PROJECT SPECIFICATIONS

Reconstruction of HOMINY HILL GOLF CENTER
92 Mercer Road
Colt's Neck, New Jersey 07722

NETTA ARCHITECTS
1084 Route 22 West
Mountainside, New Jersey 07092

ISSUE FOR BID
AUGUST 2020
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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Work covered by the Contract Documents.
   2. Type of the Contract.
   3. Use of premises.
   4. Owner-furnished products.
   5. Work restrictions.

1.3 PROJECT INFORMATION

A. Project Identification: Reconstruction Of Hominy Hill Golf Center
   1. Project Location: 92 Mercer Road, Colt’s Neck, NJ 07722

B. Owner: County of Monmouth

C. Architect: Netta Architects, LLC., 1084 Route 22 West, Mountainside, NJ 07092

D. Civil Engineer: Maser Consulting P.A., 331 Newman Springs Road, Suite 203, Red Bank, NJ 07701

E. MEPFp, Engineer: Robert Director Associates Consulting Engineers, 19 West 44 Street, New York, NY 10036

F. Structural Engineer: Ruther + Bowen: 326 Ward Street, Scranton, PA 18512

G. Food Service specialists: Raymond & Raymond Associates, 51 Greenwhich Avenue, Goshen, NY 10924

H. Construction Manager: Epic Management: 136 Eleventh Street, Piscataway, NJ 08854
   1. Construction Manager has been engaged for this Project to serve as an advisor to Owner and to provide assistance in administering the Contract for construction between Owner and Contractor, according to a separate contract between Owner and Construction Manager.

1.4 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work consists of the following:
   1. The Project consists of all work associated with the Interior and Exterior Reconstruction of the Golf Center including but not limited to new and refurbished elements. Exterior work includes,
but is not limited to, selective demolition, exterior cladding, windows, roofing, two story vestibule with a stair and elevator, new pro-shop vestibule.

2. Building service work includes, but is not limited to, selective demolition, upgrades to fire protection and new mechanical, plumbing and electrical systems and fixtures.

3. Interior work includes, but is not limited to, selective demolition, new partitions, interior finishes, structural modifications, kitchen and new basement access.

4. Site Work includes but is not limited to septic field, grading and sidewalk at new vestibule, new loop drive at front of building, grading and sidewalk at pro-shop entrance, parking layout modifications and new pump station building with associated grading.

1.5 TYPE OF CONTRACT

A. Project will be constructed under a single prime contract.

1.6 OWNER-FURNISHED PRODUCTS

A. Owner will furnish products indicated. The Work includes receiving, unloading, handling, storing, protecting, and installing Owner-furnished products and making building services connections.

B. Owner-Furnished Products:


1.7 USE OF PREMISES

A. General: Contractor shall have full use of Project site for construction operations during construction period. Contractor's use of Project site is limited only by Owner's right to perform work or to retain other contractors on portions of Project.

B. Use of Site: Limit use of premises to work in areas as indicated within the Contract limits. Do not disturb portions of Project site beyond areas in which the Work is indicated.

C. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weathertight condition throughout construction period. Repair damage caused by construction operations.

D. Condition of Existing Grounds: Maintain portions of existing grounds, landscaping, and hardscaping affected by construction operations throughout construction period. Repair damage caused by construction operations.

1.8 WORK RESTRICTIONS

A. On-Site Work Hours: Unless otherwise indicated, work shall be generally performed on the existing building during normal business working hours of 7:00 a.m. to 5:00 p.m., Monday through Friday, except as otherwise indicated.

1. Weekend Hours: As arranged with Owner.

2. Early Morning Hours: As arranged with Owner.

3. Other than emergency repair, the Contractor shall receive written approval from the Park System prior to proceeding with any on-site work during “off hours” (time not specified in these contract documents).
4. Unless prior written approval is obtained from the Owner, no on-site, regular work will be permitted on the following days:
   a. New Year's Day
   b. Martin Luther King, Jr. Day
   c. Presidents' Day
   d. Good Friday
   e. Memorial Day Observance
   f. Independence Day
   g. Labor Day
   h. Columbus Day Observance
   i. Election Day
   j. Veterans' Day
   k. Thanksgiving Day
   l. Day after Thanksgiving
   m. Christmas Day

B. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
   1. Notify Architect not less than two days in advance of proposed utility interruptions.
   2. Do not proceed with utility interruptions without Architect's written permission.

C. Nonsmoking Building: Smoking is not permitted within the building or within 25 feet of entrances, operable windows, or outdoor air intakes.

1.9 SPECIFICATION FORMATS AND CONVENTIONS

A. Specification Format: The Specifications are organized into Divisions and Sections using the CSI/CSC's "MasterFormat" numbering system.

   1. Section Identification: The Specifications use Section numbers and titles to help cross-referencing in the Contract Documents. Sections in the Project Manual are in numeric sequence; however, the sequence is incomplete because all available Section numbers are not used. Consult the table of contents at the beginning of the Project Manual to determine numbers and names of Sections in the Contract Documents.

   2. Division 01: Sections in Division 01 govern the execution of the Work of all Sections in the Specifications.

B. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

   1. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be inferred as the sense requires. Singular words shall be interpreted as plural, and plural words shall be interpreted as singular where applicable as the context of the Contract Documents indicates.

   2. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by Contractor. Occasionally, the indicative or subjunctive mood may be used in the Section Text for clarity to describe responsibilities that must be fulfilled indirectly by Contractor or by others when so noted.
a. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.

1.10 MISCELLANEOUS PROVISIONS

A. Sales Tax Exemption

1. The Contractor is hereby advised that this project is exempt from New Jersey Sales Tax. It shall be the Contractor’s responsibility to obtain the statutory sales tax exemption certificates. Exemption certificate number shall be placed on invoices for materials incorporated in work. N.J. Tax Exemption No. 69-0220842.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 010100
SECTION 012100 - ALLOWANCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements governing allowances.

B. Types of allowances include the following:

1. Lump-sum allowances.
2. Testing and inspecting allowances.
3. Contingency allowances.

C. Related Requirements:

1. Division 01 Section "Quality Requirements" for procedures governing the use of allowances for field testing by an independent testing agency.

D. The work included in any accepted allowance is to be completed within the original activity milestone dates stated in these documents, as accepted at time of award. No additional time will be awarded to the Contractor as the result of an allowance being utilized.

1.3 DEFINITIONS

A. Allowance is a quantity of work or dollar amount established in lieu of additional requirements, used to defer selection of actual materials and equipment to a later date when direction will be provided to Contractor. If necessary, additional requirements will be issued by Change Order.

B. It is to be clearly understood that the Allowances are to be used for work beyond the Contractor’s base scope of work and at the sole option of the Owner. It is the Contractor’s responsibility to perform all work required to comply with the requirements of the Contract Documents and to deliver a complete project without the use of any allowances.

1.4 SELECTION AND PURCHASE

A. At the earliest practical date after award of the Contract, notify the Construction Manager / Architect of the date when final selection, or purchase and delivery, of each product or system described by an allowance must be completed by the Owner to avoid delaying the Work.

B. At Construction Manager / Architect's request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.

C. Purchase products and systems selected by Architect from the designated supplier.
1.5 ACTION SUBMITTALS

A. Submit proposals for purchase of products or systems included in allowances in the form specified for Change Orders.

1.6 INFORMATIONAL SUBMITTALS

A. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.

B. Submit time sheets and other documentation to show labor time and cost for installation of allowance items that include installation as part of the allowance.

C. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

1.7 LUMP-SUM ALLOWANCES

A. Allowance shall include cost to Contractor of specific products and materials ordered by Owner or selected by Architect under allowance and shall include taxes, freight, and delivery to Project site.

B. Unless otherwise indicated, Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials ordered by Owner or selected by Architect under allowance shall be included as part of the Contract Sum and not part of the allowance.

C. Unused Materials: Return unused materials purchased under an allowance to manufacturer or supplier for credit to Owner, after installation has been completed and accepted.

   1. If requested by Architect, retain and prepare unused material for storage by Owner. Deliver unused material to Owner's storage space as directed.

D. At Project closeout, credit unused amounts remaining in the lump-sum allowance to Owner by Change Order.

1.8 CONTINGENCY ALLOWANCES

A. Use the contingency allowance only as directed by Construction Manager / Architect for Owner's purposes and only by Change Orders that indicate amounts to be charged to the allowance.

B. Contractor's overhead, profit, and related costs for products and equipment ordered by Owner under the contingency allowance are included in the allowance and are not part of the Contract Sum. These costs include delivery, installation, taxes, insurance, equipment rental, and similar costs.

C. Change Orders authorizing use of funds from the contingency allowance will include Contractor's related costs and reasonable overhead and profit.

D. At Project closeout, credit unused amounts remaining in the contingency allowance to Owner by Change Order.
1.9 TESTING AND INSPECTING ALLOWANCES

A. Testing and inspecting allowances include the cost of engaging testing agencies, actual tests and inspections, and reporting results.

B. The allowance does not include incidental labor required to assist the testing agency or costs for retesting if previous tests and inspections result in failure. The cost for incidental labor to assist the testing agency shall be included in the Contract Sum.

C. Costs of testing and inspection services not required by the Contract Documents are not included in the allowance.

D. At Project closeout, credit unused amounts remaining in the testing and inspecting allowance to Owner by Change Order.

1.10 ADJUSTMENT OF ALLOWANCES

A. Allowance Adjustment: To adjust allowance amounts, prepare a Change Order proposal based on the difference between purchase amount and the allowance, multiplied by final measurement of work-in-place where applicable. If applicable, include reasonable allowances for cutting losses, tolerances, mixing wastes, normal product imperfections, and similar margins.

1. Include installation costs in purchase amount only where indicated as part of the allowance.
2. If requested, prepare explanation and documentation to substantiate distribution of overhead costs and other markups.
3. Submit substantiation of a change in scope of Work, if any, claimed in Change Orders related to unit-cost allowances.
4. Owner reserves the right to establish the quantity of work-in-place by independent quantity survey, measure, or count.

B. Submit claims for increased costs because of a change in scope or nature of the allowance described in the Contract Documents, whether for the purchase order amount or Contractor's handling, labor, installation, overhead, and profit.

1. Do not include Contractor's or subcontractor's indirect expense in the Change Order cost amount unless it is clearly shown that the nature or extent of Work has changed from what could have been foreseen from information in the Contract Documents.
2. No change to Contractor's indirect expense is permitted for selection of higher- or lower-priced materials or systems of the same scope and nature as originally indicated.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.
3.2 PREPARATION

A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

3.3 SCHEDULE OF ALLOWANCES

A. Allowance No. 1: Owner’s contingency allowance of $500,000.00 for testing operations.

B. Allowance No. 2: Security allowance of $10,000.00 for security system.

C. Allowance No. 3: Signage allowance of $6,000.00 for signage.

D. Allowance No. 4: Telephone / Data allowance of $16,000.00 for telephone / data system.

END OF SECTION 012100
SECTION 012300 – ALTERNATES

PART 1 - GENERAL

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

1.2 SUMMARY
   A. Section includes administrative and procedural requirements for alternates.

1.3 DEFINITIONS
   A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the bidding requirements that may be added to or deducted from the base bid amount if the Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.

      1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
      2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternates into the Work. No other adjustments are made to the Contract Sum.

1.4 PROCEDURES
   A. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.

      1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.

   B. Execute accepted alternates under the same conditions as other work of the Contract.

   C. Schedule: A schedule of alternates is included at the end of this Section. Alternates shall be added or deducted by the Owner to/from the “Grand Total Base Bid Plus Contingency Allowance” amount in the numerical order as listed below.

   D. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.
PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

A. Deduct Alternate No. 1: Landscaping.
   1. Base Bid: Provide Landscaping as shown on drawing and in the project manual.
   2. Deduct Alternate: Eliminate all proposed Landscaping Improvements shown on the Landscaping Plan, including trees, shrubs and ground cover.

B. Deduct Alternate No. 2: Site Lighting.
   1. Base Bid: Provide Site Lighting as shown on drawing and in the project manual.
   2. Deduct Alternate: Eliminate 15 of the 18 Type “A” (single fixture) light poles and 7 of the 11 Type “B” (double fixture) light poles. All bases, wiring, etc. shall be installed as shown on the Lighting Plan. Only the poles and fixtures are to be eliminated.

END OF SECTION 012300
SECTION 012500 - SUBSTITUTION PROCEDURES

PART 1 - GENERAL

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

1.2 SUMMARY
   A. Section includes administrative and procedural requirements for substitutions.
   B. Related Requirements:
      1. Division 01 Section "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

1.3 DEFINITIONS
   A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.
      1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
      2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.

1.4 ACTION SUBMITTALS
   A. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
      1. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
         a. Statement indicating why specified product or fabrication or installation method cannot be provided, if applicable.
         b. Coordination of information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
         c. Detailed comparison of significant qualities of proposed substitutions with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes, such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.

e. Samples, where applicable or requested.

f. Certificates and qualification data, where applicable or requested.

g. List of similar installations for completed projects, with project names and addresses as well as names and addresses of architects and owners.

h. Material test reports from a qualified testing agency, indicating and interpreting test results for compliance with requirements indicated.

i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES.

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

k. Cost information, including a proposal of change, if any, in the Contract Sum.

l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents, except as indicated in substitution request, is compatible with related materials and is appropriate for applications indicated.

m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

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

a. Limitation: Architect will perform only one review of a substitution request for any single product, material, equipment, or method of construction; multiple request will be rejected.


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

1.5 QUALITY ASSURANCE

A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

1.6 PROCEDURES

A. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.

1.7 SUBSTITUTIONS

A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.
1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. Architect is not required to furnish cause for rejection of request for substitution. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
b. Substitution request is fully documented and properly submitted.
c. Requested substitution will not adversely affect Contractor's construction schedule.
d. Requested substitution has received necessary approvals of authorities having jurisdiction.
e. Requested substitution is compatible with other portions of the Work.
f. Requested substitution has been coordinated with other portions of the Work.
g. Requested substitution provides specified warranty.
h. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

B. Substitutions for Convenience: Not allowed.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012500
PART 1 - GENERAL

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

1.2 SUMMARY
   A. Section includes administrative and procedural requirements for handling and processing Contract modifications.

1.3 MINOR CHANGES IN THE WORK
   A. Construction Manager / Architect will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on AIA Document G710, "Architect's Supplemental Instructions."

1.4 CHANGE ORDER PROCEDURES
   A. On Owner's approval of a Work Changes Proposal Request, Construction Manager / Architect will issue a Change Order for signatures of Owner and Contractor on AIA Document G701.

1.5 CONSTRUCTION CHANGE DIRECTIVE

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

   B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.

   1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

1.6 PROPOSAL REQUESTS
   A. Owner-Initiated Proposal Requests: Construction Manager / Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
1. Proposal Requests issued by Construction Manager / Architect are not instructions either to stop work in progress or to execute the proposed change.

2. Within time specified in Proposal Request or 20 days, when not otherwise specified, after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
   a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
   b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
   c. Include costs of labor and supervision directly attributable to the change.
   d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.

B. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Construction Manager / Architect.
   1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
   2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
   3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
   4. Include costs of labor and supervision directly attributable to the change.
   5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
   6. Comply with requirements in Division 01 Section "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.

