-control reports.

E. Field quality-control reports.

F. Operation and maintenance data.

1.04 QUALITY ASSURANCE

A. Testing Agency Qualifications: An NRTL.
   1. Testing Agency's Field Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.

B. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Flame-Spread Index: 25 or less.
   2. Smoke-Developed Index: 450 or less.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Test cables upon receipt at Project site.
   1. Test each pair of UTP cable for open and short circuits.

1.06 PROJECT CONDITIONS

A. Do not install conductors and cables that are wet, moisture damaged, or mold damaged.

1. Indications that wire and cables are wet or moisture damaged include, but are not limited to, discoloration and sagging of factory packing materials.

B. Environmental Limitations: Do not deliver or install UTP, optical fiber, and coaxial cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

PART 2 PRODUCTS

2.01 PATHWAYS

A. Support of Open Cabling: NRTL labeled for support of Category 6 cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.

B. Conduit and Boxes: Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems."
   1. Outlet boxes shall be no smaller than 2 inches wide, 3 inches high, and 2-1/2 inches deep.

2.02 BACKBOARDS

A. Backboards: Plywood, fire-retardant treated, 3/4 by 48 by 96 inches. Comply with requirements for plywood backing panels in Division 06 Section "Rough Carpentry".

2.03 UTP CABLE

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. ADC.
   2. AMP Netconnect; a brand of Tyco Electronics Corporation.
   3. Belden CDT Networking Division/NORDX.
   4. Belden Inc.
   5. Berk-Tek; a Nexans company.
   6. CommScope, Inc.
   7. Draka Cableteq USA.
   8. Genesis Cable Products; Honeywell International, Inc.
   9. Mohawk; a division of Belden.
   10. Superior Essex Inc.
   11. SYSTIMAX Solutions; a CommScope, Inc. brand.
   12. 3M; Communication Markets Division.

B. Description: 100-ohm, 4-pair UTP, covered with a blue thermoplastic jacket.
   1. Comply with ICEA S-90-661 for mechanical properties.
   2. Comply with TIA/EIA-568-B.1 for performance specifications.
   3. Comply with TIA/EIA-568-B.2, [Category 5e] [Category 6].

2.04 UTP CABLE HARDWARE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. ADC.
   2. American Technology Systems Industries, Inc.
   3. AMP Netconnect; a brand of Tyco Electronics Corporation.
   4. Belden CDT Networking Division/NORDX.
   5. Dynacom Corporation.
   6. Hubbell Incorporated; Hubbell Premise Wiring.
   7. Leviton Voice & Data Division.
   8. Molex Premise Networks; a division of Molex, Inc.
   9. PANDUIT CORP.
   10. Siemon.

B. UTP Cable Connecting Hardware: IDC type, using modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of the same category or higher.

C. Connecting Blocks: 110-style for Category 6. Provide blocks for the number of cables terminated on the block, plus 25 percent spare. Integral with connector bodies, including plugs and jacks where indicated.

2.05 COAXIAL CABLE

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. Alpha Wire Company.
   2. Belden CDT Networking Division/NORDX.
   3. Coleman Cable, Inc.
   4. CommScope, Inc.
   5. Draka Cableteq USA.

B. General Coaxial Cable Requirements: Broadband type, recommended by cable manufacturer specifically for broadband data transmission applications. Coaxial cable and accessories shall have 75-ohm nominal impedance with a return loss of 20 dB maximum from 7 to 806 MHz.

C. RG-11/U: NFPA 70, Type CATV.
   1. No. 14 AWG, solid, copper-covered steel conductor.
   2. Gas-injected, foam-PE insulation.
   3. Double shielded with 100 percent aluminum polyester tape and 60 percent aluminum braid.
   4. Jacketed with sunlight-resistant, black PVC or PE.
   5. Suitable for outdoor installations in ambient temperatures ranging from minus 40 to plus 85 deg C.

D. RG-6/U: NFPA 70, Type CATV or CM.
   1. No. 16 AWG, solid, copper-covered steel conductor; gas-injected, foam-PE insulation.
   2. Double shielded with 100 percent aluminum-foil shield and 60 percent aluminum braid.
   3. Jacketed with black PVC or PE.
   4. Suitable for indoor installations.

E. NFPA and UL Compliance: CATV Cable, Type CATV shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 1655, and with NFPA 70 "Radio and Television Equipment" and "Community Antenna Television and Radio Distribution" Articles.

2.06 COAXIAL CABLE HARDWARE

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. Emerson Network Power Connectivity Solutions; AIM Electronics brand.
   2. Leviton Voice & Data Division.
   3. Siemon.

B. Coaxial-Cable Connectors: Type BNC, 75 ohms.

2.07 RS-232 CABLE

A. Standard Cable: NFPA 70, Type CM.
   1. Paired, 2 pairs, No. 22 AWG, stranded (7x30) tinned copper conductors.
   2. Polypropylene insulation.
   3. Individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage.
   4. PVC jacket.
   5. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) tinned copper drain wire.

6. Flame Resistance: Comply with UL 1581.

B. Plenum-Rated Cable: NFPA 70, Type CMP.
1. Paired, 2 pairs, No. 22 AWG, stranded (7x30) tinned copper conductors.
2. Plastic insulation.
3. Individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage.
4. Plastic jacket.
5. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) tinned copper drain wire.
6. Flame Resistance: Comply with NFPA 262.

2.08 RS-485 CABLE

A. Standard Cable: NFPA 70, Type CM.
1. Paired, 2 pairs, twisted, No. 22 AWG, stranded (7x30) tinned copper conductors.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with UL 1581.

B. Plenum-Rated Cable: NFPA 70, Type CMP.
1. Paired, 2 pairs, No. 22 AWG, stranded (7x30) tinned copper conductors.
2. Fluorinated ethylene propylene insulation.
3. Unshielded.
4. Fluorinated ethylene propylene jacket.
5. Flame Resistance: NFPA 262, Flame Test.

2.09 LOW-VOLTAGE CONTROL CABLE

A. Paired Cable: NFPA 70, Type CMG.
1. 1 pair, twisted, tinned copper conductors.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with UL 1581.

B. Plenum-Rated, Paired Cable: NFPA 70, Type CMP.
1. 1 pair, twisted, tinned copper conductors.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with NFPA 262.

2.10 CONTROL-CIRCUIT CONDUCTORS

A. Class 1 Control Circuits: Stranded copper.

B. Class 2 Control Circuits: Stranded copper.

C. Class 3 Remote-Control and Signal Circuits: Stranded copper, Type TW or TF, complying with UL 83.

2.11 FIRE ALARM WIRE AND CABLE

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. Comtran Corporation.
2. Draka Cableteq USA.
3. Genesis Cable Products; Honeywell International, Inc.
4. Rockbestos-Suprenant Cable Corp.

5. West Penn Wire; a brand of Belden Inc.

B. General Wire and Cable Requirements: NRTL listed and labeled as complying with NFPA 70, Article 760.

C. Signaling Line Circuits: Twisted, shielded pairNo. 18 AWG AWG.
   1. Circuit Integrity Cable: Twisted shielded pair, NFPA 70, Article 760, Classification CI, for power-limited fire alarm signal service Type FPL. NRTL listed and labeled as complying with UL 1424 and UL 2196 for a 2-hour rating.

D. Non-Power-Limited Circuits: Solid-copper conductors with 600-V rated, 75 deg C, color-coded insulation.
   1. Low-Voltage Circuits: No. 16 AWG, minimum.
   2. Line-Voltage Circuits: No. 12 AWG, minimum.
   3. Multiconductor Armored Cable: NFPA 70, Type MC, copper conductors, Type TFN/THHN conductor insulation, copper drain wire, copper armor with outer jacket with red identifier stripe, NTRL listed for fire alarm and cable tray installation, plenum rated, and complying with requirements in UL 2196 for a 2-hour rating.

2.12 IDENTIFICATION PRODUCTS

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. Brady Corporation.
   2. HellermannTyton.
   3. Kroy LLC.
   4. PANDUIT CORP.

B. Comply with UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

C. Comply with requirements in Division 26 Section "Identification for Electrical Systems."

2.13 SOURCE QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to evaluate cables.

B. Factory test UTP and optical fiber cables on reels according to TIA/EIA-568-B.1.

C. Factory test UTP cables according to TIA/EIA-568-B.2.

D. Factory test multimode optical fiber cables according to TIA-526-14-A and TIA/EIA-568-B.3.

E. Factory sweep test coaxial cables at frequencies from 5 MHz to 1 GHz. Sweep test shall test the frequency response, or attenuation over frequency, of a cable by generating a voltage whose frequency is varied through the specified frequency range and graphing the results.

F. Cable will be considered defective if it does not pass tests and inspections.

G. Prepare test and inspection reports.

PART 3 EXECUTION

3.01 INSTALLATION OF PATHWAYS

A. Comply with TIA-569-B for pull-box sizing and length of conduit and number of bends between pull points.

B. Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems." for installation of conduits and wireways.

C. Install manufactured conduit sweeps and long-radius elbows whenever possible.

D. Pathway Installation in Equipment Rooms:

1. Position conduit ends adjacent to a corner on backboard where a single piece of plywood is installed or in the corner of room where multiple sheets of plywood are installed around perimeter walls of room.
2. Install cable trays to route cables if conduits cannot be located in these positions.
3. Secure conduits to backboard when entering room from overhead.
4. Extend conduits 3 inches above finished floor.
5. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.

E. Backboards: Install backboards with 96-inch dimension vertical. Butt adjacent sheets tightly, and form smooth gap-free corners and joints.

3.02 INSTALLATION OF HANGERS AND SUPPORTS

A. Comply with requirements in Division 26 Section "Hangers and Supports for Electrical Systems." for installation of supports for pathways, conductors and cables.

3.03 WIRING METHOD

A. Install wiring in metal raceways and wireways. Conceal raceway except in unfinished spaces and as indicated. Minimum conduit size shall be 3/4 inch. Control and data transmission wiring shall not share conduit with other building wiring systems.

B. Install wiring in raceways except in accessible indoor ceiling spaces and in interior hollow gypsum board partitions where cable may be used. Conceal raceways and wiring except in unfinished spaces and as indicated. Minimum conduit size shall be 3/4 inch. Control and data transmission wiring shall not share conduit with other building wiring systems.

C. Install cable, concealed in accessible ceilings, walls, and floors when possible.

D. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points. Use lacing bars and distribution spools. Separate power-limited and non-power-limited conductors as recommended in writing by manufacturer. Install conductors parallel with or at right angles to sides and back of enclosure. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with intrusion system to terminal blocks. Mark each terminal according to system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

3.04 INSTALLATION OF CONDUCTORS AND CABLES

A. Comply with NECA 1.

B. Conductors: Size according to system manufacturer's written instructions unless otherwise indicated.

C. General Requirements for Cabling:
1. Comply with TIA/EIA-568-B.1.
2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
3. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, and cross-connect and patch panels.
4. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
5. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.
6. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.

7. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
8. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.

D. UTP Cable Installation: Install using techniques, practices, and methods that are consistent with Category 6 rating of components and that ensure Category 6 performance of completed and linked signal paths, end to end.
1. Comply with TIA/EIA-568-B.2.
2. Install 110-style IDC termination hardware unless otherwise indicated.
3. Do not untwist UTP cables more than 1/2 inch from the point of termination to maintain cable geometry.

E. Outdoor Coaxial Cable Installation:
1. Install outdoor connections in enclosures complying with NEMA 250, Type 4X. Install corrosion-resistant connectors with properly designed O-rings to keep out moisture.
2. Attach antenna lead-in cable to support structure at intervals not exceeding 36 inches.

F. Open-Cable Installation:
1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
2. Suspend copper cable not in a wireway or pathway a minimum of 8 inches above ceilings by cable supports not more than 60 inches apart.
3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

G. Separation from EMI Sources:
1. Comply with BICSI TDMM and TIA-569-B recommendations for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches.
b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches.
c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches.
3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches.
b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches.
c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches.
4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches.
c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches.
5. Separation between Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches.
6. Separation between Cables and Fluorescent Fixtures: A minimum of 5 inches.

3.05 FIRE ALARM WIRING INSTALLATION

A. Comply with NECA 1 and NFPA 72.

B. Wiring Method: Install wiring in metal raceway according to Division 26 Section "Raceway and Boxes for Electrical Systems."
1. Install plenum cable in environmental air spaces, including plenum ceilings.

2. Fire alarm circuits and equipment control wiring associated with the fire alarm system shall be installed in a dedicated raceway system. This system shall not be used for any other wire or cable.

C. Wiring Method:
   1. Cables and raceways used for fire alarm circuits, and equipment control wiring associated with the fire alarm system, may not contain any other wire or cable.

D. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with the fire alarm system to terminal blocks. Mark each terminal according to the system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

E. Cable Taps: Use numbered terminal strips in junction, pull, and outlet boxes, cabinets, or equipment enclosures where circuit connections are made.

F. Color-Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color-code for alarm circuit wiring and another for supervisory circuits. Color-code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visible alarm-indicating devices. Paint fire alarm system junction boxes and covers red.

G. Risers: Install at least two vertical cable risers to serve the fire alarm system. Separate risers in close proximity to each other with a minimum one-hour-rated wall, so the loss of one riser does not prevent the receipt or transmission of signals from other floors or zones.

H. Wiring to Remote Alarm Transmitting Device: 1-inch conduit between the fire alarm control panel and the transmitter. Install number of conductors and electrical supervision for connecting wiring as needed to suit monitoring function.

3.06 POWER AND CONTROL-CIRCUIT CONDUCTORS

A. 120-V Power Wiring: Install according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables" unless otherwise indicated.

B. Minimum Conductor Sizes:
   1. Class 1 remote-control and signal circuits, No. 14 AWG.
   2. Class 2 low-energy, remote-control and signal circuits, No. 16 AWG.
   3. Class 3 low-energy, remote-control, alarm and signal circuits, No. 12 AWG.

3.07 CONNECTIONS

A. Comply with requirements in Division 28 Section "Perimeter Security Systems" for connecting, terminating, and identifying wires and cables.

B. Comply with requirements in Division 28 Section "Intrusion Detection" for connecting, terminating, and identifying wires and cables.

C. Comply with requirements in Division 28 Section "Access Control" for connecting, terminating, and identifying wires and cables.

D. Comply with requirements in Division 28 Section "Video Surveillance" for connecting, terminating, and identifying wires and cables.

E. Comply with requirements in Division 28 Section "PLC Electronic Detention Monitoring and Control Systems" for connecting, terminating, and identifying wires and cables.

F. Comply with requirements in Division 28 Section "Digital Addressable Fire-Alarm System" for connecting, terminating, and identifying wires and cables.

G. Comply with requirements in Division 28 Section "Refrigerant Detection and Alarm" for connecting, terminating, and identifying wires and cables.

3.08 FIRESTOPPING

A. Comply with requirements in Division 07 Section "Penetration Firestopping."

B. Comply with TIA-569-B, "Firestopping" Annex A.

C. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.09 GROUNDING

A. For communications wiring, comply with ANSI-J-STD-607-A and with BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.

B. For low-voltage wiring and cabling, comply with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems."

3.10 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.11 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:
   1. Visually inspect UTP and optical fiber cable jacket materials for NRTL certification markings. Inspect cabling terminations to confirm color-coding for pin assignments, and inspect cabling connections to confirm compliance with TIA/EIA-568-B.1.
   2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
   3. Test UTP cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross connection.
      a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
   4. Coaxial Cable Tests: Comply with requirements in Division 27 Section "Master Antenna Television System."

D. Document data for each measurement. Print data for submittals in a summary report that is formatted using Table 10.1 in BICSI TDMM as a guide, or transfer the data from the instrument to the computer, save as text files, print, and submit.

E. End-to-end cabling will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

END OF SECTION

SECTION 28 1000
ACCESS CONTROL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Access control system requirements.

B. Access control units and software.

C. Access control point peripherals, including readers.

D. Accessories.

E. Access control devices.

F. Access control panel.

G. Access control software.

1.02 RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.

B. Section 08 7100 - Door Hardware: Electrically operated door hardware, for interface with access control system.
   1. Includes door hardware with integral request to exit devices.

C. Section 26 0526 - Grounding and Bonding for Electrical Systems.

D. Section 26 0533.13 - Conduit for Electrical Systems.

E. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. UL 294 - Access Control System Units; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the work with other installers to provide suitable door hardware as required for both access control functionality and code compliance.
   2. Coordinate the placement of readers with millwork, furniture, equipment, etc. installed under other sections or by others.
   3. Coordinate the work with other installers to provide power for equipment at required locations.
   4. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

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

B. Shop Drawings: Include plan views indicating locations of system components and proposed size, type, and routing of conduits and/or cables. Include elevations and details of proposed equipment arrangements. Include system interconnection schematic diagrams. Include requirements for interface with other systems.

C. Product Data: Provide manufacturer's standard catalog pages and data sheets for each system component. Include ratings, configurations, standard wiring diagrams, dimensions, finishes, service condition requirements, and installed features.

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 operation of product.

E. Maintenance contracts.

F. Operation and Maintenance Data: Include detailed information on system operation, equipment programming and setup, replacement parts, and recommended maintenance procedures and intervals.
   1. Include contact information for entity that will be providing contract maintenance and trouble call-back service.

G. Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty completed in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

A. Comply with the following:
   1. NFPA 70.
   2. The requirements of the local authorities having jurisdiction.
   3. Applicable TIA/EIA standards.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide minimum one year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Access Control System:
   1. Bosch Security Systems: www.boschsecurity.us.
   2. DoorKing, Inc: www.doorking.com.
   3. Honeywell International, Inc: www.honeywellaccess.com.
   4. S2.

B. Products other than basis of design are subject to compliance with specified requirements and prior approval of Engineer. By using products other than basis of design, Contractor accepts responsibility for costs associated with any necessary modifications to related work, including any design fees.

C. Source Limitations: Where possible, furnish system components and accessories produced by a single manufacturer and obtained from a single supplier.

2.02 ACCESS CONTROL SYSTEM REQUIREMENTS

A. Provide new access control system consisting of all required equipment, conduit, boxes, wiring, connectors, hardware, supports, accessories, software, system programming, etc. as necessary for a complete operating system that provides the functional intent indicated.

B. System Battery Backup: Provide batteries/uninterruptible power supplies (UPS) as required for 20 minutes full operation.

C. Access Control Points:
   1. Refer to drawings for peripheral device locations.
   2. See article "ACCESS CONTROL POINT PERIPHERALS" below for device descriptions.

D. Interface with Other Systems:
   1. Provide products compatible with other systems requiring interface with access control system.

E. Provide products listed, classified, and labeled as suitable for the purpose intended.
   1. Access Control Units and Readers: Listed and labeled as complying with UL 294.

2. Exterior Doors: Control access into building.

2.03 ACCESS CONTROL UNITS AND SOFTWARE

A. Provide access control units and associated software compatible with readers to be connected.

B. Access Control Unit:
   1. Features:
      a. Dedicated power loss alarm input.
      b. Supports database and event exporting.
      c. Supports database backup.
      d. Integral backup battery system.

C. Computers:
   1. Workstation Computers: Unless otherwise indicated, workstation computer hardware and associated peripherals not furnished by access control system manufacturer to be provided by Contractor as part of work of this section, meeting access control system equipment manufacturer's recommended requirements.

D. Software:
   1. Unless otherwise indicated, provide all software and licenses required for fully operational system.

2.04 ACCESS CONTROL POINT PERIPHERALS

A. Provide devices compatible with control units.

B. Provide devices suitable for operation under the service conditions at the installed location.

C. Provide readers compatible with credentials to be used.

D. Reader Color: To be selected by Architect from manufacturer's available standard colors.

E. Proximity Readers:
   1. Utilizes 125 kHz RF communication with compatible credentials.
   2. Proximity Reader:

F. Door Position Switches:
   1. Magnetic Contacts: Encapsulated reed switch(es) and separate magnet; designed to monitor opened/closed position of doors.
   2. Contact Color: To be selected by Architect from manufacturer's available standard colors.

G. Request to Exit Devices:
   1. Pushbuttons:
   2. Motion Sensors: Passive infrared.
   3. Door Hardware with Integral Request to Exit Switches: Comply with Section 08 7100.

H. Door Locking Devices (Electric Strikes and Magnetic Locks): Comply with Section 08 7100.

2.05 ACCESSORIES

A. Provide components as indicated or as required for connection of access control system to devices and other systems indicated.

B. Unless otherwise indicated, credentials to be provided by Contractor.
   1. Provide credentials compatible with readers and control units/software to be used.

C. Provide cables as indicated or as required for connections between system components.

D. Provide accessory racks/cabinets as indicated or as required for equipment mounting.

E. Security Access Control Panel:

F. Encoded Card Readers:

G. Encoded Cards/Fobs:

H. Electric Locks:

PART 3 EXECUTION

3.01 INSTALLATION

A. Install access control system in accordance with NECA 1 (general workmanship).

B. Install products in accordance with manufacturer's instructions.

C. Wiring Method: Unless otherwise indicated, use cables (not in conduit).
   1. Use suitable listed cables in wet locations, including underground raceways.
   2. Use suitable listed cables for vertical riser applications.
   3. Use listed plenum rated cables in spaces used for environmental air.
   4. Install wiring in conduit for the following:
      a. Where required for rough-in.
      b. Where required by authorities having jurisdiction.
      c. Where exposed to damage.
      d. Where installed outside the building.
      e. For exposed connections from outlet boxes to devices.
   5. Conduit: Comply with Section 26 0533.13.
   6. Conceal all cables unless specifically indicated to be exposed.
   7. Use power transfer hinges complying with Section 08 7100 for concealed connections to door hardware.
   8. Cables in the following areas may be exposed, unless otherwise indicated:
      a. Equipment closets.
   9. Route exposed cables parallel or perpendicular to building structural members and surfaces.
   10. Do not exceed manufacturer's recommended maximum cable length between components.

D. Provide grounding and bonding in accordance with Section 26 0526.

E. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.

F. Identify system wiring and components in accordance with Section 26 0553.

3.02 CLOSEOUT ACTIVITIES

A. See Section 01 7800 - Closeout Submittals, for closeout submittals.

B. See Section 01 7900 - Demonstration and Training, for additional requirements.

C. Demonstration: Demonstrate proper operation of system to Owner, and correct deficiencies or make adjustments as directed.

D. Training: Train Owner's personnel on operation, adjustment, and maintenance of system.
   1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.

3.03 PROTECTION

A. Protect installed system components from subsequent construction operations.

3.04 MAINTENANCE

A. See Section 01 7000 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.

B. Provide to Owner, at no extra cost, a separate maintenance contract for the service and maintenance of access control system for two years from date of Substantial Completion; Include a complete description of preventive maintenance, systematic examination, adjustment, cleaning, inspection, and testing, with a detailed schedule.

C. Provide trouble call-back service upon notification by Owner:

1. Include allowance for call-back service during normal working hours at no extra cost to Owner.
2. Owner will pay for call-back service outside of normal working hours on an hourly basis, based on actual time spent at site and not including travel time; include hourly rate and definition of normal working hours in maintenance contract.

END OF SECTION

SECTION 28 2000
VIDEO SURVEILLANCE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Video surveillance system requirements.

B. Video recording and viewing equipment.

C. Cameras.

D. Accessories.

E. Video management software.

1.02 RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.

B. Section 26 0526 - Grounding and Bonding for Electrical Systems.

C. Section 26 0529 - Hangers and Supports for Electrical Systems.

D. Section 26 0533.13 - Conduit for Electrical Systems.

E. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

F. Section 27 1005 - Structured Cabling for Voice and Data - Inside-Plant: Data cables for IP video surveillance system network connections.

1.03 REFERENCE STANDARDS

A. 47 CFR 15 - Radio Frequency Devices; current edition.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

C. NECA 303 - Standard for Installing Closed-Circuit Television (CCTV) Systems; 2005.

D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the placement of cameras with structural members, ductwork, piping, equipment, luminaires, diffusers, fire suppression system components, and other potential conflicts installed under other sections or by others.
   2. Coordinate the work with other installers to provide power for cameras and equipment at required locations.
   3. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

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

B. Shop Drawings: Include plan views indicating locations of system components and proposed size, type, and routing of conduits and/or cables. Include elevations and details of proposed equipment arrangements. Include system interconnection schematic diagrams. Include requirements for interface with other systems.

C. Product Data: Provide manufacturer's standard catalog pages and data sheets for each system component. Include ratings, configurations, standard wiring diagrams, dimensions, finishes, service condition requirements, and installed features.

D. Design Data:
   1. Standby battery/UPS calculations.

2. Video storage capacity calculations.

E. 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 operation of product.

F. Manufacturer’s detailed field testing procedures.

G. Operation and Maintenance Data: Include detailed information on system operation, equipment programming and setup, replacement parts, and recommended maintenance procedures and intervals.
   1. Include contact information for entity that will be providing contract maintenance and trouble call-back service.

H. Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty completed in Owner's name and registered with manufacturer.

I. Maintenance contracts.

1.06 QUALITY ASSURANCE

A. Comply with the following:
   1. NFPA 70.
   2. Applicable TIA/EIA standards.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience with video surveillance systems of similar size, type, and complexity and providing contract maintenance service as a regular part of their business; authorized manufacturer's representative.

D. Products: Furnish products listed and classified by testing firm acceptable to authority having jurisdiction as suitable for purpose specified and indicated.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Video Recording and Viewing Equipment - Basis of Design: Sony.

B. Video Recording and Viewing Equipment - Other Acceptable Manufacturers:
   1. Bosch Security Systems: www.boschsecurity.us.
   2. Honeywell International, Inc: www.honeywellvideo.com.
   3. Pelco, a brand of Schneider Electric: www.pelco.com.
   4. S2.

C. Cameras - Basis of Design: Sony.

D. Cameras - Other Acceptable Manufacturers:
   1. Bosch Security Systems: www.boschsecurity.us.
   2. Honeywell International, Inc: www.honeywellvideo.com.
   3. Pelco, a brand of Schneider Electric: www.pelco.com.
   4. S2.

E. Substitutions: See Section 01 6000 - Product Requirements.

F. Products other than basis of design are subject to compliance with specified requirements and prior approval of Engineer. By using products other than basis of design, Contractor accepts responsibility for costs associated with any necessary modifications to related work, including any design fees.

G. Video Management System:
   1. Bosch Security Systems: www.boschsecurity.us.
   2. S2

2.02 VIDEO SURVEILLANCE SYSTEM

A. Provide new video surveillance system consisting of all required equipment, conduit, boxes, wiring, connectors, hardware, supports, accessories, software, system programming, etc. as necessary for a complete operating system that provides the functional intent indicated.

B. System Description: IP system with connection to network (IP) cameras.
   1. Video Storage Capacity: Suitable for storing video from all cameras for 30 days.
   2. System Battery Backup: Provide batteries/uninterruptible power supplies (UPS) as required for 120 minutes full operation.

C. Provide products listed, classified, and labeled as suitable for the purpose intended.

D. Electromagnetic Interference/Radio Frequency Interference (EMI/RFI) Limits: Comply with FCC requirements of 47 CFR 15, for Class B, consumer application.

2.03 VIDEO RECORDING AND VIEWING EQUIPMENT

A. Provide video recording and viewing equipment compatible with cameras to be connected.

B. Network Video Recorders (NVRs):
   1. Supports connection of network (IP) cameras.
   2. Supports continuous and event-based recording.

C. Hybrid Digital Video Recorders (DVRs):
   1. Supports connection of both network (IP) and analog cameras.
   2. Supports continuous and event-based recording.

D. Computers:
   1. Workstation Computers: Unless otherwise indicated, workstation computer hardware not furnished by video surveillance system manufacturer to be provided by Contractor as part of work of this section, meeting video surveillance system equipment manufacturer's minimum requirements.