C. Contractor Fee: The maximum Contractor’s fee and other charges related to approved change orders is as follows:
   1. Work performed by the Contractor’s subcontractors: 10% of the cost of the work for the Subcontractor and 5% of that cost (subcontractor plus 10%) for the Contractor.
   2. Work performed by the Contractor: 15% of the cost of the work for the Contractor.
   3. Insurance cost shall be at the percentage included in the approved schedule of values.
   4. Bond Cost shall be at the percentage included in the approved schedule of values.
   5. When changed work is funded through base bid Contract Allowances, there shall be no payment for insurance and bond cost as they are included in the base bid amount.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012600
SECTION 012900 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.

B. Related Requirements:

1. Division 01 Section "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.

1.3 DEFINITIONS

A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

1.4 SCHEDULE OF VALUES

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

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

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

2. Submit the schedule of values to Architect at earliest possible date, but no later than seven days before the date scheduled for submittal of initial Applications for Payment.

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

1. Identification: Include the following Project identification on the schedule of values:

   a. Project name and location.
   b. Name of Architect.
   c. Contractor's name and address.
   d. Date of submittal.
2. Arrange schedule of values consistent with format of AIA Document G703.
3. Arrange the schedule of values in tabular form with separate columns to indicate the following for each item listed:
   a. Description of the Work.
   b. Dollar value of the following, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.
      1) Labor.
      2) Materials.
      3) Equipment.
4. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
5. Each item in the schedule of values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.
   a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the schedule of values or distributed as general overhead expense, at Contractor's option.
6. Schedule Updating: Update and resubmit the schedule before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.5 APPLICATIONS FOR PAYMENT

A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments as certified by Construction Manager / Architect and paid for by Owner.
   1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.

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

C. Application for Payment Forms: Use AIA Document G702 and AIA Document G703 as form for Applications for Payment.

D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Construction Manager / Architect will return incomplete applications without action.
   1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
   2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
   3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
   4. Indicate separate amounts for work being carried out under Owner-requested project acceleration.
E. Stored Materials: At the sole option of the Owner, payments may be made for materials stored off site. If this billing is permitted, include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored on-site, but not yet installed.

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

F. Transmittal: Submit three signed and notarized original copies of each Application for Payment to Construction Manager / Architect by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.

1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.

G. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from entities lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment.

1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
2. When an application shows completion of an item, submit conditional final or full waivers.
3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
4. Waiver Forms: Submit executed waivers of lien on forms acceptable to Owner.

H. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:

1. List of subcontractors.
2. Schedule of values.

I. Application for Payment at Substantial Completion: After Architect issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.

1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
2. This application shall reflect Certificate(s) of Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

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

1. Evidence of completion of Project closeout requirements.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012900
SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
   1. General coordination procedures.
   2. Requests for Information (RFIs).
   3. Project meetings.

B. Each contractor shall participate in coordination requirements. Certain areas of responsibility are assigned to a specific contractor.

C. Related Requirements:
   1. Division 01 Section "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
   2. Division 01 Section "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
   3. Division 01 Section "Closeout Procedures" for coordinating closeout of the Contract.

1.3 DEFINITIONS

A. RFI: Request from Owner, Construction Manager / Architect, or Contractor seeking information required by or clarifications of the Contract Documents.

1.4 INFORMATIONAL SUBMITTALS

A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:

1. Name, address, and telephone number of entity performing subcontract or supplying products.
2. Number and title of related Specification Section(s) covered by subcontract.
3. Drawing number and detail references, as appropriate, covered by subcontract.

B. 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, office, and cellular telephone numbers and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.
1. Post copies of list in project meeting room, in temporary field office, and by each temporary telephone. Keep list current at all times.

1.5 GENERAL COORDINATION PROCEDURES

A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections that depend on each other for proper installation, connection, and operation.

1. 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.

2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.

3. Make adequate provisions to accommodate items scheduled for later installation.

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 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 Contractor's 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.

D. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.

1.6 COORDINATION DRAWINGS

A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely indicated on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.

1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:

a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
b. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.

c. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.

d. Show location and size of access doors required for access to concealed dampers, valves, and other controls.

e. Indicate required installation sequences.

f. Indicate dimensions shown on Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternative sketches indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

B. Coordination Drawing Organization: Organize coordination drawings as follows:

1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the Work.

2. Plenum Space: Indicate subframing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within plenums to accommodate layout of light fixtures and other components indicated on Drawings. Indicate areas of conflict between light fixtures and other components.

3. Mechanical Rooms: Provide coordination drawings for mechanical rooms, showing plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment.

4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.

5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.

6. Mechanical and Plumbing Work: Show the following:

   a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.

   b. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts and electrical distribution equipment.

   c. Fire-rated enclosures around ductwork.

7. Electrical Work: Show the following:

   a. Runs of vertical and horizontal conduit 1-1/4 inches (32 mm) in diameter and larger.

   b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire-alarm locations.

   c. Panel board, switchboard, switchgear, transformer, busway, generator, and motor-control center locations.

   d. Location of pull boxes and junction boxes, dimensioned from column center lines.

8. Fire-Protection System: Show the following:

   a. Locations of standpipes, mains piping, branch lines, pipe drops, and sprinkler heads.

9. Review: Construction Manager / Architect will review coordination drawings to confirm that, in general, the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Construction Manager / Architect determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Construction Manager / Architect will so inform Contractor, who shall make suitable modifications and resubmit.
1.7 REQUESTS FOR INFORMATION (RFIs)

A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.

1. Construction Manager / Architect will return RFIs submitted to Construction Manager / Architect by other entities controlled by Contractor with no response.
2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:

1. Project name.
2. Project number.
3. Date.
4. Name of Contractor.
5. Name of Construction Manager / Architect.
6. RFI number, numbered sequentially.
7. RFI subject.
8. Specification Section number and title and related paragraphs, as appropriate.
9. Drawing number and detail references, as appropriate.
10. Field dimensions and conditions, as appropriate.
11. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
12. Contractor's signature.
13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
   a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.

C. RFI Forms: As agreed or AIA Document G716.

1. Attachments shall be electronic files in Adobe Acrobat PDF format.

D. Architect's Action: Construction Manager / Architect will review each RFI, determine action required, and respond. Allow seven working days for Architect's response for each RFI. RFIs received by Construction Manager / Architect after 1:00 p.m. will be considered as received the following working day.

1. The following Contractor-generated RFIs will be returned without action:
   a. Requests for approval of submittals.
   b. Requests for approval of substitutions.
   c. Requests for approval of Contractor's means and methods.
   d. Requests for coordination information already indicated in the Contract Documents.
   e. Requests for adjustments in the Contract Time or the Contract Sum.
   f. Requests for interpretation of Architect's actions on submittals.
   g. Incomplete RFIs or inaccurately prepared RFIs.

2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt of additional information.
3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Division 01 Section "Contract Modification Procedures."
   a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 10 days of receipt of the RFI response.

E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Include the following:
   1. Project name.
   2. Name and address of Contractor.
   3. Name and address of Construction Manager / Architect.
   4. RFI number including RFIs that were returned without action or withdrawn.
   5. RFI description.
   6. Date the RFI was submitted.
   7. Date Architect's response was received.

F. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Construction Manager / Architect within seven days if Contractor disagrees with response.

1.8 PROJECT MEETINGS

A. General: Schedule and conduct meetings and conferences at Project site unless otherwise indicated.
   1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Construction Manager / Architect of scheduled meeting dates and times.
   2. Agenda: Contractor to prepare the meeting agenda. Distribute the agenda to all invited attendees.
   3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Construction Manager / Architect, within three days of the meeting.

B. Preconstruction Conference: Construction Manager / Architect may schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Construction Manager / Architect, but no later than 15 days after execution of the Agreement.
   1. Conduct the conference to review responsibilities and personnel assignments.
   2. Attendees: Authorized representatives of Owner Construction Manager / Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
   3. Agenda: Discuss items of significance that could affect progress, including the following:
      a. Tentative construction schedule.
      b. Critical work sequencing and long-lead items.
      c. Designation of key personnel and their duties.
      d. Lines of communications.
      e. Procedures for processing field decisions and Change Orders.
      f. Procedures for RFIs.
      g. Procedures for testing and inspecting.
      h. Procedures for processing Applications for Payment.
      i. Distribution of the Contract Documents.
j. Submittal procedures.
k. Use of the premises and existing building.
l. Working hours.
m. Owner's occupancy requirements.
n. Responsibility for temporary facilities and controls.
o. Procedures for disruptions and shutdowns.
p. Parking availability.
q. Equipment deliveries and priorities.
r. Security.
s. Progress cleaning.

4. Minutes: The Construction Manager will record and distribute meeting minutes.

C. Progress Meetings: Conduct progress meetings at biweekly intervals, unless otherwise agreed.

1. Coordinate dates of meetings with preparation of payment requests.
2. Attendees: In addition to representatives of Owner and Construction Manager / Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
   a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
      1) Review schedule for next period.
   b. Review present and future needs of each entity present, including the following:
      1) Status of submittals.
      2) Deliveries.
      3) Progress cleaning.
      4) Quality and work standards.
      5) Status of correction of deficient items.
      6) Field observations.
      7) Status of RFIs.

4. Minutes: The Construction Manager will record and distribute the meeting minutes to each party present and to parties requiring information.
   a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

PART 2 - PRODUCTS (Not Used)
PART 3 - EXECUTION (Not Used)

END OF SECTION 013100
SECTION 013200 - CONSTRUCTION PROGRESS DOCUMENTATION

1.1 SUMMARY

A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the work, including the following:

1. Contractor's construction schedule.
2. Daily Construction Reports.
3. Daily Manning Reports
4. Field Condition Reports.
5. Daily Field Photographs

1.2 DEFINITIONS

A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.

1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
2. Milestone Activity: An activity that has a must finish on date
3. Predecessor Activity: An activity that precedes another activity in the network.
4. Successor Activity: An activity that follows another activity in the network.

B. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of the Project.

C. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.

D. Milestone: Milestone dates are dates that a specific activity must be completed on.

E. Float: The measure of leeway in starting and completing an activity.

1. Float time belongs to Owner.

1.3 INFORMATIONAL SUBMITTALS

A. Format for Submittals - Submit required submittals in the following format:

1. PDF electronic file.
2. Or 2 paper copies.
3. All schedules are to be provided in both PDF format.

B. Start-up Network Diagram: Of size required to display the entire network for entire construction period. Show logic ties for activities.

C. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period. Schedule to be submitted to Construction Manager for review prior to first application for payment. No contractor payment will be made until the CPM schedule is received by the Construction Manager.
1. Submit a working electronic copy of schedule, using software indicated, and labeled to comply with requirements for submittals. Include type of schedule (initial or updated) and date on label.

D. CPM Reports: Concurrent with CPM schedule, submit each of the following reports. Format for each activity in reports shall contain activity number, activity description, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.

1. Activity Report: List of all activities sorted by activity number and then early start date, or actual start date if known.
2. Logic Report: List of preceding and succeeding activities for all activities, sorted in ascending order by activity number and then early start date, or actual start date if known.
3. Total Float Report: List of all activities sorted in ascending order of total float.
4. Substantial Completion Date
5. Earnings Report: Compilation of Contractor's total earnings from the Notice to Proceed until most recent Application for Payment.

E. Daily Construction Reports: Submit at weekly intervals.

F. Field Condition Reports: Submit at time of discovery of differing conditions.

1.4 COORDINATION

A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate contractors.

B. Coordinate Contractor's construction schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests, and other required schedules and reports.

1. Secure time commitments for performing critical elements of the work from entities involved.
2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCT DELIVERABLE

2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

A. Time Frame: Extend schedule from date established for the Notice to Proceed to date of Substantial Completion and to be submitted for Construction Manager review prior to first payment application.

1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.

B. Activities: Treat each story or separate area as a separate numbered activity for each principal element of the work. Comply with the following:

1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Architect.
2. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
3. Submittal Review Time: Include review and re-submittal times indicated in Division 01 Section "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's construction schedule with submittal schedule.
4. Inspection Activities: Include time for inspections, final inspection and fire inspections, these activities should not extend more than 5 days past the work required to be inspected.

5. Startup and Testing Time: Include not less than 15 days for startup and testing.

6. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architects and Construction Manager's administrative procedures necessary for certification of Substantial Completion.

7. Punch List and Final Completion: Include not more than 30 Calendar days for punch list and final completion.

C. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the work is affected.

1. Phasing: Arrange list of activities on schedule by phase.
2. Work under more than one contract: Include a separate activity for each contract.
3. Work by Owner: Include a separate activity for each portion of the work performed by Owner.
4. Work Restrictions: Show the effect of the following items on the schedule:
   a. Coordination with existing construction.
   b. Limitations of continued occupancies.
   c. Uninterruptible services.
   d. Partial occupancy before Substantial Completion.
   e. Use of premises restrictions.
   g. Seasonal variations.
   h. Environmental control.

5. Work Stages: Indicate important stages of construction for each major portion of the work.

D. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and Final Completion.

E. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:

1. Unresolved issues.
2. Unanswered RFIs.
3. Rejected or unreturned submittals.
4. Notations on returned submittals.

F. Recovery Schedule: When periodic update indicates the work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule.

G. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.

2.2 CONTRACTOR'S CONSTRUCTION SCHEDULE (GANTT CHART)

A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal Gantt-chart-type, Contractor's construction schedule within 30 days of date established for the Notice to Proceed.

B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.
1. For construction activities that require three months or longer to complete, indicate an estimated completion percentage in 10 percent increments within time bar.

2.3 REPORTS

A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:

1. List of subcontractors at Project site.
2. List of separate contractors at Project site.
3. Approximate count of personnel at Project site.
4. Equipment at Project site.
5. Material deliveries.
6. High and low temperatures and general weather conditions, including presence of rain or snow.
7. Accidents.
8. Meetings and significant decisions.
9. Unusual events.
10. Stoppages, delays, shortages, and losses.
11. Meter readings and similar recordings.
13. Orders and requests of authorities having jurisdiction.
14. Change Orders received and implemented.
15. Services connected and disconnected.
16. Equipment or system tests and startups.
17. Partial completions and occupancies.
18. Substantial Completions authorized.
19. Services connected or disconnected.
20. Description of work progress.
21. List of visitors.

B. Field Condition Reports: Immediately on discovery of a difference between field conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

C. Material Location Reports: At monthly intervals, prepare and submit a comprehensive list of materials delivered to and stored at Project site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site.

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities and percentages complete for each activity. Issue schedule one week before each regularly scheduled progress meeting.

1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
3. As the work progresses, indicate final completion percentage for each activity.
B. Distribution: Distribute copies of approved schedule to Architect, Construction Manager, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.

1. Post copies in Project meeting rooms and temporary field offices.
2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the work and are no longer involved in performance of construction activities.

END OF SECTION 013200
SECTION 013233 - PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for the following:

1. Preconstruction photographs.
2. Periodic construction photographs.
3. Final completion construction photographs.

B. Related Requirements:

1. Division 01 Section "Closeout Procedures" for submitting photographic documentation as Project Record Documents at Project closeout.