E. Software:
   1. Unless otherwise indicated, provide all software and licenses required for fully operational system.

2.04 CAMERAS

A. Provide cameras and associated accessories suitable for operation under the service conditions at the installed location. Provide additional components (e.g. enclosures, heaters, blowers, etc.) as required.

B. Where not factory-installed, provide additional components (e.g. lenses, mounting accessories, etc.) as necessary for complete installation.

C. Network (IP) Cameras:
   1. Signal-to-Noise Ratio: Not less than 50 dB.
   2. Provide the following standard features:
      a. Automatic electronic shutter.
      b. Automatic gain control.
      c. Automatic white balance.
      d. Web-based interface for remote viewing and setup.
      e. Password protected security access.
   3. Network (IP) Indoor Fixed Dome Camera Type _____:
      a. Camera Type: True day/night with IR cut filter.
      b. Image Sensor: 1/4 inch CMOS.
      c. Resolution: Up to 1080p (1920 x 1080).

d. Frame Rate: Up to 30 frames per second (fps) at all available resolutions.
e. Minimum Illumination: 3 lux color, .1 lux black and white.

D. Camera Enclosures and Mounting Brackets:
1. Where not factory-installed, provide accessory camera enclosures suitable for operation under the service conditions at the installed location.
2. Where not factory-installed, provide accessory camera mounting brackets necessary for installation.

2.05 ACCESSORIES

A. Provide components as indicated or as required for connection of video surveillance system to devices and other systems indicated.

B. Provide network switches as required for network connections to system components.

C. Provide cables as indicated or as required for connections between system components.
1. Data Cables for IP Network Connections: Unshielded twisted pair (UTP), minimum Category 5e, complying with Section 27 1005.
2. Analog Video Connections:
a. Coaxial Cables: Copper center conductor and 95 percent bare copper braid shield, minimum RG59/U.
b. Coaxial Connectors: BNC crimp-on type.

D. Provide accessory racks/cabinets as indicated or as required for equipment mounting.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install video surveillance system in accordance with NECA 1 (general workmanship) and NECA 303.

B. Install products in accordance with manufacturer's instructions.

C. Provide required support and attachment in accordance with Section 26 0529.

D. Wiring Method: Unless otherwise indicated, use cables (not in conduit).
1. Use suitable listed cables in wet locations, including underground raceways.
2. Use suitable listed cables for vertical riser applications.
3. Use listed plenum rated cables in spaces used for environmental air.
4. Install wiring in conduit for the following:
a. Where required for rough-in.
b. Where required by authorities having jurisdiction.
c. Where exposed to damage.
d. Where installed outside the building.
e. For exposed connections from outlet boxes to cameras.
5. Conduit: Comply with Section 26 0533.13.
6. Conceal all cables unless specifically indicated to be exposed.
7. Cables in the following areas may be exposed, unless otherwise indicated:
a. Equipment closets.
8. Route exposed cables parallel or perpendicular to building structural members and surfaces.

E. Provide grounding and bonding in accordance with Section 26 0526.

F. Identify system wiring and components in accordance with Section 26 0553.

3.02 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. 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.

C. Prepare and start system in accordance with manufacturer's instructions.

D. Adjust cameras to provide desired field of view and produce suitable images under all service lighting conditions.

E. Program system parameters according to requirements of Owner.

F. Test for proper interface with other systems.

G. Correct defective work, adjust for proper operation, and retest until entire system complies with contract documents.

3.03 CLOSEOUT ACTIVITIES

A. See Section 01 7800 - Closeout Submittals, for closeout submittals.

B. See Section 01 7900 - Demonstration and Training, for additional requirements.

C. Demonstration: Demonstrate proper operation of system to Owner, and correct deficiencies or make adjustments as directed.

D. Training: Train Owner's personnel on operation, adjustment, and maintenance of system.
   1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.

3.04 MAINTENANCE

A. See Section 01 7000 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.

B. Provide to Owner, at no extra cost, a separate maintenance contract for the service and maintenance of video surveillance system for two years from date of Substantial Completion; Include a complete description of preventive maintenance, systematic examination, adjustment, cleaning, inspection, and testing, with a detailed schedule.

C. Provide trouble call-back service upon notification by Owner:
   1. Include allowance for call-back service during normal working hours at no extra cost to Owner.
   2. Owner will pay for call-back service outside of normal working hours on an hourly basis, based on actual time spent at site and not including travel time; include hourly rate and definition of normal working hours in maintenance contract.

END OF SECTION

SECTION 28 4600

FIRE DETECTION AND ALARM

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 REQUIREMENTS

A. Section 08 7100 - Door Hardware: Electrically operated locks and door holder devices to be monitored and released by fire alarm system.

B. Section 21 1300 - Fire-Suppression Sprinkler Systems: Supervisory, alarm, and actuating devices installed in sprinkler system.

C. Section 14 2010 - Passenger Elevators: Elevator systems monitored and controlled by fire alarm system.

D. Section 23 3300 - Air Duct Accessories: Smoke dampers monitored and controlled by fire alarm system.

1.03 REFERENCE STANDARDS

A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; current edition.

B. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

C. IEEE C62.41.2 - Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits; 2002 (Cor 1, 2012).

D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E. NFPA 72 - National Fire Alarm and Signaling Code; 2016.

F. NFPA 101 - Life Safety Code; 2015.

1.04 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. 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.

C. 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 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. ADA Standards.
      b. The requirements of the State Fire Marshal.
      c. The requirements of the local authority having jurisdiction.
      d. Applicable local codes.
      e. The contract documents (drawings and specifications).
      f. NFPA 101.

g. 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. Evacuation Alarm: Multiple smoke zones; allow for evacuation notification of any individual zone or combination of zones, in addition to general evacuation of entire premises.
5. General Evacuation Zones: Each smoke zone is considered a general evacuation zone unless otherwise indicated, with alarm notification in all zones on the same floor, on the floor above, and the floor below.
6. Hearing Impaired Occupants: Provide visible notification devices in all public areas and in dwelling units.
7. Master Control Unit (Panel): New, located at fire command center.

B. Supervising Stations and Fire Department Connections:
1. Public Fire Department Notification: By on-premises supervising station.
2. On-Premises Supervising Station: Existing proprietary station operated by Owner, located at _____.
3. Remote Supervising Station: UL-listed central station under contract to facility.
4. Means of Transmission to On-Premises Supervising Station: Directly connected noncoded system.
5. Means of Transmission to Remote Supervising Station: Digital alarm communicator transmitter (DACT), 2 telephone lines.

C. Circuits:
1. Initiating Device Circuits (IDC): Class B, Style A.
2. Signaling Line Circuits (SLC) Within Single Building: Class B, Style 0.5.
3. Notification Appliance Circuits (NAC): Class B, Style W.

D. Spare Capacity:
1. Initiating Device Circuits: Minimum 25 percent spare capacity.
2. Notification Appliance Circuits: Minimum 25 percent spare capacity.
3. Speaker Amplifiers: Minimum 25 percent spare capacity.
4. 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).

2.02 FIRE SAFETY SYSTEMS INTERFACES

A. Supervision: Provide supervisory signals in accordance with NFPA 72 for the following:
1. Sprinkler water control valves.
2. Dry-pipe sprinkler system pressure.
3. Dry-pipe sprinkler valve room low temperature.
4. Elevator shut-down control circuits.

B. Alarm: Provide alarm initiation in accordance with NFPA 72 for the following:
1. Sprinkler water flow.
2. Elevator lobby, elevator hoistway, and elevator machine room smoke detectors.

C. Elevators:
1. Elevator lobby, hoistway, and machine room smoke detectors: Elevator recall for fire fighters' service.
2. Elevator Machine Room Heat Detector: Shut down elevator power prior to hoistway sprinkler activation.

3. Sprinkler pressure or waterflow: Shut down elevator power prior to hoistway sprinkler activation.

D. HVAC:
   1. Duct Smoke Detectors: Furnish with auxiliary contacts. Close dampers indicated; shut down air handlers indicated.

E. Doors:
   1. Smoke Barrier Door Magnetic Holders: Release upon activation of smoke detectors in smoke zone on either side of door, upon alarm from manual pull station on same floor, and upon sprinkler activation on same floor. Refer to Section 08 7100.
   2. Electromagnetic Door Locks on Egress Doors: Unlock upon activation of any alarm initiating device or suppression system in smoke zone that doors serve as egress from. Refer to Section 08 7100.

2.03 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, classified, and labeled as suitable for the purpose intended.

C. Master Control Unit: As specified for Basis of Design above, or equivalent.

D. Initiating Devices:
   1. Manual Pull Stations: Provide 1 extra
   2. Smoke Detectors: Provide 10% extra
   3. Duct Smoke Detectors: Provide 10% extra
   4. Heat Detectors: Provide 1 extra
   5. Addressable Interface Devices: Provide [10%] extra.
   6. Carbon Monoxide Detectors: Provide 1 extra.

E. Notification Appliances:
   1. Speakers: 520hz.
      a. Provide 2 extra.
   2. Strobes: 177cd.
      a. Provide 2 extra.
   3. Sounder Bases:
      a. Provide 2 extra.

F. Circuit Conductors: Copper or optical fiber; provide 200 feet extra; color code and label.

G. Surge Protection: In accordance with IEEE C62.41.2 category B combination waveform and NFPA 70; except for optical fiber conductors.

H. Locks and Keys: Deliver keys to Owner.

I. 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. Provide final connections and interface units for associated devices. Conceal all wiring, conduit, boxes, and supports where installed in finished areas.

C. Obtain Owner's approval of locations of devices, before installation.

D. Install instruction cards and labels.

3.02 INSPECTION AND TESTING FOR COMPLETION

A. Notify Owner 7 days prior to beginning completion inspections and tests.

B. Notify authorities having jurisdiction 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. Correct defective work, adjust for proper operation, and retest until entire system complies with contract documents.

3.03 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 authority having jurisdiction; 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. All aspects of operation have been demonstrated to Owner.
   3. Final acceptance of the fire alarm system has been given by authorities having jurisdiction.
   4. Occupancy permit has been granted.

3.04 MAINTENANCE

A. See Section 01 7000 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.

B. Perform routine inspection, testing, and preventive maintenance required by NFPA 72, including:
   1. Maintenance of fire safety interface and supervisory devices connected to fire alarm system.
   2. Repairs required, unless due to improper use, accidents, or negligence beyond the control of the maintenance contractor.
   3. Record keeping required by NFPA 72 and authorities having jurisdiction.

C. Provide trouble call-back service upon notification by Owner:
   1. Provide on-site response within 2 hours of notification.
   2. Include allowance for call-back service during normal working hours at no extra cost to Owner.
   3. Owner will pay for call-back service outside of normal working hours on an hourly basis, based on actual time spent at site and not including travel time; include hourly rate and definition of normal working hours in maintenance contract.

D. Provide a complete description of preventive maintenance, systematic examination, adjustment, cleaning, inspection, and testing, with a detailed schedule.

E. Maintain a log at each fire alarm control unit, listing the date and time of each inspection and call-back visit, the condition of the system, nature of the trouble, correction performed, and parts replaced. Submit duplicate of each log entry to Owner's representative upon completion of site visit.

F. Comply with Owner's requirements for access to facility and security.

END OF SECTION

SECTION 31 1000
SITE CLEARING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Clearing and protection of vegetation.

B. Removal of existing debris.

1.02 RELATED REQUIREMENTS

A. Section 01 1000 - Summary: Limitations on Contractor's use of site and premises.

B. Section 01 5000 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.

C. Section 01 5713 - Temporary Erosion and Sediment Control.

D. Section 01 7000 - Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products.

E. Section 01 7419 - Construction Waste Management and Disposal: Limitations on disposal of removed materials; requirements for recycling.

F. Section 31 2200 - Grading: Topsoil removal.

G. Section 31 2200 - Grading: Fill material for filling holes, pits, and excavations generated as a result of removal operations.

H. Section 32 9300 - Plants: Relocation of existing trees, shrubs, and other plants.

PART 2 PRODUCTS

2.01 MATERIALS

A. Fill Material: As specified in Section 31 2200 - Grading

PART 3 EXECUTION

3.01 SITE CLEARING

A. Comply with other requirements specified in Section 01 7000.

B. Minimize production of dust due to clearing operations; do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.

3.02 EXISTING UTILITIES AND BUILT ELEMENTS

A. Coordinate work with utility companies; notify before starting work and comply with their requirements; obtain required permits.

B. Protect existing utilities to remain from damage.

C. Do not disrupt public utilities without permit from authority having jurisdiction.

D. Protect existing structures and other elements that are not to be removed.

3.03 VEGETATION

A. Scope: Remove trees, shrubs, brush, and stumps in areas to be covered by building structure, paving, playing fields, lawns, and planting beds.

B. Do not begin clearing until vegetation to be relocated has been removed.

C. Do not remove or damage vegetation in areas designated on the drawings.
   1. Exception: Specific trees and vegetation indicated on drawings to be removed.
   2. Exception: Selective thinning of undergrowth specified elsewhere.

D. Install substantial, highly visible fences at least 3 feet high to prevent inadvertent damage to vegetation to remain:

1. At vegetation removal limits.
2. Around trees to remain within vegetation removal limits; locate no closer to tree than at the drip line.

E. In areas where vegetation must be removed but no construction will occur other than pervious paving, remove vegetation with minimum disturbance of the subsoil.

F. Vegetation Removed: Do not burn, bury, landfill, or leave on site, except as indicated.
1. Chip, grind, crush, or shred vegetation for mulching, composting, or other purposes; preference should be given to on-site uses.
2. Trees: Sell if marketable; if not, treat as specified for other vegetation removed; remove stumps and roots to depth of 18 inches.
3. Existing Stumps: Treat as specified for other vegetation removed; remove stumps and roots to depth of 18 inches.
4. Sod: Re-use on site if possible; otherwise sell if marketable, and if not, treat as specified for other vegetation removed.
5. Fill holes left by removal of stumps and roots, using suitable fill material, with top surface neat in appearance and smooth enough not to constitute a hazard to pedestrians.

G. Dead Wood: Remove all dead trees (standing or down), limbs, and dry brush on entire site; treat as specified for vegetation removed.

H. Restoration: If vegetation outside removal limits or within specified protective fences is damaged or destroyed due to subsequent construction operations, replace at no cost to Owner.

3.04 DEBRIS

A. Remove debris, junk, and trash from site.

B. Leave site in clean condition, ready for subsequent work.

C. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION

SECTION 31 2200
GRADING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Removal of topsoil.

B. Rough grading the site for site structures.

C. Finish grading.

1.02 RELATED REQUIREMENTS

A. Section 31 1000 - Site Clearing.

B. Section 31 2316 - Excavation.

C. Section 31 2316.13 - Trenching: Trenching and backfilling for utilities.

D. Section 31 2323 - Fill: Filling and compaction.

PART 2 PRODUCTS

2.01 MATERIALS

A. Topsoil: See Section 31 2323.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that survey bench mark and intended elevations for the Work are as indicated.

3.02 PREPARATION

A. Identify required lines, levels, contours, and datum.

B. Stake and flag locations of known utilities.

C. Locate, identify, and protect from damage above- and below-grade utilities to remain.

D. Notify utility company to remove and relocate utilities.

E. Protect site features to remain, including but not limited to bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs, from damage by grading equipment and vehicular traffic.

F. Protect trees to remain by providing substantial fencing around entire tree at the outer tips of its branches; no grading is to be performed inside this line.

G. Protect plants, lawns, rock outcroppings, and other features to remain as a portion of final landscaping.

3.03 ROUGH GRADING

A. Remove topsoil from areas to be further excavated, re-landscaped, or re-graded, without mixing with foreign materials.

B. Do not remove topsoil when wet.

C. Remove subsoil from areas to be further excavated, re-landscaped, or re-graded.

D. Do not remove wet subsoil, unless it is subsequently processed to obtain optimum moisture content.

E. When excavating through roots, perform work by hand and cut roots with sharp axe.

F. See Section 31 2323 for filling procedures.

G. Benching Slopes: Horizontally bench existing slopes greater than 1:4 to key fill material to slope for firm bearing.

H. Stability: Replace damaged or displaced subsoil to same requirements as for specified fill.

3.04 SOIL REMOVAL

A. Stockpile topsoil to be re-used on site; remove remainder from site.

B. Stockpile subsoil to be re-used on site; remove remainder from site.

C. Stockpiles: Use areas designated on site; pile depth not to exceed 8 feet; protect from erosion.

3.05 FINISH GRADING

A. Before Finish Grading:
   1. Verify building and trench backfilling have been inspected.
   2. Verify subgrade has been contoured and compacted.

B. Remove debris, roots, branches, stones, in excess of 1/2 inch in size. Remove soil contaminated with petroleum products.

C. Where topsoil is to be placed, scarify surface to depth of 3 inches.

D. In areas where vehicles or equipment have compacted soil, scarify surface to depth of 3 inches.

E. Place topsoil in areas where seeding are indicated.

F. Place topsoil to the following compacted thicknesses:
   1. Areas to be Seeded with Grass: 6 inches.
   2. Areas to be Sodded: 4 inches.
   3. Shrub Beds: 12 inches.
   4. Flower Beds: 12 inches.
   5. Planter Boxes: To within 3 inches of box rim.

G. Place topsoil during dry weather.

H. Remove roots, weeds, rocks, and foreign material while spreading.

I. Near plants spread topsoil manually to prevent damage.

J. Fine grade topsoil to eliminate uneven areas and low spots. Maintain profiles and contour of subgrade.

K. Lightly compact placed topsoil.

3.06 TOLERANCES

A. Top Surface of Subgrade: Plus or minus 0.10 foot (1-3/16 inches) from required elevation.

B. Top Surface of Finish Grade: Plus or minus 0.04 foot (1/2 inch).

C. Finish grade shall be 8" below the finish floor elevations unless otherwise noted. Planter bed mulch shall be kept 4" below finish floor.

D. Confirm that weep holes and condensate drains are not, and cannot be blocked.

3.07 REPAIR AND RESTORATION

A. Existing Facilities, Utilities, and Site Features to Remain: If damaged due to this work, repair or replace to original condition.

B. Trees to Remain: If damaged due to this work, trim broken branches and repair bark wounds; if root damage has occurred, obtain instructions from Architect as to remedy.

C. Other Existing Vegetation to Remain: If damaged due to this work, replace with vegetation of equivalent species and size.

3.08 CLEANING

A. Remove unused stockpiled topsoil and subsoil. Grade stockpile area to prevent standing water.

B. Leave site clean and raked, ready to receive landscaping.

END OF SECTION

SECTION 31 2316
EXCAVATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Excavating for building volume below grade, footings, slabs-on-grade, paving, site structures, and utilities within the building.

B. Trenching for utilities outside the building to utility main connections.

1.02 RELATED REQUIREMENTS

A. Geotechnical report; bore hole locations and findings of subsurface materials .

B. Section 31 2200 - Grading: Soil removal from surface of site.

C. Section 31 2200 - Grading: Grading.

D. Section 31 2323 - Fill: Fill materials, filling, and compacting.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that survey bench mark and intended elevations for the work are as indicated.

3.02 PREPARATION

A. Identify required lines, levels, contours, and datum locations.

B. See Section 31 2200 for additional requirements, including protection of utilities and existing site features.

3.03 EXCAVATING

A. Excavate to accommodate new structures and construction operations.

B. Notify Architect of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.

C. Slope banks of excavations deeper than 4 feet to angle of repose or less until shored.

D. Do not interfere with 45 degree bearing splay of foundations.

E. Cut utility trenches wide enough to allow inspection of installed utilities.

F. Hand trim excavations. Remove loose matter.

G. Correct areas that are over-excavated and load-bearing surfaces that are disturbed; see Section 31 2323.

H. Grade top perimeter of excavation to prevent surface water from draining into excavation.

I. Remove excavated material that is unsuitable for re-use from site.

J. Stockpile excavated material to be re-used in area designated on site in accordance with Section 31 2200.

K. Remove excess excavated material from site.

3.04 PROTECTION

A. Prevent displacement of banks and keep loose soil from falling into excavation; maintain soil stability.

B. Protect bottom of excavations and soil adjacent to and beneath foundation from freezing.

END OF SECTION

SECTION 31 2323
FILL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Filling, backfilling, and compacting for building volume below grade and paving.

B. Backfilling and compacting for utilities outside the building to utility main connections.

C. Filling holes, pits, and excavations generated as a result of removal (demolition) operations.

1.02 RELATED REQUIREMENTS

A. Document _____: Geotechnical report; bore hole locations and findings of subsurface materials.

B. Section 31 2200 - Grading: Site grading.

1.03 DEFINITIONS

A. Finish Grade Elevations: Indicated on drawings.

B. Subgrade Elevations: Indicated on drawings.

1.04 REFERENCE STANDARDS

A. AASHTO T 180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54 kg (10-lb) Rammer and a 457 mm (18 in.) Drop; 2015.

B. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)); 2012.

C. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN m/m3)); 2012.

D. ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System); 2011.

1.05 DELIVERY, STORAGE, AND HANDLING

A. When necessary, store materials on site in advance of need.

B. When fill materials need to be stored on site, locate stockpiles where required and approved..
   1. Separate differing materials with dividers or stockpile separately to prevent intermixing.
   2. Prevent contamination.
   3. Protect stockpiles from erosion and deterioration of materials.

PART 2 PRODUCTS

2.01 FILL MATERIALS

A. General Fill: Subsoil excavated on-site or imported and conforming to State Highway Department Standard.
   1. Graded.
   2. Free of lumps larger than 3 inches, rocks larger than 2 inches, and debris.
   3. Conforming to ASTM D2487 Group Symbol CL.

B. Structural Fill: Subsoil excavated on-site or imported and conforming to State Highway Department Standard.
   1. Graded.
   2. Free of lumps larger than 3 inches, rocks larger than 2 inches, and debris.
   3. Conforming to ASTM D2487 Group Symbol CL.

C. Concrete for Fill: As specified in Section 03 3000; compressive strength of 2500 psi.

D. Granular Fill: Coarse aggregate, conforming to State Highway Department standard .

E. Sand: Conforming to State Highway Department standard .

2.02 SOURCE QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for general requirements for testing and analysis of soil material.

B. If tests indicate materials do not meet specified requirements, change material and retest.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that survey bench marks and intended elevations for the Work are as indicated.

B. Identify required lines, levels, contours, and datum locations.

C. See Section 31 2200 for additional requirements.

D. Verify subdrainage, dampproofing, or waterproofing installation has been inspected.

E. Verify structural ability of unsupported walls to support imposed loads by the fill.

3.02 PREPARATION

A. Scarify and proof roll subgrade surface to a depth of 6 inches to identify soft spots.

B. Cut out soft areas of subgrade not capable of compaction in place. Backfill with general fill.

C. Compact subgrade to density equal to or greater than requirements for subsequent fill material.

D. Until ready to fill, maintain excavations and prevent loose soil from falling into excavation.

3.03 FILLING

A. Fill to contours and elevations indicated using unfrozen materials.

B. Fill up to subgrade elevations unless otherwise indicated.

C. Employ a placement method that does not disturb or damage other work.

D. Systematically fill to allow maximum time for natural settlement. Do not fill over porous, wet, frozen or spongy subgrade surfaces.

E. Maintain optimum moisture content of fill materials to attain required compaction density.

F. Granular Fill: Place and compact materials in equal continuous layers not exceeding 6 inches compacted depth.

G. Soil Fill: Place and compact material in equal continuous layers not exceeding 8 inches compacted depth.

H. Slope grade away from building minimum 2 inches in 10 feet, unless noted otherwise. Make gradual grade changes. Blend slope into level areas.

I. Correct areas that are over-excavated.
   1. Other areas: Use general fill, flush to required elevation, compacted to minimum 97 percent of maximum dry density.

J. Compaction Density Unless Otherwise Specified or Indicated (see soils report):
   1. Under paving, slabs-on-grade, and similar construction: 97 percent of maximum dry density.

K. Reshape and re-compact fills subjected to vehicular traffic.

3.04 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for general requirements for field inspection and testing.

B. Evaluate results in relation to compaction curve determined by testing uncompacted material in accordance with ASTM D698 ("standard Proctor"), ASTM D1557 ("modified Proctor"), or AASHTO T 180.

C. If tests indicate work does not meet specified requirements, remove work, replace and retest.

D. Frequency of Tests: _____.

3.05 CLEANING

A. See Section 01 7419 - Construction Waste Management and Disposal, for additional requirements.

B. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.

C. Leave borrow areas in a clean and neat condition. Grade to prevent standing surface water.

END OF SECTION

SECTION 31 3116
TERMITE CONTROL

PART 1 GENERAL

1.01 SECTION INCLUDES

1.02 SUBMITTALS

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

B. Product Data: Indicate toxicants to be used, composition by percentage, dilution schedule, intended application rate.

C. Test Reports: Indicate regulatory agency approval reports when required.

D. Manufacturer's Application Instructions: Indicate caution requirement.

E. Warranty: Submit warranty and ensure that forms have been completed in Owner's name.

1.03 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing this type of work and:
   1. Having minimum of three (3) years documented experience.
   2. Licensed in Ohio.

1.04 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide ten year installer's warranty against damage to building caused by termites.

PART 2 PRODUCTS

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that soil surfaces are unfrozen, sufficiently dry to absorb toxicant, and ready to receive treatment.

B. Verify final grading is complete.

3.02 PROTECTION

A. Do not permit soil grading over treated work.

END OF SECTION

SECTION 32 0116.74

IN PLACE HOT REUSED ASPHALT PAVING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Heating, scarifying, remixing, placing, and compacting existing asphaltic concrete.

B. Milling of existing wearing course

1.02 REFERENCE STANDARDS

A. AI MS-19 - A Basic Asphalt Emulsion Manual; Fourth Edition.

1.03 QUALITY ASSURANCE

A. Perform Work in accordance with AI MS-20.

1.04 REGULATORY REQUIREMENTS

A. Conform to applicable code for spillage on municipal streets and positioning flag persons near public areas.

1.05 FIELD CONDITIONS

A. Do not perform work when weather conditions will not permit successful completion of the Work.

B. If ambient air temperature is below 50 degrees F, obtain approval prior to proceeding with the work.

PART 2 PRODUCTS

2.01 MATERIALS

A. Recycled Material: Existing in-place asphaltic concrete.

B. Virgin Mix Materials: Provide in accordance with State of Ohio Department of Highway Standards.

C. Seal Coat: Jennite NJ-S2 "pitch" coal tar emulsion complying with ASTM D5727. type.

D. Pavement-Marking Paint: Alkyd-resin type, lead and chromate free, ready mixed, complying with FS TT-P-115, Type II or AASHTO M 248, Type F.
   1. Select from colors below; distinguish locations if more than one color is required.
   2. Color: White.

E. Wheel Stops: Precast, air-entrained concrete, 2500-psi (17.2-MPa) minimum compressive strength, 4-1/2 inches (115 mm) high by 9 inches (225 mm) wide by 72 inches (1800 mm) long. Provide chamfered corners and drainage slots on underside and holes for anchoring to substrate.
   1. Dowels: Galvanized steel, 3/4-inch (19-mm) diameter, 10-inch (254-mm) minimum length.

F. Asphalt Geotextile Overlay:
   1. US Fabrics, Inc., US 90P nonwoven needlepunched geotextile made of 100% polypropylene staple filaments.

2.02 EQUIPMENT

A. Recycling Equipment: Type for the intended purpose as follows:
   1. Capable of processing ___ sq yd of surface per day.

B. Heated Asphalt Remixer: Type for the intended purpose as follows:
   1. Self-propelled, with a wheel base sufficient to maximize leveling action.
   2. Operational heater width of 10 feet minimum to 12 feet maximum; protective insulated hood over heated areas; heated, adjustable, direct flame heating not permitted.
   3. Capable of processing 5,500 sq yd of surface per day.

C. Milling Unit: Type for the intended purpose as follows:
   1. Self-propelled, with a wheel base sufficient to maximize leveling action.
   2. Capable of loosening pavement material to a 2 inch depth.