1.3 INFORMATIONAL SUBMITTALS

A. Digital Photographs: Submit image files within three days of taking photographs.

1. Submit photos by uploading to web-based project software site. Include copy of key plan indicating each photograph's location and direction.
2. Identification: Provide the following information with each image description in web-based project software site:

   a. Name of Project.
   b. Name and contact information for photographer.
   c. Name of Architect and Construction Manager.
   d. Name of Contractor.
   e. Date photograph was taken.
   f. Description of location, vantage point, and direction.
   g. Unique sequential identifier keyed to accompanying key plan.

1.4 FORMATS AND MEDIA

A. Digital Photographs: Provide color images in JPG format, produced by a digital camera with minimum sensor size of 12 megapixels, and at an image resolution of not less than 3200 by 2400 pixels. Use flash in low light levels or backlit conditions.

1.5 CONSTRUCTION PHOTOGRAPHS

A. General: Take photographs with maximum depth of field and in focus.
1. Maintain key plan with each set of construction photographs that identifies each photographic location.

B. Periodic Construction Photographs: Take 20 photographs monthly coinciding with the cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last photographs were taken.

C. Final Completion Construction Photographs: Take 20 photographs after date of Substantial Completion for submission as Project Record Documents. Construction Manager will inform photographer of desired vantage points.
SECTION 013300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

B. Related Requirements:

1. Division 01 Section "Payment Procedures" for submitting Applications for Payment and the schedule of values.
2. Division 01 Section "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.

1.3 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Construction Manager / Design Team's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."

B. Informational Submittals: Written and graphic information and physical samples that do not require Construction Manager / Design Team's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."


1.4 ACTION SUBMITTALS

A. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by the Design Team and additional time for handling and reviewing submittals required by those corrections.

1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
2. Initial Submittal: Submit concurrently with startup construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.

3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule.
   a. Submit revised submittal schedule to reflect changes in current status and timing for submittals.

4. Format: Arrange the following information in a tabular format:
   a. Scheduled date for first submittal.
   b. Specification Section number and title.
   c. Submittal category: Action; informational.
   d. Name of subcontractor.
   e. Description of the Work covered.
   f. Scheduled date for final release or approval.
   g. Scheduled date of fabrication.

1.5 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

A. Digital Data Files: Electronic digital data files of the Contract Drawings will not be provided by Architect for Contractor's use in preparing submittals.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
   1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
   2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
   3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.

C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
   1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
   2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
   3. Resubmittal Review: Allow 15 days for review of each resubmittal.
   4. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 21 days for initial review of each submittal.

D. Paper Submittals: Place a permanent label or title block on each submittal item for identification.
   1. Indicate name of firm or entity that prepared each submittal on label or title block.
   2. Provide a space approximately 6 by 8 inches on label or beside title block to record Contractor's review and approval markings and action taken by Architect.
3. Include the following information for processing and recording action taken:

   a. Project name.
   b. Date.
   c. Name of Construction Manager / Architect.
   d. Name of Contractor.
   e. Name of manufacturer.
   f. Number and title of appropriate Specification Section.
   g. Drawing number and detail references, as appropriate.

4. Additional Paper Copies: Unless additional copies are required for final submittal, and unless Construction Manager / Architect observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.

5. Transmittal for Paper Submittals: Assemble each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Architect will discard submittals received from sources other than Contractor.

E. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:

1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.

2. Name file with submittal number or other unique identifier, including revision identifier.

   a. File name shall use project identifier and Specification Section number followed by a decimal point and then a sequential number (e.g., LNHS-061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., LNHS-061000.01.A).

3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect.

4. Transmittal Form for Electronic Submittals: Use electronic form acceptable to Owner, containing the following information:

   a. Project name.
   b. Date.
   c. Name and address of Construction Manager / Architect.
   d. Name of Contractor.
   e. Name of firm or entity that prepared submittal.
   f. Names of subcontractor, manufacturer, and supplier.
   g. Category and type of submittal.
   h. Submittal purpose and description.
   i. Specification Section number and title.
   j. Specification paragraph number or drawing designation and generic name for each of multiple items.
   k. Drawing number and detail references, as appropriate.
   l. Location(s) where product is to be installed, as appropriate.
   m. Related physical samples submitted directly.
   n. Indication of full or partial submittal.
   o. Transmittal number, numbered consecutively.
   p. Submittal and transmittal distribution record.
   q. Other necessary identification.
   r. Remarks.

5. Metadata: Include the following information as keywords in the electronic submittal file metadata:
a. Project name.
b. Number and title of appropriate Specification Section.
c. Manufacturer name.
d. Product name.

6. If the Contractor elects to use electronic submittals, and the Owner allows that process, all related printing for the construction manager, architect and consultants is to be done on an urgent basis by the Contractor solely at the Contractor’s cost.

F. Options: Identify options requiring selection by Architect.

G. Deviations and Additional Information: On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.

H. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.

1. Note date and content of previous submittal.
2. Note date and content of revision in label or title block and clearly indicate extent of revision.
3. Resubmit submittals until they are marked with approval notation from Architect's action stamp.

I. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

J. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's action stamp.

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.

1. Submit electronic submittals via email as PDF electronic files.

2. Action Submittals: Submit three paper copies of each submittal unless otherwise indicated. Architect will return two copies.
3. Informational Submittals: Submit two paper copies of each submittal unless otherwise indicated. Architect will not return copies.
4. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
   a. Provide a digital signature with digital certificate on electronically submitted certificates and certifications where indicated.
   b. Provide a notarized statement on original paper copy certificates and certifications where indicated.
B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:
   a. Manufacturer's catalog cuts.
   b. Manufacturer's product specifications.
4. For equipment, include the following in addition to the above, as applicable:
   a. Wiring diagrams showing factory-installed wiring.
5. Submit Product Data before or concurrent with Samples.
6. Submit Product Data in the following format:
   a. PDF electronic file.
   b. Three paper copies of Product Data unless otherwise indicated. Architect will return two copies.

C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.

1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
   a. Identification of products.
   b. Compliance with specified standards.
   c. Notation of coordination requirements.
   d. Seal and signature of professional engineer if specified.
2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches, but no larger than 30 by 42 inches.
3. Submit Shop Drawings in the following format:
   a. PDF electronic file.
   b. Two opaque (bond) copies of each submittal. Architect will return one copy(ies).

D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.

1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
2. Identification: Attach label on unexposed side of Samples that includes the following:
   a. Generic description of Sample.
   b. Product name and name of manufacturer.
   c. Sample source.
   d. Number and title of applicable Specification Section.
   e. Specification paragraph number and generic name of each item.
3. For projects where electronic submittals are required, provide corresponding electronic submittal of Sample transmittal, digital image file illustrating Sample characteristics, and identification information for record.

4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
   a. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.

5. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
   a. Number of Samples: Submit one full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.

E. Application for Payment and Schedule of Values: Comply with requirements specified in Division 01 Section "Payment Procedures."

F. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Division 01 Sections "Project Record Documents", "Operation and Maintenance Data" and "Closeout Procedures."
   1. AIA G706 "Affidavit of Payment of Debt and Claims "
   2. AIA G706A "Affidavit of Release of Liens "
   3. AIA G 707 "Consent of Surety Company to Final Payment 
   4. Maintenance Bond for 100% of the Contract sum for a term of one (1) calendar year from the date that the work is completed;
   5. All guarantees and warranties required by the Specifications or available from the manufacturers and/or suppliers;
   6. All guarantees of the Contractor's work required per the Specifications;
   7. State of New Jersey Prevailing Wage Rate Affidavit

G. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.

H. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.

I. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.

J. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

PART 3 - EXECUTION
3.1 CONTRACTOR'S REVIEW

A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.

B. Project Closeout and Maintenance Material Submittals: See requirements in Division 01 Section "Closeout Procedures."

C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ARCHITECT'S ACTION

A. Action Submittals: Architect will review each submittal, make marks to indicate corrections or revisions required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.

B. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.

C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.

D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.

E. Submittals not required by the Contract Documents may be returned by the Architect without action.

END OF SECTION 013300
SECTION 014000 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.

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

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

3. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

4. The Contractor is responsible for all tests and inspections, including related costs, refer to Division 01 Section "Allowances."

1.3 DEFINITIONS

A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect.

C. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria.

D. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.

E. Source Quality-Control Testing: Tests and inspections that are performed at the source, e.g., plant, mill, factory, or shop.

F. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
G. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

H. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.

1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).

I. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.4 CONFLICTING REQUIREMENTS

A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Architect for a decision before proceeding.

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

1.5 INFORMATIONAL SUBMITTALS

A. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

B. Schedule of Tests and Inspections: Prepare in tabular form and include the following:

1. Specification Section number and title.
2. Entity responsible for performing tests and inspections.
3. Description of test and inspection.
4. Identification of applicable standards.
5. Identification of test and inspection methods.
6. Number of tests and inspections required.
7. Time schedule or time span for tests and inspections.
8. Requirements for obtaining samples.
9. Unique characteristics of each quality-control service.

1.6 CONTRACTOR'S QUALITY-CONTROL PLAN

A. Quality-Control Plan, General: Submit quality-control plan within 10 days of Notice of Award, and not less than five days prior to preconstruction conference. Submit in format acceptable to Architect. Identify personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out
Contractor's quality-assurance and quality-control responsibilities. Coordinate with Contractor's construction schedule.

B. Quality-Control Personnel Qualifications: Engage qualified full-time personnel trained and experienced in managing and executing quality-assurance and quality-control procedures similar in nature and extent to those required for Project.

1. Project quality-control manager may also serve as Project superintendent.

C. Submittal Procedure: Describe procedures for ensuring compliance with requirements through review and management of submittal process. Indicate qualifications of personnel responsible for submittal review.

D. Testing and Inspection: In quality-control plan, include a comprehensive schedule of Work requiring testing or inspection, including the following:

1. Contractor-performed tests and inspections including subcontractor-performed tests and inspections. Include required tests and inspections and Contractor-elected tests and inspections.
2. Special inspections required by authorities having jurisdiction and indicated on the "Statement of Special Inspections."
3. Owner-performed tests and inspections indicated in the Contract Documents.

E. Continuous Inspection of Workmanship: Describe process for continuous inspection during construction to identify and correct deficiencies in workmanship in addition to testing and inspection specified. Indicate types of corrective actions to be required to bring work into compliance with standards of workmanship established by Contract requirements and approved mockups.

F. Monitoring and Documentation: Maintain testing and inspection reports including log of approved and rejected results. Include work Architect has indicated as nonconforming or defective. Indicate corrective actions taken to bring nonconforming work into compliance with requirements. Comply with requirements of authorities having jurisdiction.

1.7 REPORTS AND DOCUMENTS

A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:

1. Date of issue.
2. Project title and number.
3. Name, address, and telephone number of testing agency.
4. Dates and locations of samples and tests or inspections.
5. Names of individuals making tests and inspections.
6. Description of the Work and test and inspection method.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and reinspecting.
B.  Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, and telephone number of technical representative making report.
2. Statement on condition of substrates and their acceptability for installation of product.
3. Statement that products at Project site comply with requirements.
4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
6. Statement whether conditions, products, and installation will affect warranty.
7. Other required items indicated in individual Specification Sections.

C.  Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, and telephone number of factory-authorized service representative making report.
2. Statement that equipment complies with requirements.
3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
4. Statement whether conditions, products, and installation will affect warranty.
5. Other required items indicated in individual Specification Sections.

D.  Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.8 QUALITY ASSURANCE

A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

D. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar in material, design, and extent to those indicated for this Project.

F. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329; and
with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.

1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

G. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer’s products that are similar in material, design, and extent to those indicated for this Project.

H. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

I. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:

1. Contractor responsibilities include the following:
   a. Provide test specimens representative of proposed products and construction.
   b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.

2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

1.9 QUALITY CONTROL

A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.

B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.

1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.

2. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
   a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.

3. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.

4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.

5. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Division 01 Section "Submittal Procedures."

D. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.

E. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.


1. Notify Architect promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
6. Do not perform any duties of Contractor.

G. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:

1. Access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
4. Facilities for storage and field curing of test samples.

H. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.
3.1 TEST AND INSPECTION LOG

A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:

1. Date test or inspection was conducted.
2. Description of the Work tested or inspected.
3. Date test or inspection results were transmitted to Architect.
4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's reference during normal working hours.

3.2 REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.

1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Division 01 Section "Execution."

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 014000
SECTION 014200 - REFERENCES

PART 1 - GENERAL

1.1 DEFINITIONS

A. General: Basic Contract definitions are included in the Conditions of the Contract.

B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.

C. "Directed": A command or instruction by Architect or Construction Manager. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."

D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."

E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the work.

F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

G. "Install": Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

H. "Provide": Furnish and install, complete and ready for the intended use.

I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.2 INDUSTRY STANDARDS

A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.
1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.3 ABBREVIATIONS AND ACRONYMS

A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Thomson Gale's "Encyclopedia of Associations" or in Columbia Books' "National Trade & Professional Associations of the U.S."

B. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list.