D. Onboard Pug Mill: Type for the intended purpose as follows:
   1. Horizontal shaft, hydrostatically driven, heated mixer.
   2. Capable of adding and remixing recycled material, rejuvenating agent, and virgin mat.
   3. To produce uniform mixture at required temperature.

E. Compactor: Pneumatic tired roller for initial compaction; steel wheeled rollers required for additional compaction and smoothness. An oscillating screed or tamper is not acceptable.

2.03 RECYCLED MIX

A. Remove random samples of existing pavement material; record sample location and perform testing.

B. Establish mix design from test sample materials.

C. Identify asphalt content, aggregate gradation curve, penetration value, viscosity of residual asphalt, and density.

D. Establish recycling agent demand ratios; determine maximum stability curve to support demand ratios.

E. Maintain minimum moisture content of 3 percent.

PART 3 EXECUTION

3.01 PREPARATION

A. Mechanically sweep pavement surfaces immediately prior to commencement of work. Clean pavement surfaces of loose foreign matter. Verify that surfaces are dry.

B. Protect existing improvements, overhanging trees, and plant life from heat damage by individual shielding and water spray.

C. Remove and store manhole covers and frames.

3.02 REMOVAL

A. Do not disfigure adjacent Work.

B. Heat pavement surface uniformly by continuous movement of a heated scarifier.

C. Execute removal to a depth not less than 1/2 inch at any point across the full width of surface without detrimental aggregate degradation.

3.03 MIXING

A. Mix removed material by spinning or tumbling action for asphalt rejuvenation.

B. Blend recycled material, recycling agent, and virgin material in pug mill in accordance with Asphalt Recycling and Reclaiming Association' ARRA ARS-5-HR, Proven Guidelines for Hot-Mix Recycling.

C. Maintain temperature of remixed material, directly behind the screed, as follows:
   1. Air Temperature: 50 Degrees F; Mix Temperature: 250 Degrees F
   2. Air Temperature: 60 Degrees F; Mix Temperature: 240 Degrees F
   3. Air Temperature: 70 Degrees F; Mix Temperature: 230 Degrees F

3.04 PLACING

A. Form a gutter cut 3/4 inch deep tapered to a feather edge for a minimum of 3 feet from lip of gutter; for subsequent surface overlay to be flush with the lip of the gutter.

B. Discharge remixed material and added virgin material by a heated vibratory precompactor.

C. Spread material in a windrow for profiling and precompaction.

D. Compact by a heated vibratory screed to a uniform cross sectional thickness.

E. Place mixed material to thicknesses indicated. Thickness not less than 3/4" inch.

3.05 ROLLING AND COMPACTING

A. Roll and compact pavement materials to elevations existing before commencing the Work.

B. Complete the compaction process within 5 minutes of removal.

C. Compact pavement by rolling. Do not displace or extrude pavement from position.

D. Develop rolling with consecutive passes to achieve even and smooth finish, without roller marks.

E. Reinstall manhole covers and frames.

3.06 SEAL COAT

A. Apply seal coat to top surface of wearing course in accordance with Asphalt Institute MS-19.

3.07 PROTECTION

A. Do not permit traffic over surface for 2 hours.

END OF SECTION

SECTION 32 1216
ASPHALT PAVING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Single course bituminous concrete paving.

B. Double course bituminous concrete paving.

C. Surface sealer.

1.02 REFERENCE STANDARDS

A. AI MS-2 - Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types; 1997.

B. AI MS-19 - A Basic Asphalt Emulsion Manual; Fourth Edition.

C. ASTM D946 - Standard Specification for Penetration-Graded Asphalt Cement for Use in Pavement Construction; 2009a.

1.03 QUALITY ASSURANCE

A. Perform Work in accordance with State of Ohio Highways standard.

B. Mixing Plant: Conform to State of Ohio Highways standard.

C. Obtain materials from same source throughout.

1.04 REGULATORY REQUIREMENTS

A. Conform to applicable code for paving work on public property.

1.05 FIELD CONDITIONS

A. Do not place asphalt when ambient air or base surface temperature is less than 40 degrees F, or surface is wet or frozen.

B. Place bitumen mixture when temperature is not more than 15 F degrees below bitumen supplier's bill of lading and not more than maximum specified temperature.

PART 2 PRODUCTS

2.01 MATERIALS

A. Asphalt Cement: ASTM D946.

B. Aggregate for Binder Course: in accordance with State of Ohio Highways standard. .

C. Aggregate for Wearing Course: in accordance with State of Ohio Highways standard. .

D. Fine Aggregate: in accordance with State of Ohio Highways standard. .

E. Seal Coat: Jennite NJ-S2 "pitch" coal tar emulsion complying with ASTM D5727. type.

F. Pavement-Marking Paint: Alkyd-resin type, lead and chromate free, ready mixed, complying with FS TT-P-115, Type II or AASHTO M 248, Type F.
   1. Select from colors below; distinguish locations if more than one color is required.
   2. Color: White.

G. Wheel Stops: 100% recycled plastic wheel stops 5.5 inches wide by 72 inches (1800 mm) long. Provide chamfered corners and holes for anchoring to substrate.
   1. Dowels: Galvanized steel, 5/8-inch diameter, 12-inch minimum length.

H. Base stabilization geogrid: US 250 as manufactured by US Fabrics, Inc., woven geotextile made of 100% polypropylene slit film yarns.

2.02 ASPHALT PAVING MIXES AND MIX DESIGN

A. Binder Course: 4.5 to 6 percent of asphalt cement by weight in mixture in accordance with AI MS-2.

B. Wearing Course: 5 to 7 percent of asphalt cement by weight in mixture in accordance with AI MS-2.

2.03 SOURCE QUALITY CONTROL

A. Test mix design and samples in accordance with AI MS-2.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that compacted subgrade is dry and ready to support paving and imposed loads.

B. Verify gradients and elevations of base are correct.

3.02 PREPARATION - PRIMER

A. Apply primer in accordance with manufacturer's instructions.

B. Apply primer on aggregate base or subbase at uniform rate of 1/3 gal/sq yd.

C. Use clean sand to blot excess primer.

3.03 PREPARATION - TACK COAT

A. Apply tack coat in accordance with manufacturer's instructions.

B. Apply tack coat on asphalt or concrete surfaces over subgrade surface at uniform rate of 1/3 gal/sq yd.

C. Apply tack coat to contact surfaces of curbs, gutters and _____.

D. Coat surfaces of manhole frames with oil to prevent bond with asphalt pavement. Do not tack coat these surfaces.

3.04 PLACING ASPHALT PAVEMENT - SINGLE COURSE

A. Install Work in accordance with State of Ohio Highways standardsx

B. Place asphalt within 24 hours of applying primer or tack coat.

C. Compact pavement by rolling to specified density. Do not displace or extrude pavement from position. Hand compact in areas inaccessible to rolling equipment.

D. Perform rolling with consecutive passes to achieve even and smooth finish without roller marks.

3.05 PLACING ASPHALT PAVEMENT - DOUBLE COURSE

A. Place asphalt binder course within 24 hours of applying primer or tack coat.

B. Place wearing course within two hours of placing and compacting binder course.

C. Compact pavement by rolling to specified density. Do not displace or extrude pavement from position. Hand compact in areas inaccessible to rolling equipment.

D. Perform rolling with consecutive passes to achieve even and smooth finish, without roller marks.

3.06 SEAL COAT

A. Apply seal coat to surface course and asphalt curbs in accordance with AI MS-19.

3.07 TOLERANCES

A. Flatness: Maximum variation of 1/4 inch measured with 10 foot straight edge.

B. Compacted Thickness: Within 1/4 inch of specified or indicated thickness.

C. Variation from True Elevation: Within 1/2 inch.

3.08 PROTECTION

A. Immediately after placement, protect pavement from mechanical injury for ____ days or until surface temperature is less than 140 degrees F.

END OF SECTION

SECTION 32 1313
CONCRETE PAVING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Concrete sidewalks, stair steps, integral curbs, gutters, median barriers, parking areas, and roads.

1.02 RELATED REQUIREMENTS

A. Section 03 1000 - Concrete Forming and Accessories.

B. Section 03 2000 - Concrete Reinforcing.

C. Section 03 3000 - Cast-in-Place Concrete.

D. Section 32 1726 - Tactile Warning Surfacing: Plastic tactile and detectable warning tiles for pedestrian walking surfaces.

1.03 REFERENCE STANDARDS

A. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete; 1991 (Reapproved 2009).

B. ACI 301 - Specifications for Structural Concrete; 2010 (Errata 2012).

C. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete; 2000.

D. ACI 305R - Hot Weather Concreting; 2010.

E. ACI 306R - Cold Weather Concreting; 2010.

F. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement; 2015.

G. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2016.

H. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 2015a.

I. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2015.

J. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method; 2014.

K. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete; 2010a.

L. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete; 2011.

M. ASTM C685/C685M - Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing; 2014.

N. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types); 2004 (Reapproved 2013).

O. ASTM D1752 - Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction; 2004a (Reapproved 2013).

1.04 SUBMITTALS

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

B. Product Data: Provide data on joint filler, admixtures, and curing compound.

PART 2 PRODUCTS

2.01 PAVING ASSEMBLIES

A. Comply with applicable requirements of ACI 301.

2.02 FORM MATERIALS

A. Form Materials: As specified in Section 03 1000, conform to ACI 301.

B. Joint Filler: Preformed; non-extruding bituminous type (ASTM D1751) or sponge rubber or cork (ASTM D1752).
   1. Thickness: 1/2 inch.

2.03 REINFORCEMENT

A. Reinforcing Steel and Welded Wire Reinforcement: Types specified in Section 03 2000.

B. Dowels: ASTM A615/A615M, Grade 40 - 40,000 psi yield strength; deformed billet steel bars; unfinished finish.

2.04 CONCRETE MATERIALS

A. Obtain cementitious materials from same source throughout.

B. Concrete Materials: As specified in Section 03 3000.

C. Fiber Reinforcement: Synthetic fibers shown to have long-term resistance to deterioration when in contact with alkalis and moisture; 1/2 inch length.

2.05 ACCESSORIES

A. Curing Compound: ASTM C309, Type 1, Class A.

B. Tactile Warning Surfaces: See Section 32 1726.

C. Joint Sealer: Type ____ as specified in Section 07 9005.

2.06 CONCRETE MIX DESIGN

A. Proportioning Normal Weight Concrete: Comply with ACI 211.1 recommendations.

B. Concrete Strength: Establish required average strength for each type of concrete on the basis of field experience or trial mixtures, as specified in ACI 301.
   1. For trial mixtures method, employ independent testing agency acceptable to Architect for preparing and reporting proposed mix designs.

C. Fiber Reinforcement: Add to mix at rate of 1.5 pounds per cubic yard, or as recommended by manufacturer for specific project conditions.

D. Concrete Properties:
   1. Compressive strength, when tested in accordance with ASTM C39/C39M at 28 days; _____ psi.
   2. Fly Ash Content: Maximum 15 percent of cementitious materials by weight.
   3. Calcined Pozzolan Content: Maximum 10 percent of cementitious materials by weight.
   4. Silica Fume Content: Maximum 5 percent of cementitious materials by weight.
   5. Water-Cement Ratio: Maximum.48 percent by weight.
   6. Total Air Content: 4 percent, determined in accordance with ASTM C173/C173M.
   7. Maximum Slump: 3 inches.

2.07 MIXING

A. On Project Site: Mix in drum type batch mixer, complying with ASTM C685/C685M. Mix each batch not less than 1-1/2 minutes and not more than 5 minutes.

B. Transit Mixers: Comply with ASTM C94/C94M.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify compacted subgrade is acceptable and ready to support paving and imposed loads.

B. Verify gradients and elevations of base are correct.

3.02 SUBBASE

A. Prepare subbase in accordance with State of Ohio Highways standards .

3.03 PREPARATION

A. Moisten base to minimize absorption of water from fresh concrete.

B. Coat surfaces of manhole frames with oil to prevent bond with concrete pavement.

C. Notify Architect minimum 48 hours prior to commencement of concreting operations.

3.04 FORMING

A. Place and secure forms to correct location, dimension, profile, and gradient.

B. Assemble formwork to permit easy stripping and dismantling without damaging concrete.

C. Place joint filler vertical in position, in straight lines. Secure to formwork during concrete placement.

3.05 REINFORCEMENT

A. Place reinforcement as indicated.

B. Interrupt reinforcement at contraction joints.

C. Place dowels to achieve pavement and curb alignment as detailed.

3.06 COLD AND HOT WEATHER CONCRETING

A. Follow recommendations of ACI 305R when concreting during hot weather.

B. Follow recommendations of ACI 306R when concreting during cold weather.

C. Do not place concrete when base surface temperature is less than 40 degrees F, or surface is wet or frozen.

3.07 PLACING CONCRETE

A. Place concrete in accordance with ACI 304R.

B. Ensure reinforcement, inserts, embedded parts, formed joints and ____ are not disturbed during concrete placement.

C. Place concrete continuously over the full width of the panel and between predetermined construction joints. Do not break or interrupt successive pours such that cold joints occur.

3.08 JOINTS

A. Place 3/8 inch wide expansion joints at 20 foot intervals and to separate paving from vertical surfaces and other components and in pattern indicated.
   1. Form joints with joint filler extending from bottom of pavement to within 1/2 inch of finished surface.

B. Provide scored joints.
   1. At sidewalks and curbs: spaced to match width of sidewalk.
   2. At driveways: at 10' intervals.

C. Saw cut contraction joints 3/16 inch wide at an optimum time after finishing. Cut 1/3 into depth of slab.

3.09 FINISHING

A. Area Paving: Light broom, texture perpendicular to pavement direction with troweled and radiused edges; 1/4" radius.

B. Sidewalk Paving: Light broom, texture perpendicular to direction of travel with tooled picture frame troweled and radiused edges and joints; 1/4 inch radius.

C. Curbs and Gutters: Light broom, texture parallel to pavement direction.

D. Inclined Vehicular Ramps: Broomed perpendicular to slope.

E. Place curing compound on exposed concrete surfaces immediately after finishing. Apply in accordance with manufacturer's instructions.

3.10 JOINT SEALING

A. See Section 07 9005 for joint sealer requirements.

3.11 TOLERANCES

A. Maximum Variation of Surface Flatness: 1/4 inch in 10 ft.

B. Maximum Variation From True Position: 1/4 inch.

3.12 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 01 4000 - Quality Requirements.
   1. Provide free access to concrete operations at project site and cooperate with appointed firm.
   2. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of concrete operations.

B. Compressive Strength Tests: ASTM C39/C39M; for each test, mold and cure three concrete test cylinders. Obtain test samples for every 100 cu yd or less of each class of concrete placed.
   1. Take one additional test cylinder during cold weather concreting, cured on job site under same conditions as concrete it represents.
   2. Perform one slump test for each set of test cylinders taken.

C. Maintain records of placed concrete items. Record date, location of pour, quantity, air temperature, and test samples taken.

3.13 PROTECTION

A. Immediately after placement, protect pavement from premature drying, excessive hot or cold temperatures, and mechanical injury.

B. Do not permit pedestrian traffic over pavement for 7 days minimum after finishing.

END OF SECTION

SECTION 32 1726

TACTILE WARNING SURFACING

PART 1 GENERAL

1.01 SECTION INCLUDES

1.02 RELATED REQUIREMENTS

A. Section 32 1313 - Concrete Paving: Concrete sidewalks.

1.03 REFERENCE STANDARDS

A. ATBCB PROWAG - Proposed Accessibility Guidelines for Pedestrian Facilities in the Public Right-of-Way; 2011.

1.04 SUBMITTALS

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

B. Product Data: Submit manufacturer's product data, standard details, details specific to this project; written installation and maintenance instructions.

C. Shop Drawings: Submit plan and detail drawings. Indicate:
   1. Locations on project site. Demonstrate compliance with referenced accessibility standards.
   2. Sizes and layout.
   3. Pattern spacing and orientation.
   4. Attachment and fastener details, if applicable

PART 2 PRODUCTS

2.01 MANUFACTURERS

2.02 TACTILE AND DETECTABLE WARNING DEVICES

2.03 ACCESSORIES

PART 3 EXECUTION

3.01 EXAMINATION

A. When installation location is near site boundary or property line, verify required location using property survey.

B. Verify that work area is ready to receive work:
   1. If existing conditions are not as required to properly complete the work of this section, notify Architect.
   2. Do not proceed with installation until deficiencies in existing conditions have been corrected.

C. Verify that dimensions, tolerances, and attachment methods for work in this section are properly coordinated with other work on site.

3.02 INSTALLATION, GENERAL

A. Install in accordance with manufacturer's written instructions.
   1. Do not install damaged, warped, bowed, dented, abraded, or otherwise defective units.
   2. Do not install when ambient or substrate temperature has been below 40 degrees F during the preceding 8 daylight hours.

B. Field Adjustment:
   1. Cut units to size and configuration shown on drawings.
   2. Do not cut plastic tiles to less than 9 inches wide in any direction.
   3. Locate relative to curb line in compliance with ATBCB PROWAG, Sections 304 and 305.
   4. Orient so dome pattern is aligned with the direction of ramp.
   5. Align truncated dome pattern between adjacent units.

C. Install units fully seated to substrate, square to straight edges and flat to required slope.

D. Align units so that tops of adjacent units are flush and joints between units are uniform in width.

3.03 CLEANING PLASTIC UNITS

A. Remove protective plastic sheeting within 24 hours of installation.

B. Remove excess sealant or adhesive from joints and edges.

C. Clean four days prior to date of scheduled inspection.

3.04 PROTECTION

A. Protect installed units from traffic, subsequent construction operations or other imposed loads until concrete is fully cured.

B. Touch-up, repair or replace damaged products prior to Date of Substantial Completion.

END OF SECTION

SECTION 32 3134

PARKING ACCESS CONTROL AND TICKETING EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Security gates and barriers.

B. Parking ticket dispenser

C. Parking ticket receiving / payment device

D. Parking Automatic Pay Station

E. Controls and related wiring.

F. Parking Management Software and Web Validation Software System

1.02 RELATED REQUIREMENTS

A. Section 26 0533.13 - Conduit for Electrical Systems: Empty conduit between system components.

B. Section 26 0583 - Wiring Connections: Electrical power connections to the hydraulic power unit and controls.

C. Section 31 2316 - Excavation: Excavating for footings, and utility trenching.

D. Section 32 1216 - Asphalt Paving: Installation of adjacent paved surfaces.

E. Section 32 1313 - Concrete Paving: Installation of adjacent paved surfaces.

1.03 REFERENCE STANDARDS

A. ASTM F2200 - Standard Specification for Automated Vehicular Gate Construction; 2014.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate installation of units with size, location and installation of service utilities.

B. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of work of this section; require attendance by affected installers.

C. Sequencing: Ensure that utility connections are completed in an orderly and expeditious manner.

1.05 SUBMITTALS

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

B. Shop Drawings: Provide detailed drawings showing:

1. Layout and overall dimensions of each major element of the parking ticketing and control access equipment, including the hydraulic power unit and operator control panels, if applicable.
2. Foundation and anchoring requirements of the barrier equipment.
3. Hydraulic schematic drawing showing size and number of hoses required to run between the barrier device and the hydraulic power unit.
4. Electrical schematic including associated wiring, showing electrically connected components, including interface points for connection to equipment; indicate minimum conduit size and number of wires required to run between each component of the barrier equipment.
5. Schematic drawings of the entire parking access and ticketing system, with manufacturer supplied equipment connected and integrated.

C. Maintenance Contracts.

D. Project Record Documents: After completion of field tests, provide updated drawings, showing exactly where equipment and controls are installed.

E. Operation and Maintenance Data.

F. Software: Copy of software required for operation of products specified under this section.

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. Installer's Qualifications: Company specializing in performing the work of this section with minimum 5 years of experience.

C. Copies of Documents at Project Site: Maintain at the project site a copy of each referenced document that prescribes execution requirements.

1.07 DELIVERY, STORAGE AND HANDLING

A. Store materials in a manner to ensure proper ventilation and drainage. Protect against damage, weather, vandalism and theft.

1.08 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a one year period after Date of Substantial Completion.

C. Provide one year manufacturer warranty for materials and workmanship.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Parking garage access and security control equipment system: Basis-of-Design Product: Subject to compliance with requirements, provide equipment by TIBA Parking Systems as appended to this section or comparable product another approved manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verification of Conditions:
   1. Verify location of existing utilities, grades and conditions of substrate.
   2. Verify existing vehicle detector loops, including their size, geometry and wiring.
   3. Verify integration requirements with other site security equipment including but not limited to card readers, tire puncture devices, gates and other automated barrier systems.

3.02 PREPARATION

A. Protect existing work from damage due to installation of this work.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

3.04 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

3.05 SYSTEM STARTUP

A. Provide manufacturer's field representative to observe systems startup.

B. Prepare and start equipment in accordance with manufacturers' instructions and recommendations.

C. Adjust for proper operation within manufacturer's published tolerances.

3.06 CLEANING

A. Touch up scratched surfaces using materials recommended by manufacturer. Match touchup paint color with barrier finish.

3.07 CLOSEOUT ACTIVITIES

A. See Section 01 7800 - Closeout Submittals, for closeout submittals.

B. See Section 01 7900 - Demonstration and Training, for additional requirements.

C. Demonstrate proper operation of equipment to Owner's designated representative.

D. Demonstration: Demonstrate operation of the barrier to Owner's personnel.
   1. Use operation and maintenance data as reference during demonstration.
   2. Briefly describe function, operation, and maintenance of each component.

E. Training: Train Owner's personnel on operation and maintenance of the barrier.
   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. Location: At project site.

3.08 PROTECTION

A. Protect installed units from subsequent construction operations.

3.09 MAINTENANCE

A. See Section 01 7000 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.

B. Provide a separate maintenance contract for specified maintenance service.

END OF SECTION

SECTION 32 9300
PLANTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Topsoil bedding.

B. New trees, plants, and ground cover.

C. Relocated trees, plants, and ground cover.

D. Grass and groundcover

E. Mulch and Fertilizer.

F. Maintenance.

1.02 RELATED REQUIREMENTS

A. Section 31 2200 - Grading: Topsoil material.

B. Section 31 2323 - Fill: Topsoil material.

1.03 DEFINITIONS

A. Weeds: Include Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Bermuda Grass, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Perennial Sorrel, and Brome Grass.

B. Plants: Living trees, plants, and ground cover specified in this Section, and described in ANSI Z60.1.

1.04 REFERENCE STANDARDS

A. ANSI/ANLA Z60.1 - American National Standard for Nursery Stock; 2004.

1.05 SUBMITTALS

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

B. Submit list of plant life sources.

1.06 QUALITY ASSURANCE

A. Nursery Qualifications: Company specializing in growing and cultivating the plants with three years documented experience.

B. Installer Qualifications: Company specializing in installing and planting the plants with 5 years experience.

C. Maintenance Services: Performed by installer up until Substantial Completion.

1.07 REGULATORY REQUIREMENTS

A. Comply with regulatory agencies for fertilizer and herbicide composition.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.

B. Protect and maintain plant life until planted.

C. Deliver plant life materials immediately prior to placement. Keep plants moist.

1.09 FIELD CONDITIONS

A. Do not install plant life when ambient temperatures may drop below 35 degrees F or rise above 90 degrees F.

B. Do not install plant life when wind velocity exceeds 30 mph.

1.10 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide one year warranty on all plantings and shrubbery commencing at time of acceptanceof lawns and plantings by the Architect.
   1. Replace dead and unhealthy plants within the warranty period.
   2. Warranty shall stipulate the Landscape contractor is responsible for maintaining all lawns and plantings for a period of 12 months or until they are established, whichever period is longer and final acceptance in writing from the Architect is delivered to the landscape contractor.
      a. This maintenance is to include mowing, fertilizing, treating adn watering. labor, equipment and materials are by the contractor (except for water provided by the Owner).

C. Warranty: Include coverage for one continuous growing season; commencing at date of Substantial Completion; replace dead or unhealthy plants.

PART 2 PRODUCTS

2.01 PLANTS

A. Plants: Species and size identified in plant schedule, grown in climatic conditions similar to those in locality of the work.

2.02 GRASS MATERIALS

A. Grass Seed: Provide fresh, clean, new-crop seed complying with tolerance for purity and germination established by Official Seed Analysts of North America. Provide seed mixture composed of grass species, proportions and minimum percentages of purity, germination, and maximum percentage of weed seed, as follows:
   1. Seed of grass species as follows, with not less than 95 percent germination, not less than 85 percent pure seed, and not more than 0.5 percent weed seed:
      a. 90% Tall Fescue Blend with 10% Merit Kentucky Bluegrass.

2.03 GROUND COVER

A. Provide plants established and well rooted in removable containers or integral peat pots and with not less than minimum number and length of runners required by ANSI Z60.1 for the pot size shown or listed.

2.04 WEED-CONTROL BARRIERS

A. Composite Fabric: Woven, needle-punched polypropylene substrate bonded to a nonwoven polypropylene fabric, 4.8 oz./sq. yd. (162 g/sq. m).

B. Install at all mulched beds.

2.05 SOIL MATERIALS

A. Topsoil: Type ____ as specified in Section 31 2323.

2.06 SOIL AMENDMENT MATERIALS

A. Commercial Fertilizer: Complete fertilizer of neutral character, with some elements derived from organic sources and containing following percentages of available plant nutrients:
   1. For trees and shrubs, provide fertilizer with not less than 5 percent total nitrogen, 10 percent available phosphoric acid and 5 percent soluble potash.
   2. For lawns, provide fertilizer with percentage of nitrogen required to provide not less than 1 pound of actual nitrogen per 1,000 sq. ft. of lawn area and not less than 4 percent phosphoric acid and 2 percent potassium. Provide nitrogen in a form that will be available to lawn during initial period of growth; at least 50 percent of nitrogen to be organic form.

B. Peat Moss: Shredded, loose, sphagnum moss; free of lumps, roots, inorganic material or acidic materials; minimum of 85 percent organic material measured by oven dry weight, pH range of 4 to 5; moisture content of 30 percent.

C. Bone Meal: Raw, finely ground, commercial grade, minimum of 3 percent nitrogen and 20 percent phosphorous.

D. Lime: Ground limestone, dolomite type, minimum 95 percent carbonates.

E. Water: Clean, fresh, and free of substances or matter that could inhibit vigorous growth of plants.

2.07 MULCH MATERIALS

2.08 ACCESSORIES

A. Wrapping Materials: Burlap.

B. Stakes: Softwood lumber, pointed end.

C. Cable, Wire, Eye Bolts and Turnbuckles: Non-corrosive, of sufficient strength to withstand wind pressure and resulting movement of plant life.

D. Plant Protectors: Rubber sleeves over cable to protect plant stems, trunks, and branches.

2.09 TOP SOIL MIX

A. A uniform mixture of 1 part peat and 3 parts topsoil by volume.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that prepared subsoil and planters are ready to receive work.

B. Saturate soil with water to test drainage.

C. Verify that required underground utilities are available, in proper location, and ready for use.

3.02 PLACING TOPSOIL

A. Spread topsoil to a minimum depth of 4 inches over area to be planted. Rake smooth.

B. Place topsoil during dry weather and on dry unfrozen subgrade.

C. Remove vegetable matter and foreign non-organic material from topsoil while spreading.

D. Grade topsoil to eliminate rough, low or soft areas, and to ensure positive drainage.

E. Install topsoil into pits and beds intended for plant root balls, to a minimum thickness of 6 inches.

3.03 FERTILIZING

A. Apply fertilizer in accordance with manufacturer's instructions.

B. Apply after initial raking of topsoil.

C. Mix thoroughly into upper 2 inches of topsoil.

D. Lightly water to aid the dissipation of fertilizer.

3.04 PLANTING

A. Set plants vertical.

B. Remove non-biodegradable root containers.

C. Set plants in pits or beds, partly filled with prepared plant mix, at a minimum depth of 6 inches under each plant. Remove burlap, ropes, and wires, from the root ball.