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AA</td>
<td>Aluminum Association, Inc. (The)</td>
</tr>
<tr>
<td>AAADM</td>
<td>American Association of Automatic Door Manufacturers</td>
</tr>
<tr>
<td>AABC</td>
<td>Associated Air Balance Council</td>
</tr>
<tr>
<td>AAMA</td>
<td>American Architectural Manufacturers Association</td>
</tr>
<tr>
<td>AASHTO</td>
<td>American Association of State Highway and Transportation Officials</td>
</tr>
<tr>
<td>AATCC</td>
<td>American Association of Textile Chemists and Colorists</td>
</tr>
<tr>
<td>ABAA</td>
<td>Air Barrier Association of America</td>
</tr>
<tr>
<td>ABMA</td>
<td>American Bearing Manufacturers Association</td>
</tr>
<tr>
<td>ACI</td>
<td>American Concrete Institute</td>
</tr>
<tr>
<td>ACPA</td>
<td>American Concrete Pipe Association</td>
</tr>
<tr>
<td>AEIC</td>
<td>Association of Edison Illuminating Companies, Inc. (The)</td>
</tr>
<tr>
<td>AF&amp;PA</td>
<td>American Forest &amp; Paper Association</td>
</tr>
<tr>
<td>AGA</td>
<td>American Gas Association</td>
</tr>
<tr>
<td>AGC</td>
<td>Associated General Contractors of America (The)</td>
</tr>
<tr>
<td>AHA</td>
<td>American Hardboard Association (Now part of CPA)</td>
</tr>
<tr>
<td>AHAM</td>
<td>Association of Home Appliance Manufacturers</td>
</tr>
<tr>
<td>AI</td>
<td>Asphalt Institute</td>
</tr>
<tr>
<td>AIA</td>
<td>American Institute of Architects (The)</td>
</tr>
<tr>
<td>AISC</td>
<td>American Institute of Steel Construction</td>
</tr>
<tr>
<td>AISI</td>
<td>American Iron and Steel Institute</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Description</td>
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</tr>
<tr>
<td>AITC</td>
<td>American Institute of Timber Construction</td>
</tr>
</tbody>
</table>
| ALCA         | Associated Landscape Contractors of America  
(Now PLANET - Professional Landcare Network) |
| ALSC         | American Lumber Standard Committee, Incorporated |
| AMCA         | Air Movement and Control Association International, Inc. |
| ANSI         | American National Standards Institute |
| AOSA         | Association of Official Seed Analysts, Inc. |
| APA          | Architectural Precast Association |
| APA          | APA - The Engineered Wood Association |
| APA EWS      | APA - The Engineered Wood Association; Engineered Wood Systems  
(See APA - The Engineered Wood Association) |
| API          | American Petroleum Institute |
| ARI          | Air-Conditioning & Refrigeration Institute |
| ARMA         | Asphalt Roofing Manufacturers Association |
| ASCE         | American Society of Civil Engineers |
| ASCE/SEI     | American Society of Civil Engineers/Structural Engineering Institute  
(See ASCE) |
| ASHRAE       | American Society of Heating, Refrigerating and Air-Conditioning Engineers |
| ASME         | ASME International  
(American Society of Mechanical Engineers International) |
| ASSE         | American Society of Sanitary Engineering |
| ASTM         | ASTM International  
(American Society for Testing and Materials International) |
| AWCI         | Association of the Wall and Ceiling Industry |
| AWCMMA       | American Window Covering Manufacturers Association  
(Now WCMA) |
| AWI          | Architectural Woodwork Institute |
| AWPA         | American Wood Protection Association  
(Formerly: American Wood Preservers' Association) |
<p>| AWS          | American Welding Society |
| AWWA         | American Water Works Association |</p>
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Full Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>BHMA</td>
<td>Builders Hardware Manufacturers Association</td>
</tr>
<tr>
<td>BIA</td>
<td>Brick Industry Association (The)</td>
</tr>
<tr>
<td>BICSI</td>
<td>BICSI, Inc.</td>
</tr>
<tr>
<td>BIFMA</td>
<td>BIFMA International (Business and Institutional Furniture Manufacturer's Association International)</td>
</tr>
<tr>
<td>BISSC</td>
<td>Baking Industry Sanitation Standards Committee</td>
</tr>
<tr>
<td>BWF</td>
<td>Badminton World Federation (Formerly: IBF - International Badminton Federation)</td>
</tr>
<tr>
<td>CCC</td>
<td>Carpet Cushion Council</td>
</tr>
<tr>
<td>CDA</td>
<td>Copper Development Association</td>
</tr>
<tr>
<td>CEA</td>
<td>Canadian Electricity Association</td>
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<td>CEA</td>
<td>Consumer Electronics Association</td>
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<td>CFFA</td>
<td>Chemical Fabrics &amp; Film Association, Inc.</td>
</tr>
<tr>
<td>CGA</td>
<td>Compressed Gas Association</td>
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<tr>
<td>CIMA</td>
<td>Cellulose Insulation Manufacturers Association</td>
</tr>
<tr>
<td>CISCA</td>
<td>Ceilings &amp; Interior Systems Construction Association</td>
</tr>
<tr>
<td>CISPI</td>
<td>Cast Iron Soil Pipe Institute</td>
</tr>
<tr>
<td>CLFMI</td>
<td>Chain Link Fence Manufacturers Institute</td>
</tr>
<tr>
<td>CRRC</td>
<td>Cool Roof Rating Council</td>
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<tr>
<td>CPA</td>
<td>Composite Panel Association</td>
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<td>CPPA</td>
<td>Corrugated Polyethylene Pipe Association</td>
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<tr>
<td>CRI</td>
<td>Carpet and Rug Institute (The)</td>
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<td>CRSI</td>
<td>Concrete Reinforcing Steel Institute</td>
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<td>CSA</td>
<td>Canadian Standards Association</td>
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<td>CSA</td>
<td>CSA International (Formerly: IAS - International Approval Services)</td>
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<td>CSI</td>
<td>Cast Stone Institute</td>
</tr>
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<td>CSI</td>
<td>Construction Specifications Institute (The)</td>
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<tr>
<td>CSSB</td>
<td>Cedar Shake &amp; Shingle Bureau</td>
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<tr>
<td>Acronym</td>
<td>Description</td>
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<tr>
<td>CTI</td>
<td>Cooling Technology Institute (Formerly: Cooling Tower Institute)</td>
</tr>
<tr>
<td>DHI</td>
<td>Door and Hardware Institute</td>
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<tr>
<td>EIA</td>
<td>Electronic Industries Alliance</td>
</tr>
<tr>
<td>EIMA</td>
<td>EIFS Industry Members Association</td>
</tr>
<tr>
<td>EJCDC</td>
<td>Engineers Joint Contract Documents Committee</td>
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<tr>
<td>EJMA</td>
<td>Expansion Joint Manufacturers Association, Inc.</td>
</tr>
<tr>
<td>ESD</td>
<td>ESD Association (Electrostatic Discharge Association)</td>
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<tr>
<td>ETL SEMCO</td>
<td>Intertek ETL SEMCO (Formerly: ITS - Intertek Testing Service NA)</td>
</tr>
<tr>
<td>FIBA</td>
<td>Federation Internationale de Basketball (The International Basketball Federation)</td>
</tr>
<tr>
<td>FIVB</td>
<td>Federation Internationale de Volleyball (The International Volleyball Federation)</td>
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<td>FM Approvals</td>
<td>FM Approvals LLC</td>
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<td>FM Global</td>
<td>FM Global (Formerly: FMG - FM Global)</td>
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<tr>
<td>FMRC</td>
<td>Factory Mutual Research (Now FM Global)</td>
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<td>FRSA</td>
<td>Florida Roofing, Sheet Metal &amp; Air Conditioning Contractors Association, Inc.</td>
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<tr>
<td>FSA</td>
<td>Fluid Sealing Association</td>
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<tr>
<td>FSC</td>
<td>Forest Stewardship Council</td>
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<tr>
<td>GA</td>
<td>Gypsum Association</td>
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<tr>
<td>GANA</td>
<td>Glass Association of North America</td>
</tr>
<tr>
<td>GRI</td>
<td>(Part of GSI)</td>
</tr>
<tr>
<td>GS</td>
<td>Green Seal</td>
</tr>
<tr>
<td>GSI</td>
<td>Geosynthetic Institute</td>
</tr>
<tr>
<td>HI</td>
<td>Hydraulic Institute</td>
</tr>
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<td>HI</td>
<td>Hydronics Institute</td>
</tr>
<tr>
<td>HMMA</td>
<td>Hollow Metal Manufacturers Association (Part of NAAMM)</td>
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<tr>
<td>Acronym</td>
<td>Name</td>
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<tr>
<td>HPVA</td>
<td>Hardwood Plywood &amp; Veneer Association</td>
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<tr>
<td>HPW</td>
<td>H. P. White Laboratory, Inc.</td>
</tr>
<tr>
<td>IAS</td>
<td>International Approval Services (Now CSA International)</td>
</tr>
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<td>IBF</td>
<td>International Badminton Federation (Now BWF)</td>
</tr>
<tr>
<td>ICEA</td>
<td>Insulated Cable Engineers Association, Inc.</td>
</tr>
<tr>
<td>ICRI</td>
<td>International Concrete Repair Institute, Inc.</td>
</tr>
<tr>
<td>IEC</td>
<td>International Electrotechnical Commission</td>
</tr>
<tr>
<td>IEEE</td>
<td>Institute of Electrical and Electronics Engineers, Inc. (The)</td>
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<tr>
<td>IESNA</td>
<td>Illuminating Engineering Society of North America</td>
</tr>
<tr>
<td>IEST</td>
<td>Institute of Environmental Sciences and Technology</td>
</tr>
<tr>
<td>IGCC</td>
<td>Insulating Glass Certification Council</td>
</tr>
<tr>
<td>IGMA</td>
<td>Insulating Glass Manufacturers Alliance</td>
</tr>
<tr>
<td>ILI</td>
<td>Indiana Limestone Institute of America, Inc.</td>
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<tr>
<td>ISO</td>
<td>International Organization for Standardization Available from ANSI</td>
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<tr>
<td>ISSFA</td>
<td>International Solid Surface Fabricators Association</td>
</tr>
<tr>
<td>ITS</td>
<td>Intertek Testing Service NA (Now ETL SEMCO)</td>
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<tr>
<td>ITU</td>
<td>International Telecommunication Union</td>
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<td>KCMA</td>
<td>Kitchen Cabinet Manufacturers Association</td>
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<tr>
<td>LMA</td>
<td>Laminating Materials Association (Now part of CPA)</td>
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<tr>
<td>LPI</td>
<td>Lightning Protection Institute</td>
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<td>MBMA</td>
<td>Metal Building Manufacturers Association</td>
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<tr>
<td>MFMA</td>
<td>Maple Flooring Manufacturers Association, Inc.</td>
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<tr>
<td>MFMA</td>
<td>Metal Framing Manufacturers Association, Inc.</td>
</tr>
<tr>
<td>MH</td>
<td>Material Handling (Now MHIA)</td>
</tr>
<tr>
<td>MHIA</td>
<td>Material Handling Industry of America</td>
</tr>
<tr>
<td>Acronym</td>
<td>Full Name</td>
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<tr>
<td>MIA</td>
<td>Marble Institute of America</td>
</tr>
<tr>
<td>MPI</td>
<td>Master Painters Institute</td>
</tr>
<tr>
<td>MSS</td>
<td>Manufacturers Standardization Society of The Valve and Fittings Industry Inc.</td>
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<tr>
<td>NAAMM</td>
<td>National Association of Architectural Metal Manufacturers</td>
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<tr>
<td>NACE</td>
<td>NACE International (National Association of Corrosion Engineers International)</td>
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<td>NADCA</td>
<td>National Air Duct Cleaners Association</td>
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<tr>
<td>NAGWS</td>
<td>National Association for Girls and Women in Sport</td>
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<td>NAIMA</td>
<td>North American Insulation Manufacturers Association</td>
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<tr>
<td>NBGQA</td>
<td>National Building Granite Quarries Association, Inc.</td>
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<tr>
<td>NCAAD</td>
<td>National Collegiate Athletic Association (The)</td>
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<td>NCMA</td>
<td>National Concrete Masonry Association</td>
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<td>NCPI</td>
<td>National Clay Pipe Institute</td>
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<td>NCTA</td>
<td>National Cable &amp; Telecommunications Association</td>
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<td>NEBB</td>
<td>National Environmental Balancing Bureau</td>
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<td>NECA</td>
<td>National Electrical Contractors Association</td>
</tr>
<tr>
<td>NeLMA</td>
<td>Northeastern Lumber Manufacturers' Association</td>
</tr>
<tr>
<td>NEMA</td>
<td>National Electrical Manufacturers Association</td>
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<tr>
<td>NETA</td>
<td>Inter-National Electrical Testing Association</td>
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<tr>
<td>NFHS</td>
<td>National Federation of State High School Associations</td>
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<tr>
<td>NFPA</td>
<td>NFPA (National Fire Protection Association)</td>
</tr>
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<td>NFRC</td>
<td>National Fenestration Rating Council</td>
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<td>NGA</td>
<td>National Glass Association</td>
</tr>
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<td>NHLA</td>
<td>National Hardwood Lumber Association</td>
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<td>NLGA</td>
<td>National Lumber Grades Authority</td>
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<tr>
<td>NOFMA</td>
<td>NOFMA: The Wood Flooring Manufacturers Association (Formerly: National Oak Flooring Manufacturers Association)</td>
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<tr>
<td>NOMMA</td>
<td>National Ornamental &amp; Miscellaneous Metals Association</td>
</tr>
</tbody>
</table>
NRCA  National Roofing Contractors Association
NRMCA  National Ready Mixed Concrete Association

NSF  NSF International
(National Sanitation Foundation International)

NSSGA  National Stone, Sand & Gravel Association

NTMA  National Terrazzo & Mosaic Association, Inc. (The)

NTRMA  National Tile Roofing Manufacturers Association
(Now TRI)

NWWDA  National Wood Window and Door Association
(Now WDMA)

OPL  Omega Point Laboratories, Inc.
(Now ITS)

PCI  Precast/Prestressed Concrete Institute

PDCA  Painting & Decorating Contractors of America

PDI  Plumbing & Drainage Institute

PGI  PVC Geomembrane Institute

PLANET  Professional Landcare Network
(Formerly: ACLA - Associated Landscape Contractors of America)

PTI  Post-Tensioning Institute

RCSC  Research Council on Structural Connections

RFCI  Resilient Floor Covering Institute

RIS  Redwood Inspection Service

SAE  SAE International

SDI  Steel Deck Institute

SDI  Steel Door Institute

SEFA  Scientific Equipment and Furniture Association

SEI/ASCE  Structural Engineering Institute/American Society of Civil Engineers
(See ASCE)

SGCC  Safety Glazing Certification Council

SIA  Security Industry Association
<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SIGMA</td>
<td>Sealed Insulating Glass Manufacturers Association (Now IGMA)</td>
</tr>
<tr>
<td>SJI</td>
<td>Steel Joist Institute</td>
</tr>
<tr>
<td>SMA</td>
<td>Screen Manufacturers Association</td>
</tr>
<tr>
<td>SMACNA</td>
<td>Sheet Metal and Air Conditioning Contractors' National Association</td>
</tr>
<tr>
<td>SMPTE</td>
<td>Society of Motion Picture and Television Engineers</td>
</tr>
<tr>
<td>SPFA</td>
<td>Spray Polyurethane Foam Alliance (Formerly: SPI/SPFD - The Society of the Plastics Industry, Inc.; Spray Polyurethane Foam Division)</td>
</tr>
<tr>
<td>SPIB</td>
<td>Southern Pine Inspection Bureau (The)</td>
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<tr>
<td>SPRIG</td>
<td>Single Ply Roofing Industry</td>
</tr>
<tr>
<td>SSINA</td>
<td>Specialty Steel Industry of North America</td>
</tr>
<tr>
<td>SSPC</td>
<td>SSPC: The Society for Protective Coatings</td>
</tr>
<tr>
<td>STI</td>
<td>Steel Tank Institute</td>
</tr>
<tr>
<td>SWI</td>
<td>Steel Window Institute</td>
</tr>
<tr>
<td>SWRI</td>
<td>Sealant, Waterproofing, &amp; Restoration Institute</td>
</tr>
<tr>
<td>TCA</td>
<td>Tile Council of America, Inc. (Now TCNA)</td>
</tr>
<tr>
<td>TCNA</td>
<td>Tile Council of North America, Inc.</td>
</tr>
<tr>
<td>TIA/EIA</td>
<td>Telecommunications Industry Association/Electronic Industries Alliance</td>
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<td>TMS</td>
<td>The Masonry Society</td>
</tr>
<tr>
<td>TPI</td>
<td>Truss Plate Institute, Inc.</td>
</tr>
<tr>
<td>TPI</td>
<td>Turfgrass Producers International</td>
</tr>
<tr>
<td>TRI</td>
<td>Tile Roofing Institute</td>
</tr>
<tr>
<td>UL</td>
<td>Underwriters Laboratories Inc.</td>
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<tr>
<td>UNI</td>
<td>Uni-Bell PVC Pipe Association</td>
</tr>
<tr>
<td>USAV</td>
<td>USA Volleyball</td>
</tr>
<tr>
<td>USGBC</td>
<td>U.S. Green Building Council</td>
</tr>
<tr>
<td>USITT</td>
<td>United States Institute for Theatre Technology, Inc.</td>
</tr>
</tbody>
</table>
B. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list.

   C. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list.