D. Place bare root plant materials so roots lie in a natural position. Backfill soil mixture in 6 inch layers. Maintain plant life in vertical position.

E. Saturate soil with water when the pit or bed is half full of topsoil and again when full.

3.05 SEEDING NEW LAWNS

A. Do not use wet seed or seed that is moldy or otherwise damaged in transit or storage.

B. Sow seed using a spreader or seeding machine. Do not seed when wind velocity exceeds 5 miles per hour. Distribute

C. Sow seed at rate of 4 pounds per 1,000 square feet.

D. Rake seed lightly into top 1/8 inch of soil, roll lightly, and water with a fine spray.

E. Protect seeded slopes against erosion with erosion netting or other methods acceptable to the Architect.

F. Protect seeded areas against erosion by spreading specified lawn mulch after completion of seeding operations. Spread uniformly to form a continuous blanket not less than 1-1/2 inches loose measurement over seeded areas.

1. Anchor mulch by spraying with asphalt emulsion at the rate of 10 to 13 gallons per 1000 sq. ft. Take precautions to prevent damage or staining of construction or other plantings adjacent to mulched areas.

3.06 HYDROSEEDING NEW LAWNS

A. Hydro-seeding of new lawns is acceptable.

B. Mix specified seed, fertilizer, and pulverized mulch in water, using equipment specifically designed for hydroseed application. Continue mixing until uniformly blended into homogenous slurry suitable for hydraulic application.

C. Apply slurry uniformly to all areas to be seeded. Rate of application as required to obtain specified seed sowing rate.

3.07 PLANTING GROUND COVER

A. Space ground cover plants as indicated or scheduled.

B. Dig holes large enough to allow for spreading of roots and backfill with planting soil. Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water. Water thoroughly after planting, taking care not to cover crowns of plants with wet soils.

C. Mulch areas between ground cover plants; place not less than 2 inches thick.

3.08 INSTALLATION OF ACCESSORIES

3.09 MAINTENANCE

A. Provide maintenance at no extra cost to Owner; Owner will pay for water.

B. Maintain plant life for three months after Date of Substantial Completion.

C. Irrigate sufficiently to saturate root system and prevent soil from drying out.

D. Remove dead or broken branches and treat pruned areas or other wounds.

E. Neatly trim plants where necessary.

F. Immediately remove clippings after trimming.

G. Control growth of weeds. Apply herbicides in accordance with manufacturer's instructions.

H. Control insect damage and disease. Apply pesticides in accordance with manufacturers instructions.

I. Remedy damage from use of herbicides and pesticides.

J. Replace mulch when deteriorated.

K. Maintain wrappings, guys, turnbuckles, and stakes. Adjust turnbuckles to keep guy wires tight. Repair or replace accessories when required.

END OF SECTION

SECTION 33 0513
MANHOLES AND STRUCTURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Monolithic concrete manholes with masonry transition to lid frame, covers, anchorage, and accessories.

B. Modular precast concrete manhole sections with tongue-and-groove joints with masonry transition to lid frame, covers, anchorage, and accessories.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete.

1.03 REFERENCE STANDARDS

A. ACI 530/530.1/ERTA - Building Code Requirements and Specification for Masonry Structures and Related Commentaries; 2011.

B. ASTM A48/A48M - Standard Specification for Gray Iron Castings; 2003 (Reapproved 2012).

C. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2015.

D. ASTM C478 - Standard Specification for Circular Precast Reinforced Concrete Manhole Sections; 2015.

E. ASTM C478M - Standard Specification for Circular Precast Reinforced Concrete Manhole Sections [Metric]; 2015.

F. ASTM C923 - Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals; 2008 (Reapproved 2013).

G. ASTM C923M - Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals [Metric]; 2008b (Reapproved 2013).

1.04 SUBMITTALS

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

B. Shop Drawings: Indicate manhole locations, elevations, piping sizes and elevations of penetrations.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1.06 FIELD CONDITIONS

A. Cold and Hot Weather Requirements: Comply with requirements of ACI 530/530.1/ERTA or applicable building code, whichever is more stringent.

PART 2 PRODUCTS

2.01 MATERIALS

A. Manhole Sections: Reinforced precast concrete in accordance with ASTM C478 (ASTM C478M), with resilient connectors complying with ASTM C923 (ASTM C923M).

B. Concrete: As specified in Section 03 3000.

C. Concrete Reinforcement: As specified in Section 03 3000.

2.02 COMPONENTS

A. Lid and Frame: ASTM A48/A48M, Class 30B Cast iron construction, machined flat bearing surface, removable lockable lid, closed lid design; live load rating of ____ psf; sealing gasket; lid molded with identifying name. Provide _____ manufactured by _____.

B. Manhole Steps: Formed galvanized steel rungs; 3/4 inch diameter. Formed integral with manhole sections.

C. Strap Anchors: Bent steel shape, __ x __ inch size x ____ inch thick, galvanized to ASTM A123/A123M, Grade specified for applicable material category.

2.03 CONFIGURATION

A. Shaft Construction: Concentric with concentric cone top section; lipped male/female dry joints; sleeved to receive pipe sections.

B. Shape: Cylindrical.

C. Clear Inside Dimensions: As indicated.

D. Design Depth: As indicated.

E. Clear Lid Opening: As indicated.

F. Pipe Entry: Provide openings as indicated.

G. Steps: As indicated.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify items provided by other sections of Work are properly sized and located.

B. Verify that built-in items are in proper location, and ready for roughing into Work.

C. Verify excavation for manholes is correct.

3.02 PREPARATION

A. Coordinate placement of inlet and outlet pipe or duct sleeves required by other sections.

3.03 MANHOLES

A. Place concrete base pad, trowel top surface level.

B. Place manhole sections plumb and level, trim to correct elevations, anchor to base pad.

C. Form and place manhole cylinder plumb and level, to correct dimensions and elevations. As work progresses, build in fabricated metal items.

D. Cut and fit for pipe.

E. Grout base of shaft sections to achieve slope to exit piping. Trowel smooth. Contour as required.

F. Set cover frames and covers level without tipping, to correct elevations.

G. Coordinate with other sections of work to provide correct size, shape, and location.

END OF SECTION

SECTION 33 1416

SITE WATER UTILITY DISTRIBUTION PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pipe and fittings for site water lines including domestic water lines and fire water lines.

B. Valves, Fire hydrants, and Domestic water hydrants.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Concrete for thrust restraints.

B. Section 09 9113 - Exterior Painting.

C. Section 31 2316 - Excavation: Excavating of trenches.

D. Section 31 2323 - Fill: Bedding and backfilling.

E. Section 33 0110.58 - Disinfection of Water Utility Piping Systems: Disinfection of site service utility water piping.

1.03 REFERENCE STANDARDS

A. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2011.

B. ASME B16.4 - Gray Iron Threaded Fittings: Classes 125 and 250; 2011.

C. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2014.

D. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts; 2015.

E. ASTM A563M - Standard Specification for Carbon and Alloy Steel Nuts [Metric]; 2007.

F. ASTM D3035 - Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter; 2015.

G. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems; 2010.

H. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings; 2012.

I. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast; 2009.

J. AWWA C205 - Cement-Mortar Protective Lining and Coating for Steel Water Pipe, 4 in. (100 mm) and Larger - Shop Applied; 2012.

K. AWWA C206 - Field Welding of Steel Water Pipe; 2011.

L. AWWA C208 - Dimensions for Fabricated Steel Water Pipe Fittings; 2012.

M. AWWA C209 - Cold-Applied Tape Coatings for Steel Water Pipe, Special Sections, Connections, and Fittings; 2013.

N. AWWA C500 - Metal-Seated Gate Valves for Water Supply Service; 2009.

O. AWWA C504 - Rubber-Seated Butterfly Valves 3 In. (75 mm) Through 72 In. (1,800 mm); 2010.

P. AWWA C508 - Swing-Check Valves for Waterworks Service, 2 In. (50 mm) Through 24 In. (600 mm) NPS; 2011.

Q. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances; 2010.

R. AWWA C602 - Cement-Mortar Lining of Water Pipelines in Place, 4 In. (100 mm) and Larger; 2011.

S. AWWA C901 - Polyethylene (PE) Pressure Pipe and Tubing, 1/2 In. (13 mm) Through 3 In. (76 mm), for Water Service; 2008.

T. AWWA M11 - Steel Water Pipe - A Guide For Design and Installation; 2004 w/Errata.

1.04 SUBMITTALS

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

B. Product Data: Provide data on pipe materials, pipe fittings, valves and accessories.

1.05 QUALITY ASSURANCE

A. Perform Work in accordance with utility company requirements.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store valves in shipping containers with labeling in place.

PART 2 PRODUCTS

2.01 WATER PIPE

A. Steel Pipe: Welded or Seamless complying with AWWA C200.
   1. Underground Pipe and Fittings: Cement-mortar lining and cement-mortar coating.
   2. Fittings: AWWA C208.
      a. Construct of same material as pipe with standard tube turns or segmentally welded sections to accommodate the type of couplings or joints provided.
      b. Thickness Rating: Comply with not less than specified pipe thickness and calculated pipe pressure rating.
      c. Mechanically or manually wrap, line, and coat all fittings with same protective materials and applications used for pipe.
   3. Pipe manufacturer to calculate and determine wall thickness and fittings in the following manner:
      a. Design Parameters:
         1) Pressure Rating: _____ psi.
         2) Earth Cover: 3 ft.
         3) Water Hammer: 40 percent of pressure rating.
         4) Live Load: H20 truck loading in accordance with AASHTO HB.
         5) Allowable Deflection: 2 percent of nominal pipe diameter.
      b. Comply with design procedures outlined in AWWA M11.
   4. Joints:
      a. Rubber Gasketed Bell and Spigot: Provide pipe manufacturer's standard design, meeting the requirements of AWWA C200.
      b. Welded: Provide electrodes complying with AWWA C206.
      c. Sleeve Type Mechanical Coupled:
         1) Designed to couple plain-end piping by compression of a ring gasket at each end of the adjoining pipe sections and provide for confinement and compression of gaskets.
         2) Coupling Assembly:
            (a) One steel middle ring, flared or beveled at each end, providing a gasket seat and two steel or malleable iron follower rings, providing for confinement and compression of the gaskets.
            (b) Provide middle ring and follower rings consisting of true, circular sections, free from irregularities, flat spots, and surface defects.
            (c) Two resilient and tapered rubber gaskets, designed for resistance to set after installation.
            (d) Bolts and nuts to draw the follower rings toward each other to compress the gaskets.
         3) Bolts: Track head conforming to ASTM A307, Grade A, with nuts conforming to ASTM A563 and ASTM A563M, Grade A.
         4) Coupling Strength: Not less than adjoining pipeline.

B. Ductile Iron Pipe: AWWA C151:
   1. Fittings: Ductile iron, standard thickness.
   2. Joints: AWWA C111/A21.11, rubber gasket with rods.
   3. Jackets: AWWA C105/A21.5 polyethylene jacket.

C. Polyethylene Pipe: ASTM D3035, for 45 psig pressure rating:
   1. Fittings: AWWA C901, molded or fabricated.
   2. Joints: Compression.

D. Trace Wire: Magnetic detectable conductor, clear plastic covering, imprinted with "Water Service" in large letters.

2.02 VALVES

A. Valves: Manufacturer's name and pressure rating marked on valve body.

B. Gate Valves Up To 3 Inches:
   1. Brass or Bronze body, non-rising stem, inside screw, single wedge or disc, compression ends, with control rod, post indicator, valve key, and extension box.

C. Gate Valves 3 Inches and Over:
   1. AWWA C500, iron body, bronze trim, non-rising stem with square nut, single wedge, flanged ends, control rod, post indicator, valve key, and extension box.

D. Ball Valves Up To 2 Inches:
   1. Brass body, Teflon coated brass ball, rubber seats and stem seals, Tee stem pre-drilled for control rod, AWWA inlet end, compression outlet with electrical ground connector, with control rod, valve key, and extension box.

E. Swing Check Valves From 2 Inches to 24 Inches:
   1. AWWA C508, iron body, bronze trim, 45 degree swing disc, renewable disc and seat, flanged ends.

F. Butterfly Valves From 2 Inches to 24 Inches:
   1. AWWA C504, iron body, bronze disc, resilient replaceable seat, water or lug ends, ten position lever handle.

2.03 HYDRANTS

A. Hydrants: Type as required by utility company.

B. Hydrant Extensions: Fabricate in multiples of 6 inches with rod and coupling to increase barrel length.

C. Hose and Streamer Connection: Match sizes with utility company, two hose nozzles, one pumper nozzle.

D. Finish: Primer and two coats of enamel in color required by utility company.

2.04 BEDDING AND COVER MATERIALS

A. Bedding: As specified in Section 31 2316.13.

B. Cover: As specified in Section 31 2316.13.

2.05 ACCESSORIES

A. Concrete for Thrust Restraints: Concrete type specified in Section 03 3000.

B. Backflow Preventer: _____.

C. Meter: _____.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that building service connection and municipal utility water main size, location, and invert are as indicated.

3.02 PREPARATION

A. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, remove burrs.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare pipe connections to equipment with flanges or unions.

3.03 TRENCHING

A. See the sections on excavation and fill for additional requirements.

B. Hand trim excavation for accurate placement of pipe to elevations indicated.

C. Form and place concrete for pipe thrust restraints at each change of pipe direction. Place concrete to permit full access to pipe and pipe accessories. Provide thrust restraint bearing as required by local utility and fire department.

D. Backfill around sides and to top of pipe with cover fill, tamp in place and compact, then complete backfilling.

3.04 INSTALLATION - PIPE

A. Maintain separation of water main from sewer piping in accordance with applilable codes.

B. Group piping with other site piping work whenever practical.

C. Establish elevations of buried piping to ensure not less than 3' ft of cover.

D. Install ductile iron piping and fittings to AWWA C600.

E. Route pipe in straight line.

F. Install pipe to allow for expansion and contraction without stressing pipe or joints.

G. Slope water pipe and position drains at low points.

3.05 INSTALLATION - STEEL PIPE

A. Make and assemble rubber-gasketed, bell-and-spigot joints in accordance with manufacturer's recommendations.

B. Make welded joints in accordance with AWWA C206 and install in accordance with AWWA M11, Chapter 12, Transportation, Installation, and Testing.

C. Assemble sleeve-type mechanical coupling joints in accordance with manufacturer's recommendations.

D. Make flanged joints water-tight without undue strain on other material and equipment, using right-sized bolts, and parallel to adjoining flanges.

E. Make grooved joints with equipment designed and produced by the manufacturer of grooved joint couplings and assemble in accordance with the coupling manufacturer's recommendations.

F. Make shouldered type joints with the specified coupling, connect with shouldered ends, and assemble in accordance with the couplings manufacturer's recommendations.

G. Make insulating joints with specified materials and assemble for flanged joints with bolts, with full size insulating sleeves for bolt holes, and no metal-to-metal contact with dissimilar metals after assembly.

H. After installation, line piping in-place with cement mortar in accordance with AWWA C602.

I. Finish joints on piping with cement-mortar lining in accordance with AWWA C205.

J. Finish joints on piping with coal-tar enamel, coal-tar epoxy, or _____ coating by cleaning, priming, coating, and wrapping with cold-applied tape coating in accordance with AWWA C209.

K. Maximum, allowable offsets for bell-and-spigot rubber-gasket joints, from a straight line or grade, as required by vertical curves, horizontal curves, or offsets, shall be five degrees or less in accordance with manufacturer's recommendations.

L. Form short-radius curves and closures with short pipe lengths or specified, fabricated specials.

3.06 INSTALLATION - VALVES AND HYDRANTS

A. Set valves on solid bearing.

B. Center and plumb valve box over valve. Set box cover flush with finished grade.

C. Set hydrants plumb; locate pumper nozzle perpendicular to and facing roadway.

D. Set hydrants to grade, with nozzles at least 20 inches above ground.

E. Locate control valve 4 inches away from hydrant.

F. Provide a drainage pit 36 inches square by 24 inches deep filled with 2 inches washed gravel. Encase elbow of hydrant in gravel to 6 inches above drain opening. Do not connect drain opening to sewer.

G. Paint hydrants in accordance with Section 09 9113.

3.07 SERVICE CONNECTIONS

A. Provide water service to utility company requirements with reduced pressure backflow preventer and water meter with bypass valves and sand strainer.

B. Provide sleeve in retaining wall for service main. Support with reinforced concrete bridge. Calk enlarged sleeve watertight.

C. Anchor service main to interior surface of foundation wall.

D. Provide 18 gage, 0.0478 inch galvanized sheet metal sleeve surrounding service main to 6 inches above floor and 6 feet minimum below grade. Size for 2 inches minimum of glass fiber insulation stuffing.

3.08 FIELD QUALITY CONTROL

A. Perform field inspection and testing in accordance with Section 01 4000.

B. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.

END OF SECTION

SECTION 33 3113

SITE SANITARY SEWERAGE GRAVITY PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Sanitary sewerage drainage piping, fittings, and accessories.

B. Connection of building sanitary drainage system to municipal sewers.

C. Cleanout access.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Concrete for cleanout base pad construction.

B. Section 31 2316 - Excavation: Excavating of trenches.

C. Section 31 2316.13 - Trenching: Excavating, bedding, and backfilling.

D. Section 31 2323 - Fill: Bedding and backfilling.

E. Section 33 0513 - Manholes and Structures.

1.03 DEFINITIONS

A. Bedding: Fill placed under, beside and directly over pipe, prior to subsequent backfill operations.

1.04 REFERENCE STANDARDS

A. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings; 2016.

B. ASTM A746 - Standard Specification for Ductile Iron Gravity Sewer Pipe; 2009 (Reapproved 2014).

C. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings; 2014.

D. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120; 2015.

E. ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications; 2014.

F. ASTM D2729 - Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 2011.

G. ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 2015.

H. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings; 2012.

1.05 SUBMITTALS

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

B. Product Data: Provide data indicating pipe, pipe accessories.

PART 2 PRODUCTS

2.01 SEWER PIPE MATERIALS

A. Provide products that comply with applicable code(s).

B. Cast Iron Soil Pipe: ASTM A74, service type, inside nominal diameter of ____ inches, hub and spigot end.

C. Joint Seals for Cast Iron Pipe: ASTM C564 rubber gaskets.

D. Ductile Iron Pipe: ASTM A746, Pressure Class 350, with asphaltic lining, inside nominal diameter of ____ inches, bell and spigot end.

E. Joint Seals for Ductile Iron Pipe: AWWA C111/A21.11 rubber gaskets.

F. Plastic Pipe: ASTM D1785, Schedule 40, Poly(Vinyl Chloride) (PVC) material; inside nominal diameter of ____ inches, bell and spigot style solvent sealed joint end.

G. Fittings: Same material as pipe molded or formed to suit pipe size and end design, in required tee, bends, elbows, cleanouts, reducers, traps and other configurations required.

2.02 CLEANOUT MANHOLE

A. Lid and Frame: Cast iron construction, hinged lid.

B. Shaft Construction and Concentric Cone Top Section: Reinforced precast Concrete pipe sections, lipped male/female dry joints, cast steel ladder rungs into shaft sections at 12 inches; nominal shaft diameter of 36 inches.

C. Base Pad: Cast-in-place concrete of type specified in Section 03 3000, levelled top surface to receive concrete shaft sections, sleeved to receive sanitary sewer pipe sections.

2.03 BEDDING AND COVER MATERIALS

A. Pipe Bedding Material: As specified in Section 31 2323.

B. Pipe Cover Material: As specified in Section 31 2323.

PART 3 EXECUTION

3.01 GENERAL

A. Perform work in accordance with applicable code(s).

3.02 TRENCHING

A. See Section 31 2316.13 for additional requirements.

B. Hand trim excavation for accurate placement of pipe to elevations indicated.

C. Backfill around sides and to top of pipe with cover fill, tamp in place and compact, then complete backfilling.

3.03 INSTALLATION - PIPE

A. Verify that trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated on layout drawings.

B. Install pipe, fittings, and accessories in accordance with manufacturer's instructions. Seal watertight.
   1. Plastic Pipe: Also comply with ASTM D2321.

C. Lay pipe to slope gradients noted on layout drawings; with maximum variation from true slope of 1/8 inch in 10 feet.

D. Connect to building sanitary sewer outlet and municipal sewer system, through installed sleeves.

3.04 INSTALLATION - CLEANOUTS

A. Form bottom of excavation clean and smooth to correct elevation.

B. Form and place cast-in-place concrete base pad, with provision for sanitary sewer pipe end sections.

C. Establish elevations and pipe inverts for inlets and outlets as indicated.

D. Mount lid and frame level in grout, secured to top cone section to elevation indicated.

3.05 PROTECTION

A. Protect pipe and bedding cover from damage or displacement until backfilling operation is in progress.

END OF SECTION

SECTION 33 4100
SUBDRAINAGE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Building Perimeter, Retaining Wall, and Under-Slab Drainage Systems.

1.02 REFERENCE STANDARDS

A. ASTM D2729 - Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 2011.

PART 2 PRODUCTS

2.01 PIPE MATERIALS

A. Polyvinyl Chloride Pipe: ASTM D2729; plain end, 4 inch inside diameter; with required fittings.

B. Corrugated Plastic Tubing: Flexible type; 4 inch diameter, with required fittings.

C. Use perforated pipe at subdrainage system; unperforated through sleeved walls.

2.02 AGGREGATE AND BEDDING

A. Filter Aggregate and Bedding Material: Granular fill as specified in Section 31 2323.

B. Filter Sand and Bedding Material: Sand as specified in Section 31 2323.

2.03 ACCESSORIES

A. Pipe Couplings: Solid plastic.

B. Joint Covers: No. 15 asphalt saturated roofing felt.

C. Filter Fabric: Water pervious type, black fiberglass.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated on layout Drawings.

3.02 PREPARATION

A. Hand trim excavations to required elevations. Correct over-excavation with _____.

B. Remove large stones or other hard matter that could damage drainage piping or impede consistent backfilling or compaction.

3.03 INSTALLATION

A. Install and join pipe and pipe fittings in accordance with pipe manufacturer's instructions.

B. Place drainage pipe on clean cut subsoil.

C. Lay pipe to slope gradients noted on Drawings; with maximum variation from true slope of 1/8 inch in 10 feet.

D. Place pipe with perforations facing down. Mechanically join pipe ends.

E. Install pipe couplings.

F. Install filter aggregate at sides, over joint covers and top of pipe. Provide top cover compacted thickness of 12 inches.

G. Place filter fabric over levelled top surface of aggregate cover prior to subsequent backfilling operations.

H. Place aggregate in maximum 4 inch lifts, consolidating each lift.

I. Refer to Section 31 2323 for compaction requirements. Do not displace or damage pipe when compacting.

J. Connect to storm sewer system with unperforated pipe, through installed sleeves.

K. Coordinate the Work with connection to municipal sewer utility service, and trenching.

3.04 FIELD QUALITY CONTROL

A. Section 01 4000 - Quality Requirements: Field inspection and testing.

B. Request inspection prior to and immediately after placing aggregate cover over pipe.

3.05 PROTECTION

A. Protect pipe and aggregate cover from damage or displacement until backfilling operation begins.

END OF SECTION

SECTION 33 4211
STORMWATER GRAVITY PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Storm drainage piping, fittings, and accessories.

B. Connection of drainage system to municipal sewers.

C. Catch basins, Paved area drainage, Site surface drainage, and Detention basin.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Concrete for cleanout base pad construction.

B. Section 31 2316 - Excavation: Excavating of trenches.

C. Section 31 2316.13 - Trenching: Excavating, bedding, and backfilling.

D. Section 31 2323 - Fill: Bedding and backfilling.

E. Section 33 0513 - Manholes and Structures.

1.03 DEFINITIONS

A. Bedding: Fill placed under, beside and directly over pipe, prior to subsequent backfill operations.

1.04 REFERENCE STANDARDS

A. AASHTO M 36 - Standard Specification for Corrugated Steel Pipe, Metallic-Coated, for Sewers and Drains; 2014.

B. AASHTO M 252 - Standard Specification for Corrugated Polyethylene Drainage Pipe; 2009.

C. AASHTO M 294 - Standard Specification for Corrugated Polyethylene Pipe, 300- to 1500 MM (12- to 60-in.) Diameter; 2013.

D. ASTM C76 - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe; 2015.

E. ASTM C76M - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe (Metric); 2014.

F. ASTM C443 - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets; 2012.

G. ASTM C443M - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets (Metric); 2011.

H. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120; 2015.

I. ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications; 2014.

J. ASTM D2729 - Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 2011.

K. ASTM D3350 - Standard Specification for Polyethylene Plastics Pipe and Fittings Material; 2014.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate the installation of downspouts with size, location and installation of service utilities.

B. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

C. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.

1.06 SUBMITTALS

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

B. Product Data: Provide data indicating pipe, pipe accessories, and _____.

1.07 REGULATORY REQUIREMENTS

A. Conform to applicable code for materials and installation of the Work of this section.

PART 2 PRODUCTS

2.01 SEWER PIPE MATERIALS

A. Provide products that comply with applicable code(s).

B. Concrete Pipe: Reinforced, ASTM C76 (ASTM C76M), Class II with Wall type A; mesh reinforcement; inside nominal diameter of ____ inches, bell and spigot end joints.

C. Reinforced Concrete Pipe Joint Device: ASTM C443 (ASTM C443M) rubber compression gasket joint.

D. Plastic Pipe: ASTM D1785, Schedule 40, Poly Vinyl Chloride (PVC) material; inside nominal diameter of ____ inches, bell and spigot style solvent sealed joint end.

2.02 PIPE ACCESSORIES

A. Pipe Joints: Mechanical clamp ring type, stainless steel expanding and contracting sleeve, neoprene ribbed gasket for positive seal.

B. Fittings: Same material as pipe molded or formed to suit pipe size and end design, in required tee, bends, elbows, cleanouts, reducers, traps and other configurations required.

C. Filter Fabric: Non-biodegradable, non-woven, geotextile fabric. Provide US 115NW manufactured by US Fabrics, Inc..

2.03 CATCH BASIN, TRENCH DRAIN, CLEANOUT, AND AREA DRAIN COMPONENTS

A. Lids and Drain Covers: Cast iron, hinged to cast iron frame.
   1. Catch Basin:
      a. Lid Design: Linear grill.
   2. Provide 4" diameter slotted polyethylene finger drains minimum 10 long at each side of catch basin vaults.

2.04 BEDDING AND COVER MATERIALS

A. Bedding: As specified in Section 31 2323.

B. Cover: As specified in Section 31 2316.13.

PART 3 EXECUTION

3.01 TRENCHING

A. See Section 31 2316.13 for additional requirements.

B. Hand trim excavation for accurate placement of pipe to elevations indicated.

C. Backfill around sides and to top of pipe with cover fill, tamp in place and compact, then complete backfilling.

3.02 INSTALLATION - PIPE

A. Verify that trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated on layout drawings.

B. Install pipe, fittings, and accessories in accordance with manufacturer's instructions. Seal watertight.
   1. Plastic Pipe: Also comply with ASTM D2321.

C. Lay pipe to slope gradients noted on layout drawings; with maximum variation from true slope of 1/8 inch in 10 feet.

D. Connect to building storm drainage system, foundation drainage system, and utility/municipal sewer system.

3.03 INSTALLATION - CATCH BASINS, TRENCH DRAINS AND CLEANOUTS

A. Form bottom of excavation clean and smooth to correct elevation.

B. Form and place cast-in-place concrete base pad, with provision for sanitary sewer pipe end sections.

C. Level top surface of base pad; sleeve concrete shaft sections to receive storm sewer pipe sections.

D. Establish elevations and pipe inverts for inlets and outlets as indicated.

E. Mount lid and frame level in grout, secured to top cone section to elevation indicated.

3.04 PROTECTION

A. Protect pipe and bedding cover from damage or displacement until backfilling operation is in progress.

END OF SECTION