   IAPMO International Association of Plumbing and Mechanical Officials
   ICC International Code Council
   ICC-ES ICC Evaluation Service, Inc.
   UBC Uniform Building Code
   (See ICC)

D. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

   CE Army Corps of Engineers
   CPSC Consumer Product Safety Commission
   DOC Department of Commerce
   DOD Department of Defense
   DOE Department of Energy
   EPA Environmental Protection Agency
   FAA Federal Aviation Administration
   FCC Federal Communications Commission
FDA  Food and Drug Administration
GSA  General Services Administration
HUD  Department of Housing and Urban Development
LBL  Lawrence Berkeley National Laboratory
NCHRP National Cooperative Highway Research Program
     (See TRB)
NIST  National Institute of Standards and Technology
OSHA  Occupational Safety & Health Administration
PBS  Public Buildings Service
     (See GSA)
PHS  Office of Public Health and Science
RUS  Rural Utilities Service
     (See USDA)
SD  State Department
TRB  Transportation Research Board
USDA  Department of Agriculture
USPS  Postal Service

E. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

ADAAG  Americans with Disabilities Act (ADA)
       Architectural Barriers Act (ABA)
       Accessibility Guidelines for Buildings and Facilities
       Available from U.S. Access Board
CFR  Code of Federal Regulations
     Available from Government Printing Office
DOD  Department of Defense Military Specifications and Standards
     Available from Department of Defense Single Stock Point
DSCC  Defense Supply Center Columbus
     (See FS)
FED-STD  Federal Standard
     (See FS)
FS Federal Specification
Available from Department of Defense Single Stock Point
Available from Defense Standardization Program
Available from General Services Administration
Available from National Institute of Building Sciences

FTMS Federal Test Method Standard
(See FS)

MIL (See MILSPEC)

MIL-STD (See MILSPEC)

MILSPEC Military Specification and Standards
Available from Department of Defense Single Stock Point

UFAS Uniform Federal Accessibility Standards
Available from Access Board

F. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

CBHF State of California, Department of Consumer Affairs Bureau of Home Furnishings and Thermal Insulation
CCR California Code of Regulations
CPUC California Public Utilities Commission
TFS Texas Forest Service
Forest Resource Development

END OF SECTION 014200
SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes requirements for temporary facilities and controls, including temporary utilities, support facilities, and security, protection facilities.

B. The contractor shall establish a temporary office within the existing building. The office is to have sufficient space for construction progress meetings.

C. The contractor shall be responsible for the installation, coordination, fees, removal and utility use costs for all temporary utilities, support facilities, and security and protection facilities. The contractor shall not tie into the existing utilities. Contractor shall coordinate trailer location with cm/owner.

D. The contractor may use the new permanent mechanical heating and cooling systems if the filters are replaced and ducts cleaned afterwards, however, all warranties and guarantees shall begin on the date of substantial completion (i.e., temporary or final certificate of occupancy), not the start-up date. Contractor to pay all start-up and temporary use cost related to union jurisdiction(s) work rules.

E. Temporary utilities include, but are not limited to, the following:
   1. Sanitary facilities, including drinking-water facilities.
   2. Heating and cooling facilities.
   3. Ventilation.
   4. Electric power service.
   5. Lighting.
   6. Telephone service.

F. Support facilities include, but are not limited to, the following:
   1. Project identification and temporary signs.
   2. Waste disposal facilities and site cleaning.
   3. Field offices.
   4. Two (2) lockable desks with two (2) desk arm chairs
   5. One 8 foot long Conference table with ten (10) stackable chairs
   6. Four (4) lockable four (4) drawer file cabinets
   7. Lifts and hoists.
   8. Construction aids and miscellaneous services and facilities.

G. Security and protection facilities include, but are not limited to, the following:
   1. Environmental protection.
   2. Tree and plant protection.
   3. Pest control.
4. Site enclosure fence.
5. Security enclosure and lockup.
7. Temporary enclosures.
8. Temporary partitions.

H. Related Sections include the following:
   1. Division 01 Section "Submittal Procedures" for procedures for submitting copies of implementation and termination schedule and utility reports.

1.3 DEFINITIONS
   A. Permanent Enclosure: As determined by Architect, permanent or temporary roofing is complete, insulated, and weather-tight; exterior walls are insulated and weather-tight; and all openings are closed with permanent construction or substantial temporary closures.

1.4 USE CHARGES
   A. Installation, removal, and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities engaged in the Project to use temporary services and facilities without cost, including, but not limited to, Architect, testing agencies, and authorities having jurisdiction.
   B. Water and Sewer Service from Existing System: Water from Owner's existing water system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.
   C. Electric Power Service from Existing System: Electric power from Owner's existing system is available for use. Provide connections and extensions of services as required for construction operations.

1.5 SUBMITTALS
   A. Temporary Utility Reports: Submit reports of tests, inspections, meter readings, and similar procedures performed on temporary utilities.
   B. Implementation and Termination Schedule: Within 15 days of date established for submittal of Contractor's Construction Schedule, submit a schedule indicating implementation and termination of each temporary utility.

1.6 QUALITY ASSURANCE
      1. Trade Jurisdictions: Assigned responsibilities for installation and operation of temporary utilities are not intended to interfere with trade regulations and union jurisdictions.
      2. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.
B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

1.7 PROJECT CONDITIONS

A. Temporary Utilities: At date of substantial completion, or earlier date when acceptable to Owner, change over from use of temporary service to use of permanent service. Contractor shall continue to pay all temporary utility costs up to the date of substantial completion even if permanent services are in use.
   1. Temporary Use of Permanent Facilities: Installer of each permanent service shall assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.
   2. Specified warranties shall not be reduced or voided by temporary use of permanent facilities. All warranties and guarantees start at date of certificate of occupancy or temporary certificate of occupancy.

B. Conditions of Use: The following conditions apply to use of temporary services and facilities by all parties engaged in the Work:
   1. Keep temporary services and facilities clean and neat.
   2. Relocate temporary services and facilities as required by progress of the Work at no additional cost.
   3. Contractor shall provide temporary covers over all return registers and provide new clean filters at time of certificate of occupancy or temporary certificate of occupancy. If ducts require cleaning as a result of temporary heat or air conditioning, the contractor shall clean said ductwork. All costs for cleaning the ductwork shall be by the contractor.
   4. Dumpster location: Coordinate the dumpster locations with the construction manager. The general contractor shall be responsible for obtaining and maintaining all the dumpsters and clean all work areas throughout the course of the project.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Provide new materials. Undamaged, previously used materials in serviceable condition may be used if approved by Architect. Provide materials suitable for use intended.


C. Lumber and Plywood: Comply with requirements in Division 6 Section "Rough Carpentry."

D. Gypsum Board: Minimum 1/2 inch thick by 48 inches wide by maximum available lengths; regular-type panels with tapered edges. Comply with ASTM C 36.

E. Insulation: Unfaced mineral-fiber blanket, manufactured from glass, slag wool, or rock wool; with maximum flame-spread and smoke-developed indices of 25 and 50, respectively.

F. Paint: Comply with requirements in Division 9 Section "Painting."
G. Tarpaulins: Fire-resistive labeled with flame-spread rating of 15 or less.
H. Water: Potable.

2.2 TEMPORARY FACILITIES

A. Field Offices: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.
B. Common-Use Field Office: Of sufficient size to accommodate needs of Owner, Architect, Construction Manager, and construction personnel office activities and to accommodate Project meetings specified in other Division 01 Sections. Keep office clean and orderly. Furnish and equip offices as follows:
   1. Furniture required for Project-site documents, including file cabinets, plan tables, plan racks, and bookcases.
   2. Conference room of sufficient size to accommodate meetings of 10 individuals. Provide electrical power service and 120-V ac duplex receptacles, with no less than one receptacle on each wall. Furnish room with conference table, chairs, and 4-foot square tack and marker boards.
   3. Drinking water and private toilet.
   4. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F.
   5. Lighting fixtures capable of maintaining average illumination of 20 fc at desk height.
C. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.
   1. Store combustible materials apart from building.

2.3 EQUIPMENT

A. General: Provide equipment suitable for use intended.
B. Fire Extinguishers: Hand carried, portable, UL rated. Provide class and extinguishing agent as indicated or a combination of extinguishers of NFPA-recommended classes for exposures.
   1. Comply with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.
C. Drinking-Water Fixtures: bottled-water drinking-water units, including paper cup supply.
   1. Where power is accessible, provide electric water coolers to maintain dispensed water temperature at 45 to 55 degree F.
D. Heating Equipment: Before permanent HVAC equipment is installed and Owner authorizes use of permanent heating system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
   1. The use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
   2. Heating Units: Listed and labeled, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use for type of fuel being consumed.
3. Temporary heat: the contractor is responsible for providing temporary heat including the cost of fuel and electricity. This includes all loads, including lighting connected to utility distribution systems used for temporary heat during the temporary heat period.
   a. If it is practical to use the HVAC equipment for temporary heat, the contractor shall provide temporary filters at all return air openings.
   b. The contractor shall pay for all gas use charges and electrical use charges to run the units.
   c. The contractor shall install the permanent gas and electric service associated with the HVAC units prior to starting. The contractor doing temporary hook up shall pay any charges by utility companies for said hook up.
   d. If the contractor suggests to the owner that the permanent electric and gas service be used, the contractor shall pay for all gas and electric bills until the new construction is accepted by the owner. The owner may however accept the main electric service and distribution panels and have meters in his name. The owner will forward the gas and electric bills to the contractor for payment by the contractor.
   e. It shall be understood by all contractors that finish work cannot proceed with the use of spot type open flame units.

E. Electrical Outlets: Properly configured, NEMA-polarized outlets to prevent insertion of 110- to 120-V plugs into higher-voltage outlets; equipped with ground-fault circuit interrupters, reset button, and pilot light.

F. Power Distribution System Circuits: Where permitted and overhead and exposed for surveillance, wiring circuits, not exceeding 125-V ac, 20-A rating, and lighting circuits may be nonmetallic sheathed cable.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the work. Relocate and modify facilities as required.

B. Provide each facility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

C. Safety barriers: the general contractor shall erect safety barriers to deter and prohibit unauthorized access to the construction site. Such barriers may take the form of fences and shall be clearly marked with signage prohibiting unauthorized access. The general contractor shall be responsible for safety barriers within the building. The contractor shall be liable for damages to persons or property due to the construction process if adequate safety measures are not undertaken. The architect shall review safety precautions for their adequacy but shall not be held liable for contractor’s failure to maintain or provide adequate protection.

D. Each contractor shall take all necessary precautions to ensure the safety of all structural elements during all phases of all work. No materials, cranes, trucks or any other construction loads shall be placed on any part of the structure until the contractor has determined the adequacy of that structure to carry the intended load without damage or overstress.

E. Remove temporary facilities when no longer needed, or when use of appropriate permanent facility is approved, but not later than substantial completion.

   1. Exception: When the architect or owner requests usage.
3.2 TEMPORARY UTILITY INSTALLATION

A. General: Engage appropriate local utility company to install temporary service. Where utility company provides only part of the service, provide the remainder with matching, compatible materials and equipment. Comply with utility company recommendations.

1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
2. Provide adequate capacity at each stage of construction. Before temporary utility is available, provide trucked-in services.
3. Obtain easements to bring temporary utilities to Project site where Owner's easements cannot be used for that purpose.

B. Sanitary Facilities: Provide temporary drinking-water fixtures. Comply with regulations and health codes for type, number, location, operation, and maintenance of fixtures and facilities.

C. Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment from that specified that will not have a harmful effect on completed installations or elements being installed.

D. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment from that specified that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.

E. Electric Power Service: Unless otherwise directed, connect to Owner's existing electric power service. Maintain equipment in a condition acceptable to Owner.

F. Electric Distribution: Provide receptacle outlets adequate for connection of power tools and equipment.

1. Provide waterproof connectors to connect separate lengths of electrical power cords if single lengths will not reach areas where construction activities are in progress. Do not exceed safe length-voltage ratio.
2. Provide warning signs at power outlets other than 110 to 120 V.
3. Provide metal conduit, tubing, or metallic cable for wiring exposed to possible damage. Provide rigid steel conduits for wiring exposed on grades, floors, decks, or other traffic areas.
4. Provide metal conduit enclosures or boxes for wiring devices.
5. Provide 4-gang outlets, spaced so 100-foot extension cord can reach each area for power hand tools and task lighting. Provide a separate 125-V ac, 20-A circuit for each outlet.
6. Provide any 220-volt power that may be required for specialty equipment.

G. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations and traffic conditions.

1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
2. Provide one (1) 150-W rough service incandescent lamp every 50 feet in traffic areas.
3. Install exterior-yard site lighting that will provide adequate illumination for construction operations, traffic conditions, and signage visibility when the Work is being performed.
4. Provide minimum ½ foot-candle at all paved surfaces.
H. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.

1. Toilets: Use of Owner's existing toilet facilities will be permitted, as long as facilities are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.

I. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel. Install one telephone line(s) for each field office.

1. Provide additional telephone lines for the following:
   a. Provide a dedicated telephone line for each facsimile machine and computer in each field office.
   b. Provide one telephone line(s) for Owner's use.

2. At each telephone, post a list of important telephone numbers.
   a. Police and fire departments.
   b. Ambulance service.
   c. Contractor's home office.
   d. Construction Manager’s office
   e. Architect's office.
   f. Engineers' offices.
   g. Owner's office.
   h. Principal subcontractors' field and home offices.

3. Provide superintendent with cellular telephone or portable two-way radio for use when away from field office.

4. Provide temporary electronic communication service, including electronic mail, in common-use facilities by way of an internet service provider (ISP) account with fiber optic, cable modem or broadband service, with a static I.P. address.

3.3 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:

1. Locate temporary field offices, storage sheds, sanitary facilities, and other temporary construction and support facilities.

2. Provide incombustible construction for offices, shops, and sheds located within construction area or within 30 feet of building lines. Comply with NFPA 241.

3. Maintain support facilities until near Substantial Completion. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

B. Project Identification and Temporary Signs: Prepare (1) 8 foot x 8 foot Project identification sign. Install sign in location selected by owner, construction manager and architect to inform public and persons seeking entrance to Project. Do not permit installation of unauthorized signs.

1. Construct signs of ¾” thick exterior-type Grade B-B high-density concrete form overlay plywood. Support on 6”X6” pressure treated wood posts or framing steel.
A. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects. Avoid using tools and equipment that produce harmful noise. Restrict use of noisemaking tools and equipment to hours that will minimize complaints from persons or firms near Project site.

B. Pest Control: Before deep foundation work has been completed, retain a local exterminator or pest-control company to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests. Engage this pest-control service to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Obtain extended warranty for Owner. Perform control operations lawfully, using environmentally safe materials.

C. Security Enclosure and Lockup: Install substantial temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security.

D. Barricades, Warning Signs, and Lights: Comply with standards and code requirements for erecting structurally adequate barricades. Paint with appropriate colors, graphics, and warning signs to inform personnel and public of possible hazard. Where appropriate and needed, provide lighting, including flashing red or amber lights.

   1. For safety barriers, sidewalk bridges, and similar uses, provide minimum 5/8-inch-thick exterior plywood.

E. Covered Walkway and Temporary Scaffolding: Erect a structurally adequate, protective, covered walkway for passage of persons along adjacent Public Street to temporary entry and as required for public safety. Coordinate with entrance gates, other facilities, and obstructions. Comply with regulations of authorities having jurisdiction. Also, provide similar interior temporary scaffolding and safety coverings at the entire two-story Records Room.

   1. Construct covered walkways using scaffold or shoring framing.
   2. Provide wood-plank overhead decking, protective plywood enclosure walls, handrails, barricades, warning signs, lights, safe and well-drained walkways, and similar provisions for protection and safe passage.
   3. Extend back wall beyond the structure to complete enclosure fence.
   4. Paint and maintain in a manner approved by Owner and Architect.
   5. For safety barriers, sidewalk bridges, and similar uses, provide minimum 5/8-inch-thick exterior plywood.

F. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weather-tight enclosure for building exterior.
1. Where heating or cooling is needed and permanent enclosure is not complete, provide insulated temporary enclosures. Coordinate enclosure with ventilating and material drying or curing requirements to avoid dangerous conditions and effects.
2. Vertical Openings: Close openings of 25 sq. ft. or less with plywood or similar materials.
3. Horizontal Openings: Close openings in floor or roof decks and horizontal surfaces with load-bearing, wood-framed construction.
4. Install tarpaulins securely using fire-retardant-treated wood framing and other materials.
5. Where temporary wood or plywood enclosure exceeds 100 sq. ft. in area, use fire-retardant-treated material for framing and main sheathing.

G. Temporary Partitions: Erect and maintain dustproof partitions and temporary enclosures to limit dust and dirt migration and to separate areas from fumes and noise.
1. Construct dustproof partitions of not less than nominal 4-inch studs, 5/8-inch gypsum wallboard with joints taped on occupied side, and 1/2-inch fire-retardant plywood on construction side.
2. Insulate partitions to provide noise protection to occupied areas.
3. Seal joints and perimeter. Equip partitions with dustproof doors and security locks.
4. Protect air-handling equipment.
5. Weather-strip openings.

H. Temporary Fire Protection: Until fire-protection needs are supplied by permanent facilities, install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241.
1. Provide fire extinguishers, installed on walls on mounting brackets, visible and accessible from space being served, with sign mounted above.
   a. Field Offices: Class A stored-pressure water-type extinguishers.
   b. Other Locations: Class ABC dry-chemical extinguishers or a combination of extinguishers of NFPA-recommended classes for exposures.
   c. Locate fire extinguishers where convenient and effective for their intended purpose; provide not less than one extinguisher on each floor at or near each usable stairwell.
2. Store combustible materials in containers in fire-safe locations.
3. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire-protection facilities, stairways, and other access routes for firefighting. Prohibit smoking in hazardous fire-exposure areas.
4. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition.
5. Permanent Fire Protection: At earliest feasible date in each area of Project, complete installation of permanent fire-protection facility, including connected services, and place into operation and use. Instruct key personnel on use of facilities. Develop and supervise an overall fire-prevention and first-aid fire-protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.

I. Temporary Railings: The Contractor is responsible for the furnishing, installation, maintenance and removal of safety, fall and opening protection, etc., associated with their work in the existing building.
1. The Contractor is responsible for the removal and immediate replacement, at the conclusion of their work, of all temporary protection measures as required in order to facilitate their work.
2. No fall or opening protection shall be removed until the progress of the permanent work is installed in a manner that results in no hazard to any party.
3. The installation of all barricades, enclosure, temporary partitions and other protective measures shall be performed in full compliance with the requirements of the New Jersey State Department of Labor, OSHA regulations and all other applicable Federal, State and Local laws.

3.5 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

B. Maintenance: Maintain facilities in good operating condition until removal. Protect from damage caused by freezing temperatures and similar elements.

1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
2. Prevent water-filled piping from freezing. Maintain markers for underground lines. Protect from damage during excavation operations.

C. Operate Project-identification-sign lighting daily from dusk until 12:00 midnight.

D. Temporary Facility Changeover: Except for using permanent fire protections as soon as available, do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.

E. Permanent Facilities Used During Construction: Clean; replace parts that are worn in excess of that expected during normal use.

1. All warranties and guarantees shall start at time of substantial completion even if systems and equipment (i.e.; rooftop units, HVAC equipment.) Have been used for temporary services during construction.

F. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

1. Materials and facilities that constitute temporary facilities are the property of Contractor. Owner reserves right to take possession of Project identification signs.
2. At Substantial Completion, clean and renovate permanent facilities used during construction period. Comply with final cleaning requirements in Division 1 Section "Closeout Procedures."

END OF SECTION 015000
SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

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

B. Related Section:
   1. Division 1 Section "Contract Modification/Substitution Procedures" for requests for substitutions.

1.2 DEFINITIONS

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

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

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

   1. Evaluation of Comparable Products: In addition to the basis-of-design product description, product attributes and characteristics may be listed to establish the significant qualities related to type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other special features and requirements for purposes of evaluating comparable products of additional manufacturers named in the specification.
      a. Comparable products are not considered substitutions.
      b. Comparable products are considered the same as "or equal" products.

C. Subject to Compliance with Requirements: Where the phrase "Subject to compliance with requirements" introduces a product selection procedure in an individual Specification Section, provide products qualified under the specified product procedure. In the event that a named product or product by a named manufacturer does not meet the other requirements of the specifications, select another named product or product from another named manufacturer that does meet the requirements of the specifications; submit a comparable product.
1.3 QUALITY ASSURANCE

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

1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING

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

B. Delivery and Handling:

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

C. Storage:

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

1.5 PRODUCT WARRANTIES

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

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

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

1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
2. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.

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

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

1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Division 01 Section "Substitution Procedures" for proposal of product.

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

2.2 COMPARABLE PRODUCTS

A. Conditions for Consideration: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:

1. Evidence that the proposed product does not require revisions to the Contract Documents that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the work.
2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
3. Evidence that proposed product provides specified warranty.
4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
5. Samples, if requested.

B. Second, third and fourth request by the Contractor for the same product/material/equipment item will be rejected with the Basis-of Design provided.
SECTION 017300 - EXECUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

2. Installation of the Work.
3. Cutting and patching.
4. Progress cleaning.
5. Starting and adjusting.
6. Protection of installed construction.
7. Correction of the Work.

B. Related Sections:

1. Division 01 Section "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.

1.3 DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of other work.

B. Patching: Fitting and repair work required to restore construction to original conditions after installation of other work.

1.4 QUALITY ASSURANCE

A. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.

1. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.

   a. Water, moisture, or vapor barriers.
   b. Membranes and flashings.
   c. Equipment supports.
   d. Piping, ductwork, vessels, and equipment.
e. Noise- and vibration-control elements and systems.

2. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

B. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

1.5 WARRANTY

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

PART 2 - PRODUCTS

2.1 MATERIALS

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

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

PART 3 - EXECUTION

3.1 PREPARATION

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

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

C. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of the Contractor, submit a request for information to Architect according to requirements in Division 01 Section "Project Management and Coordination."

3.2 INSTALLATION

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

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

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

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

E. 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. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
2. Allow for building movement, including thermal expansion and contraction.
3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

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.

3.3 CUTTING AND PATCHING

A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

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

C. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
D. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching in accordance with requirements of Division 01 Section "Summary."

E. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to minimize interruption to occupied areas.

F. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.

2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.

3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.

4. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.

5. Proceed with patching after construction operations requiring cutting are complete.

G. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.

2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.

   a. Clean piping, conduit, and similar features before applying paint or other finishing materials.

   b. Restore damaged pipe covering to its original condition.

3. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition.

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

3.4 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.


2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F.
3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
   a. Utilize containers intended for holding waste materials of type to be stored.

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

C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
   1. Remove liquid spills promptly.
   2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

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

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

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

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

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

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

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

3.5 STARTING AND ADJUSTING

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

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

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

D. Manufacturer's Field Service: Comply with qualification requirements in Division 01 Section "Quality Requirements."
3.6 PROTECTION OF INSTALLED CONSTRUCTION

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

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

3.7 CORRECTION OF THE WORK

A. Repair or remove and replace defective construction. Restore damaged substrates and finishes.
   1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.

B. Restore permanent facilities used during construction to their specified condition.

C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.

D. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.

E. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION 017300
SECTION 017700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:

1. Substantial Completion procedures.
2. Final completion procedures.
3. Warranties.
4. Final cleaning.
5. Repair of the Work.

B. Related Requirements:

1. Division 01 Section "Execution" for progress cleaning of Project site.
2. Division 01 Section "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.

1.3 ACTION SUBMITTALS

A. Product Data: For cleaning agents.

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

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

1.4 MAINTENANCE MATERIAL SUBMITTALS

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

1.5 SUBSTANTIAL COMPLETION PROCEDURES

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

1.6 FINAL COMPLETION PROCEDURES
A. Submittals Prior to Final Completion: Before requesting final inspection for determining final completion, complete the following:

1. Submit a final Application for Payment according to Division 01 Section "Payment Procedures."

1.7 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

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

1. Organize list of spaces in sequential order.
2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
3. Include the following information at the top of each page:
   a. Project name.
   b. Date.
   c. Name of Architect.
   d. Name of Construction Manager.
   e. Name of Contractor.

4. Submit list of incomplete items in the following format:
   b. Three paper copies. Architect will return two copies.

1.8 SUBMITTAL OF PROJECT WARRANTIES

A. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.

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

PART 2 - PRODUCTS

2.1 MATERIALS

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

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:

   a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, of rubbish, waste material, litter, and other foreign substances.
   b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
   c. Remove tools, construction equipment, machinery, and surplus material from Project site.
   d. Clean exposed interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
   e. Remove debris and surface dust from limited access spaces, including plenums, shafts, trenches, equipment vaults and similar spaces.
   f. Remove labels that are not permanent.
   g. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
   h. Leave Project clean and ready for occupancy.

3.2 REPAIR OF THE WORK

A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.

B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.

1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that that already show evidence of repair or restoration.
3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.

END OF SECTION 017700
SECTION 017823 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

1. Operation and maintenance documentation directory manuals.
2. Systems and equipment operation manuals.
3. Systems and equipment maintenance manuals.
4. Product maintenance manuals.

1.3 CLOSEOUT SUBMITTALS

A. Submit operation and maintenance manuals indicated. Provide content for each manual as specified in individual Specification Sections, and as reviewed and approved at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.

1. Construction Manager / Architect will comment on whether content of operation and maintenance submittals is acceptable.
2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

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

1. Submit on digital media acceptable to Construction Manager / Architect by email to Architect through Construction Manager. Enable reviewer comments on draft submittals.
2. Submit three paper copies. Architect, through Construction Manager, will return two copies.

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

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

D. Comply with Division 01 Section "Closeout Procedures" for schedule for submitting operation and maintenance documentation.
1.4 FORMAT OF OPERATION AND MAINTENANCE MANUALS

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

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

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

1. Binders: Heavy-duty, three-ring, vinyl-covered binders, in thickness necessary to accommodate contents; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
2. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
   a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
   b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

1.5 SYSTEMS AND EQUIPMENT OPERATION MANUALS

A. Systems and Equipment Operation Manual: Assemble a complete set of data indicating operation of each system, subsystem, and piece of equipment not part of a system. Include information required for daily operation and management, operating standards, and routine and special operating procedures.

B. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:

2. Performance and design criteria if Contractor has delegated design responsibility.
3. Operating standards.
4. Operating procedures.
5. Operating logs.
6. Wiring diagrams.
7. Control diagrams.
8. Piped system diagrams.
9. Precautions against improper use.
10. License requirements including inspection and renewal dates.
1.6  SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

A. Systems and Equipment Maintenance Manuals: Assemble a complete set of data indicating maintenance of each system, subsystem, and piece of equipment not part of a system. Include manufacturers' maintenance documentation, preventive maintenance procedures and frequency, repair procedures, wiring and systems diagrams, lists of spare parts, and warranty information.

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

C. Manufacturers' Maintenance Documentation: Include the following information for each component part or piece of equipment:

1. Standard maintenance instructions and bulletins; include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

   a. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
3. Identification and nomenclature of parts and components.
4. List of items recommended to be stocked as spare parts.

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

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

   1. Include procedures to follow and required notifications for warranty claims.

1.7  PRODUCT MAINTENANCE MANUALS

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

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

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

   1. Include procedures to follow and required notifications for warranty claims.
PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 017823
SECTION 017839 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for project record documents, including the following:

1. Record Drawings.
2. Record Specifications.
3. Record Product Data.

B. Related Requirements:

1. Division 01 Section "Execution" for final property survey.
2. Division 01 Section "Closeout Procedures" for general closeout procedures.

1.3 CLOSEOUT SUBMITTALS

A. Record Drawings: Comply with the following:

1. Number of Copies: Submit one set(s) of marked-up record prints.

B. Record Specifications: Submit one paper copy or annotated PDF electronic files of Project's Specifications, including addenda and contract modifications.

C. Record Product Data: Submit one paper copy or annotated PDF electronic files and directories of each submittal.

1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

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

1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or
entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.

a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
b. Accurately record information in an acceptable drawing technique.
c. Record data as soon as possible after obtaining it.
d. Record and check the markup before enclosing concealed installations.
e. Cross-reference record prints to corresponding archive photographic documentation.

2. Content: Types of items requiring marking include, but are not limited to, the following:

a. Dimensional changes to Drawings.
b. Revisions to details shown on Drawings.
c. Revisions to electrical circuitry.
d. Changes made by Change Order or Construction Change Directive.

3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.

4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.

5. Mark important additional information that was either shown schematically or omitted from original Drawings.

6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

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

1. Record Prints: Organize record prints and newly prepared record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.

2. Identification: As follows:

a. Project name.
b. Date.
c. Designation "PROJECT RECORD DRAWINGS."
d. Name of Architect.
e. Name of Construction Manager.
f. Name of Contractor.

2.2 RECORD SPECIFICATIONS

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

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.

2. Note related Change Orders and record Drawings where applicable.

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

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

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

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

   1. Include record Product Data directory organized by Specification Section number and title, electronically linked to each item of record Product Data.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

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

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

END OF SECTION 017839
SECTION 017900 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
   1. Instruction in operation and maintenance of systems, subsystems, and equipment.

1.3 INFORMATIONAL SUBMITTALS

A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.
   1. Indicate proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.

1.4 COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.

B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data have been reviewed and approved by Construction Manager / Architect.

1.5 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.
1.6 PREPARATION

A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Division 01 Section "Operation and Maintenance Data."

B. Set up instructional equipment at instruction location.

1.7 INSTRUCTION

A. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

B. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.

PART 2 - PRODUCTS

PART 3 - EXECUTION

END OF SECTION 017900
SECTION 024118 - SELECTIVE DEMOLITION

PART 1 - GENERAL

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

1.2 SUMMARY
A. Section Includes:
   1. Demolition and removal of selected portions of building or structure.
   2. Demolition and removal of selected site elements.
B. Related Requirements:
   1. Division 01 Section "Summary" for restrictions on the use of the premises, Owner-occupancy requirements, and phasing requirements.
   2. Division 01 Section "Execution" for cutting and patching procedures.

1.3 DEFINITIONS
A. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or removed and reinstalled.
B. Remove and Salvage: Carefully detach from existing construction, in a manner to prevent damage, and deliver to Owner.
C. Remove and Reinstall: Detach items from existing construction, prepare for reuse, and reinstall where indicated.
D. Existing to Remain: Existing items of construction that are not to be permanently removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.4 MATERIALS OWNERSHIP
A. Unless otherwise indicated, demolition waste becomes property of Contractor.
B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.
   1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.5 CLOSEOUT SUBMITTALS
A. Inventory: Submit a list of items that have been removed and salvaged.
1.6 FIELD CONDITIONS

A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.

B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
   1. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.

E. Storage or sale of removed items or materials on-site is not permitted.

F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
   1. Maintain fire-protection facilities in service during selective demolition operations.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ANSI/ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting selective demolition operations.

B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

C. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.

3.2 PREPARATION

A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
   1. Comply with requirements for access and protection specified in Section 015000 "Temporary Facilities and Controls."
B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
4. Cover and protect furniture, furnishings, and equipment that have not been removed.

3.3 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
5. Maintain adequate ventilation when using cutting torches.
6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
7. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
8. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
9. Dispose of demolished items and materials promptly.

B. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and reinstalled in their original locations after selective demolition operations are complete.

3.4 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw then remove masonry between saw cuts.

B. Roofing: Remove no more existing roofing than what can be covered in one day by new roofing and so that building interior remains watertight and weathertight. See Division 07 Section "Ethylene-Propylene-Diene-Monomer (EPDM) Roofing" for new roofing requirements.
1. Remove existing roof membrane, flashings, copings, and roof accessories.
2. Remove existing roofing system down to substrate.

3.5 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site.

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.

B. Burning: Do not burn demolished materials.

C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.6 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.
SECTION 028201 – ASBESTOS ABATEMENT

PART 1 GENERAL REQUIREMENTS

1.1 RELATED DOCUMENTS

A. General and Supplementary General Conditions, and the Contract Drawings apply to this Section.


1.2 CONDITIONS

A. ETI shall be responsible for any and all final inspections and sampling relative to air monitoring and provide analytical services with respect to the removal, handling and disposal of the identified asbestos containing materials to facilitate the work referenced in this Section. Where required, including by the Owner or any of the Owner’s agents, ETI shall conduct air sampling and provide analytical services to evaluate the effectiveness of engineering controls, verify completion of abatement work for occupancy, etc., by an on-site Industrial Hygiene Technician employed by ETI. ETI shall also represent the Owner at the site with regulatory and Contract compliance with respect to the asbestos abatement related work specified herein.

B. The Contractor performing the work involving the removal of asbestos containing materials shall notify ETI at least within 24-hours prior to that scheduled asbestos abatement work not occurring on a pre-arranged date.

C. Regulated Asbestos Containing Materials (RACM) shall be removed and disposed from the Golf Center Building 2020 Renovation Areas. These activities, including disposal, shall be completed in a manner that are in compliance with 40 CFR, Part 61, Sub-part M, and 29 CFR, Part 1926.1101, and as adopted by New Jersey Administrative Codes (N.J.A.C.) 5:23-8, 7:26, 8:60, 12:120 and 12:100-13.

D. The disposal of asbestos containing materials shall be in accordance with N.J.A.C. 7:26; also 40 CFR, Part 61, Sub-part M, which requires, at a minimum, asbestos containing waste to be adequately wetted and appropriately packaged, transported in leak-tight containers and disposed of at an authorized landfill for such waste. Waste manifests shall be provided to the Owner.

E. The transport of asbestos containing waste materials shall be in accordance with N.J.A.C. 7:26, including the use of State of New Jersey, Department of Environmental Protection, (DEP) registered solid waste haulers. United States Department of Transportation regulations, including, but not limited to, 49 CFR, Part 173, shall apply, with respect to placards, labels, etc.

F. It is the responsibility of the Contractor to pay directly all fees associated with any Patent, instrument, devices, process, etc., utilized on this project where required by the patent holder.

1.3 PROJECT DIRECTORY


1.4 QUANTITIES

ASBESTOS ABATEMENT 028201 - 1
A. The quantities shown are for informational purposes only. The Contractor shall inspect and verify all locations, quantities and measurements indicated in Contract Documents prior to bidding. No additional compensation shall be awarded for failure to complete said review or inspection.

1.5 CODES & STANDARDS RELATIVE TO ASBESTOS ABATEMENT

A. State of New Jersey requirements which govern asbestos abatement work or hauling and disposal of asbestos waste materials, as well as indoor air quality standards, include, but are not limited to the following:

1. N.J.A.C. 5:23-8
   New Jersey Asbestos Hazard Abatement Sub-code
2. N.J.A.C. 7:26
   Disposal Regulations
3. N.J.A.C. 8:60 and 12:120
   Asbestos Training Courses, Licenses and Permits
4. N.J.A.C. 12:100-13
   New Jersey Indoor Air Quality Standard

1.6 PRE-PROJECT INSPECTION

A. Prior to commencement of work, inspect areas in which work is to be performed. Prepare a listing of damage to structure, surfaces, equipment or of surrounding properties which could be misconstrued as damage resulting from the work. Photograph or videotape existing conditions, as necessary to document conditions. Submit a copy of these photos or tapes to the Owner's representative prior to starting work.

1.7 POTENTIAL ENVIRONMENTAL HAZARDS

A. The disturbance or dislocation of asbestos containing materials identified in these Technical Specifications may cause a release within the building’s atmosphere or the environment, thereby creating a potential health hazard to workmen and building occupants. Apprise all workers, supervisory personnel, sub-contractors, consultants and authorized visitors who will be at the job site of the seriousness of the hazard and of proper work procedures which must be followed.

1.8 STOP WORK

A. If the Owner, the Owner's representative, or the Project Administrator presents a written stop work order, immediately and automatically stop all work. Do not recommence work until authorized in writing by the Owner or his/her appropriate representative.

1.9 CONTRACTOR’S USE OF THE PREMISE

A. Keep existing driveways and entrances serving the premises clear and available to the Owner and his employees at all times. Do not use these areas for parking or storage of materials.

B. Do not unreasonably encumber the site with materials or equipment. Confine stockpiling of materials and location of storage sheds to the areas indicated. If additional storage is necessary, obtain and pay for such storage off site.

C. Keep public areas such as hallways, stairs, elevator lobbies and toilet rooms free from accumulation of waste, rubbish or construction debris.
D. Cooperate fully with the Owner and/or the Owner's representative during construction operations to minimize conflicts with other Trades. Perform the work so as not to interfere with the Owner's operation.

1.10 SUBMITTALS

A. Pre-Project Submittals

1. Written Respiratory Protection Plan, in accordance with 29 CFR, Parts 1910 and 1926.
2. Written site-specific Health and Safety Plan.
3. All notifications and permits.
4. All Safety Data Sheets (SDS).

B. Post Project Submittals: Upon completion of work on this project the Asbestos Abatement Contractor shall submit the following information to the Owner:

1. Daily activity reports and personnel sign-in sheets
2. Minutes of meetings
3. Visitations; authorized and unauthorized
4. Special or unusual events
5. Waste material disposal manifests

PART 2 DESCRIPTION OF THE WORK

2.1 SCOPE OF WORK

<table>
<thead>
<tr>
<th>Material Location</th>
<th>Material Description</th>
<th>Friability</th>
<th>Est. Quantity of Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basement</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ceiling Above Boilers</td>
<td>Transite Panels</td>
<td>Category-2 Non-Friable</td>
<td>42 SF</td>
</tr>
<tr>
<td>1ST Floor</td>
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<tr>
<td>Coat Room</td>
<td>9”x9” Beige Floor Tiles</td>
<td>Category-1 Non-Friable</td>
<td>215 SF</td>
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<tr>
<td>Janitors Closet (J.C.)</td>
<td>9”x9” Beige Floor Tiles</td>
<td>Category-1 Non-Friable</td>
<td>12 SF</td>
</tr>
<tr>
<td>Basement Stair Landing (ledge)</td>
<td>9”x9” Beige Floor Tiles</td>
<td>Category-1 Non-Friable</td>
<td>4 SF</td>
</tr>
<tr>
<td>Maintenance Shop</td>
<td>9”x9” Beige Floor Tiles</td>
<td>Category-1 Non-Friable</td>
<td>55 SF</td>
</tr>
<tr>
<td>Snack Bar Kitchen Closet (under HVAC)</td>
<td>9”x9” Beige Floor Tiles</td>
<td>Category-1 Non-Friable</td>
<td>5 SF</td>
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<tr>
<td>Snack Bar Kitchen Exterior Door Landing</td>
<td>9”x9” Beige Floor Tiles</td>
<td>Category-1 Non-Friable</td>
<td>2 SF</td>
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<tr>
<td>Snack Bar Kitchen</td>
<td>Sheet Flooring (bottom layer), under 12” Floor Tiles</td>
<td>Category-1 Non-Friable</td>
<td>130 SF</td>
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<tr>
<td>Kitchen Storage Room</td>
<td>Vinyl Sheet Flooring (tan) w/Glue</td>
<td>Category-1 Non-Friable</td>
<td>130 SF</td>
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</table>
### 2nd Floor

<table>
<thead>
<tr>
<th>Existing Bar</th>
<th>Vinyl Sheet Flooring (tan) w/Glue</th>
<th>Category-1 Non-Friable</th>
<th>S.F.</th>
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<tbody>
<tr>
<td>Storage Room #1</td>
<td>9”x9” Beige Floor Tiles</td>
<td>Category-1 Non-Friable</td>
<td>80 SF</td>
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<tr>
<td>Storage Room #2</td>
<td>9”x9” Beige Floor Tiles</td>
<td>Category-1 Non-Friable</td>
<td>72 SF</td>
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<tr>
<td>Storage Room #3</td>
<td>9”x9” Beige Floor Tiles</td>
<td>Category-1 Non-Friable</td>
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<td>Storage Room #4</td>
<td>9”x9” Beige Floor Tiles</td>
<td>Category-1 Non-Friable</td>
<td>60 SF</td>
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<td>Storage Room #5</td>
<td>9”x9” Beige Floor Tiles</td>
<td>Category-1 Non-Friable</td>
<td>180 SF</td>
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<tr>
<td>Break Room</td>
<td>9”x9” Beige Floor Tiles</td>
<td>Category-1 Non-Friable</td>
<td>300 SF</td>
</tr>
<tr>
<td>Hallways</td>
<td>9”x9” Beige Floor Tiles</td>
<td>Category-1 Non-Friable</td>
<td>360 SF</td>
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</tbody>
</table>

S.F. = Square Feet; L.F. = Linear Feet; a/w = Associated With; adj. = Adjacent

A. Abatement in the Basement shall include the removal and disposal of Category-2 Non-friable transite panels.

B. Abatement on the first and second floor levels shall include the removal and disposal of Category-1 Non-friable floor tiles, vinyl sheet flooring and associated glue (mastic).

C. Where necessary, limited demolition of non-asbestos containing wall and floor finishes shall be performed by the Contractor to access asbestos containing materials.

D. Where multiple layers of asbestos containing vinyl flooring and wood exist, the contractor shall remove all layers of flooring to the concrete or wood joist sub-floor.

### 2.2 ADDITIONAL INFORMATION

A. Refer to Architectural and Engineering Plans, as prepared by Netta Architects, for additional information.

B. The project schedule and phasing of the work shall be coordinated with the General/Prime Contractor.

C. Work shall be coordinated during minimal periods of occupancy for the work areas; interior work area locations shall be unoccupied during the work, which could result in relocation of occupants or the asbestos abatement work occurring after hours. Relocation of moveable items from the extents of the work areas shall be the responsibility of others, and not that of the Asbestos Abatement Contractor.

D. The Contractor shall be responsible for the cleaning of all suspect asbestos containing debris and dust within the work areas, prior to asbestos abatement, which is an industry standard. The cleaning shall consist of High Efficiency Particulate Air (HEPA) vacuuming and/or wet wiping/mopping surfaces within the work. For large debris items, the debris shall be misted with amended water prior
to packaging as asbestos waste.

E. The Asbestos Abatement Contractor, licensed by the State of New Jersey, Department of Labor and Workforce Development, shall coordinate with the Prime and/or General Contractor as to any shoring, bracing or other temporary structural supports or protection necessary to complete the referenced asbestos abatement work, in accordance with OSHA requirements.

G. Electrical power, water and sanitary facilities are available at the site. The Contractor shall arrange with the Facility and/or Owner for the utilization of said items. Connection to the point of source to the work area shall be the sole responsibility of the Contractor. All electrical connections, with exception to receptacles and extension cords, shall be accomplished by a licensed Electrician.

H. Smoke/fire detectors within the work areas shall be protected with plastic covers, specifically designed for such purpose. Where present, fire suppression systems that do not operate by separate detectors, but rather fire sprinklers that activate at a temperature, the Contractor shall arrange with the Owner to have these systems isolated from the work areas, placed on “Test” and the Contractor shall provide a licensed Asbestos Handler that is permitted by the State of New Jersey, Department of Labor and Workforce Development, (L&WD) as a supervisor to maintain a “Fire Watch.” The individual responsible for the “Fire Watch” shall be on-site when the Contractor is not on-site, and shall inspect and document conditions, at a minimum, every hour. In the event of an emergency, this individual shall immediately notify emergency services for the municipality via the “911” system, the Owner, the Owner’s representative, the Contractor and ETI at the telephone numbers provided. The Contractor’s bid shall reflect this requirement at no additional cost to the Owner, Owner’s representative and/or EC.

I. AFDs shall exhaust via duct work to the exterior of the building through windows and/or doors, as indicated on the Contract Drawings. The AFD duct work shall be connected to exhaust manifold constructed by the Contractor from ½” fire-rated plywood. At the exterior exhaust points for the manifolds, the Contractor shall secure ¾” wire mesh, that is of the same diameter and shape as the manifold exhaust port. No exposed sharp edges from the wire mesh shall be allowed. Cardboard and/or polyethylene sheeting manifolds shall not be allowed, without exception. The manifolds shall be secured in a manner to prevent unauthorized access. The direction of the AFD exhaust shall not be within twenty-five (25) feet of air handler unit(s), fresh air intakes; otherwise, the Contractor shall arrange with the Owner to have such units shut down and critical barriers installed for the duration of the project.

J. Where specified, the removal and disposal of specified asbestos containing materials shall be completed in accordance with N.J.A.C. 5:23-8.

1. Warning signs, as prescribed by OSHA, shall be placed at the entrance to the work area.
2. For full containment work areas, work area pressure differential shall be established and maintained at -0.03 inches of water column for full containment work under NJAC 5:23-8. Pressure differential monitoring shall be established at the decontamination unit using a digital monometer with a continuous printout. Negative air filtration devices shall achieve four (4) air changes per hour; air filtration devices shall exhaust to the building exterior.
3. Where present, the Heating, Ventilating and Air Conditioning (HVAC) system servicing the work area shall be shut-off and diffusers and grilles shall be sealed with critical barriers. If present, the filter for the HVAC system’s air handler unit shall be removed and disposed of as asbestos contaminated waste after shutting down the system. All wall and ceiling/roof mounted exhaust fans, an approximate total of two (2) wall units and two (2) ceiling/roof units, shall be cleaned and sealed with critical barriers.
4. Critical barriers, two (2) independent layers of six (6) mil polyethylene sheeting, shall be
installed over all openings (i.e., doors, windows, ventilation dispersers, etc.), suspended ceiling systems, and non-moveable items in the work area extents, prior to the application of protective wall and ceiling polyethylene sheeting.

5. A three-stage decontamination unit shall be established at the entrance to the work area, with a clean chamber, shower chamber, and equipment chamber, where the equipment chamber is attached to the work area, for the decontamination of personnel and appropriately bagged waste.

6. Waste removal from the work area to the on-site waste container shall be completed during the least occupied period in the building. Coordinate all transfer of waste with the AST for air sample monitoring. Allow sufficient time, as required, for installation of air sampling cassettes. The Contractor’s waste hauler shall be licensed by the State of New Jersey, Department of Environmental Protection, (DEP) and have currently solid waste hauler placards affixed to the waste container for transport.

K. Where suspect asbestos containing materials that are not identified above are uncovered during demolition work, the activities shall cease. The suspect asbestos containing materials shall be inspected by an accredited USEPA Asbestos Building Inspector. A third-party independent laboratory that is accredited by the American Industrial Hygiene Association (AIHA), participating in the National Voluntary Laboratory Accreditation Program (NVLAP) shall provide analytical services.

L. Sampling efforts and analytical services shall not be cause for a delay claim by the Contractor against the Owner, the Owner’s representative and/or the Owner’s agents, as well as the Prime and/or General Contractor.

M. Summary by References: Work of this Contract can be summarized by references to the Contract, General Conditions, Supplementary Conditions, Specifications Sections, Drawings, Addenda and modifications to the Contract Documents issued subsequent to the initial printing of this project manual and included, but not necessarily limited to, printed material referenced by any of these. Work of the Contract is also unavoidably affected or influenced by governing regulations, natural phenomena including weather conditions and other forces outside the Contract Documents.

PART 3 ASBESTOS ABATEMENT REQUIREMENTS

3.1 GENERAL REQUIREMENTS

A. The Contractor shall provide a "competent person" on-site at all times, in accordance with OSHA Regulations, and shall maintain the necessary staffing to complete the project in accordance with the project schedule. The competent person shall have knowledge in construction and shall be knowledgeable in reading and interpreting construction documents.

B. All materials (i.e., caulk, polyethylene sheeting, lumber, etc.) utilized in association with asbestos abatement activities shall be of nominal size and fire-retardant. All polyethylene sheeting shall be six (6) mil in thickness.

C. Worker Protection

1. The Contractor shall utilize workers trained in accordance with 29 CFR, Part 1926.1101, which sets forth the dangers inherent in handling asbestos and breathing asbestos dust and in proper work procedures and personnel, and area protective measures.

2. Appropriate respiratory protection shall be provided by the employer, upon notification that employees have received medical clearance and monitoring, followed by passing respiratory fit testing, and having read the Contractor’s written Respiratory Protection Program.

a. The Contractor shall provide medical examinations for all workers in accordance with 29
CFR, Part 1926.1101. Provide an evaluation of the individual’s ability to work with respiratory protection in an environment capable of producing heat stress in the worker.
b. The Contractor shall have a respiratory protection program established which is in compliance with ANSI Z88.2 - 1980 "Practices for Respiratory Protection" and OSHA’s 29CFR, Parts 1910 and 1926. The written program shall be posted at the job site.
c. Provide half face or full-face type respirators to each worker. Equip full face respirators with a nose cup or other anti-fogging device. If negative pressure air purifying respirators are being used, the Contractor shall supply a sufficient quantity of respirator filters approved for asbestos dust, so that workers can change filters during the workday. Store respirators and filters at the job site and protect from exposure to asbestos prior to their use. Clean and sanitize as required.
d. Provide, at a minimum, HEPA type filters labeled with NIOSH and MSHA Certification for "Radionuclides, Radon Daughters, Dust, Fumes, Mists including Asbestos-Containing Dusts and Mists" and color coded in accordance with ANSI Z88.2 (1980). In addition, a chemical cartridge section may be added, if required, for solvents, etc., in use. In this case, provide cartridges that have each section of the combination canister labeled with the appropriate color code and NIOSH/MSHA Certification.
e. Single use, disposable, or quarter face respirators are strictly forbidden for use during asbestos abatement related work.
f. No one having a beard or other facial hair in the respiratory facial fit area will be permitted to don a respirator and enter the work area.

3. Provide disposable full-body coverall including foot and head covers and require that they be worn by all workers in the work area. Provide a sufficient number for all required changes, for all workers in the work area.

4. Provide gloves to all workers and require that they be worn inside the work area. Do not remove gloves from the work area and dispose of as asbestos contaminated waste at the end of work.

5. The Contractor shall strictly prohibit workers from eating, drinking, smoking and chewing gum or tobacco while within the work area. In order to perform any of these functions, workers must exit the work area, and are required to follow the outlined decontamination procedures on each occasion.

D. Perform United States Department of Labor, Occupational Safety and Health Administration (OSHA) 8-hour Time Weighted Average personal exposure air monitoring in accordance with 29 CFR, Part 1926.1101. OSHA monitoring is solely the responsibility of the Contractor, and the Contractor shall ensure that the Contractor’s Supervisor performs OSHA monitoring in accordance with 29 CFR, Part 1926.1101. The Owner’s representative is not responsible for the Contractor’s compliance with OSHA monitoring.

E. The Contractor shall establish the means for personnel decontamination, such as, but not limited to:

1. Decontamination procedures requiring personnel entering the work area/performing the work, to don two (2) protective suits. The first suit shall be a protective suit and shall be HEPA vacuumed, removed and placed in appropriate disposal bags, prior to exiting. The second suit shall be removed and disposed of appropriately upon exiting the work area. The Contractor shall establish hygiene facilities for hand, face, etc.; respiratory protection shall be removed during this process and the respirator cleaned of all visible dust/debris.

2. Construction of a personal decontamination unit which consists of an equipment room, shower room for the workers to remove protective clothing and wash hands, face, etc., and a clean room to be used for changing from street clothes into protective clothing and to dry off from decontaminating and donning street clothes at the end of the work shift.

   a. For non-friable exterior work, the decontamination unit shall be constructed remote from, but in proximity to, the work area(s).
b. The shower chamber shall be the hygiene facility for all workers involved with the removal of asbestos containing materials.

c. For exterior decontamination units, provide plywood sheathing as necessary to protect the decontamination unit from weather and unauthorized access. The decontamination unit shall have a lockable door which the Contractor shall secure when the decontamination unit is not in use.

F. Ensure all HVAC and electrical systems within proximity to the work area are deactivated and/or protected with polyethylene sheeting that is secured airtight with duct tape.

G. Asbestos warning signs and/or tape shall be posted around the perimeter of the exterior work areas for the removal of asbestos containing materials.

H. No asbestos containing material shall be disturbed during preparation activity. The exception is asbestos material required to be cleaned up to complete preparation shall be treated first with an amended water solution and removed in a manner designed to limit or prevent fiber release to the environment.

I. Removal activities shall generate no visible emissions, as enforceable under 40 CFR, Part 61, of the National Emissions Standard for Hazardous Air Pollutants (NESHAPS).

J. All asbestos waste bags and packages shall be labeled with the prescribed federal OSHA warning signs and shall include site specific waste generator information.

1. The Contractor shall provide a fully enclosed, watertight waste container complete with a locking device for storage of all contaminated waste removed from the site. The waste container shall have asbestos warning signs affixed to all sides and doors. A perimeter warning band shall be placed near the trailer location and the exterior route of travel during waste transfer activities.

2. The Contractor shall be responsible for coordination of waste removal immediately upon completion of the project. This is essential in order to obtain a permit for re-occupancy. No payment shall be made to the Contractor until all contaminated waste has been removed from the site and a waste manifest signed by the proper authority is submitted to the Owner.

3. Asbestos waste that may puncture or tear waste bags, and which is required to be bagged for disposal, shall be placed in cardboard boxes, burlap or nylon sacks, or other protective covering, prior to bagging, as necessary to ensure that bags are not punctured or torn during the disposal process. Items that are too large for standard bagging that require bagging for disposal, shall be wrapped in two (2) layers of six (6) mil polyethylene sheeting and sealed with duct tape. All asbestos waste shall be packaged and disposed of in accordance with all applicable local, state and federal regulations and ordinances.

3.2 NOTIFICATIONS, WARNING SIGNS, LABELS AND POSTINGS

A. Asbestos abatement work specified herein is scheduled to be removed utilizing non-friable procedures. Notification may apply to the USEPA and DEP relative to waste disposal.

B. At the entrance to each work area, the Contractor’s ingress/egress point to the work area and at the waste removal route, and all sides of the waste dumpster/container, post an approximate 20 inch by 14 inch manufactured caution sign displaying the following legend with letter sized and styles of a visibility required by 29 CFR, Part 1926:

DANGER
ASBESTOS
CANCER AND LUNG DISEASE HAZARD
RESPIRATORS AND PROTECTIVE CLOTHING ARE REQUIRED IN THIS AREA

C. Disposal/Waste Bags/Containers shall be labeled as follows:

DANGER CONTAINS ASBESTOS FIBERS AVOID CREATING DUST
CANCER AND LUNG DISEASE HAZARD
AVOID BREATHING AIRBORNE ASBESTOS FIBERS
ASBESTOS, NA2212, RQ AND CLASS 9 LABEL

1. In addition, the Contractor shall also label all disposal bags and/or containers with the
   name of the waste generator (Owner) and the location from which the waste was generated;
   all in accordance with the USEPA NESHAPS regulation - 40 CFR, Part 61, Sub-part M.

D. Provide other signs, labels, warnings and posted instructions that are necessary to protect, inform
   and warn people of the hazard from asbestos exposure. Post in a prominent and convenient place for
   the workers a copy of the latest applicable regulations from OSHA, USEPA and NIOSH.

E. Post Construction Permits, if applicable, at the entrance to the work area(s).

3.3 NON-FRIABLE REMOVAL AND DISPOSAL OF ASBESTOS CONTAINING FLOOR TILE AND
   MASTIC

A. Products

1. Six (6) mil polyethylene sheeting
2. Spray glue
3. High quality duct tape
4. Garden sprayer
5. Amended water
6. Asbestos warning signs
7. Other equipment deemed necessary by the Contractor.

B. Floor Tile Removal

1. The Contractor shall install a two (2) flapped, six (6) mil polyethylene sheeted air lock at
   the entrance to the work area. Entrance flaps are to be installed so that the flaps will close if
   air flow into the work area is stopped for any reason. All work shall be performed in
   accordance with the Resilient Floor Coverings Institute’s (RFCI) Recommended Work Practices.
2. The Contractor shall be responsible for the erection of critical barriers consisting of two
   (2) layers of six (6) mil polyethylene sheeting over all openings within the work area. The
   Contractor shall provide all ladders, scaffolding and/or other necessary equipment for the
   installation of all engineering controls.
3. The Contractor shall provide and install HEPA equipped air filtration device(s) (AFDs) within
   the work area to create a continuous negative pressure within the work area throughout
   abatement operations, in addition to the prevention smoke/fumes from exiting the work area.
   The AFDs shall be exhausted to the exterior of the building. Additional requirements specified
   within this Technical Specification apply.
4. Removal activity shall not commence until a written Notice to Proceed has been issued by the
   IHT. Approval of the work area for removal activity shall not, in any way, relieve the
   Contractor of his responsibility to ensure that non-work areas and items/equipment within
   the work area are protected from smoke/fumes, physical damage, or asbestos contamination.
5. The Contractor shall remove floor tiles by heating with an approved radiant heat machine until the heat penetrates through the tile and softens the adhesive. When the tile/adhesive is sufficiently heated, carefully lift the tiles with a long handled tile scraper from the sub-flooring. Where present, carpet tiles shall be removed and disposed of as regular construction debris if tile and/or visible mastic is not affixed to the carpet backing. Otherwise, carpet with tile residue shall be disposed of as asbestos contaminated waste. Ensure that all broken tiles show evidence of heat application and apply amended water to the broken tile and any debris before removing from the sub-flooring and disposing of as asbestos waste.

C. Vinyl Sheet Flooring Glue/Mastic Removal

1. For the purpose of glue/mastic removal, the Contractor shall be responsible for the erection of a single layer of six (6) mil polyethylene to operate as a splash guard around the perimeter of the work area(s). The splash guards shall start at the floor level and shall be erected to a minimum height of two (2) feet.

2. The Contractor shall protect all data cables, telephone lines, mechanical systems, fiber optic cables, etc., in proximity to and potentially affected by the floor tile and mastic removal. Further, holes in the floor slab are to be protected from mastic remover penetration. Exercise extreme caution when working around electric, communication, security, phone and other data transmission lines. Costs of repair or replacement of damaged facility components caused by Contractor operations shall be the responsibility of the Contractor. No repair work may be performed by the Contractor of damaged equipment unless authorized by the Owner.

3. Following preparations identified above, the Contractor shall apply an odorless solvent for the removal of floor tile mastic with a mop or hand sprayer. The Contractor shall allow for a minimum of 5-10 minutes prior to the commencement of removal activities.

4. Remove settled solvent by squeegeeing the mastic, adding shredded newspaper, sawdust or rags to absorb the liquid slurry, collect the slur with shovels and place in asbestos waste bags. Rags shall be utilized for fine cleaning and disposed of as asbestos waste.

5. The Contractor shall be responsible for rinsing the floor and cleaning the surface again, once as a minimum and as many times as necessary to remove adhesive to the desired degree. The completed floor shall be sufficiently cleaned to the satisfaction of the Owner. No visible blackening of the floor surface shall be permitted at the completion of the glue/mastic removal. The floor should appear brown or tan in color, in order to be considered clean.

PART 4 ASBESTOS WASTE HANDLING AND DISPOSAL

4.1 SUMMARY

A. Disposal bags shall be six (6 mil, leak tight, and labeled in accordance with OSHA, NESHAPS, and the United States Department of Transportation (USDOT) regulations.

B. Load all asbestos containing waste material in disposal bags or leak-tight drums. All materials are to be contained in one (1) of the following:

1. Two (2), six (6) mil disposal bags, or,
2. Two (2), six (6) mil disposal bags and a fiberboard drum, or
3. Two (2), six (6) mil disposal bags and sealed steel drum.

C. Two (2) layers of six (6) mil polyethylene sheeting shall be utilized for wrapping large components not suited for disposal bags or drums.

D. Duct tape shall be used to seal disposal bags and wrapped components.
E. The Contractor’s vehicle and/or dumpster shall be lined with a critical barrier. The Contractor’s vehicle and/or dumpster utilized to transport the asbestos waste off-site, and the Waste Hauler shall be licensed by the New Jersey Department of Environmental Protection.

F. Maintain records of waste shipment in accordance with NESHAPS 40 CFR, Part 61, Section 61.150, (d) 1-5 and (e).

G. Notify the USEPA ID #27 approved landfill within 10-days prior to transportation of the asbestos containing waste to the landfill. Provide the name and address of the landfill. Retain manifest from the landfill for all materials disposed of. At the completion of asbestos abatement, forward all manifests to the Owner.

H. On-site activities shall not be considered complete until all waste is off-site, upon demobilization of the work area(s), and after receipt of satisfactory final clearance air sample results.

PART 5 AIR MONITORING

5.1 SUMMARY

A. Air monitoring shall be performed to demonstrate the effectiveness of Engineering controls and methods for the removal of asbestos containing materials with respect to the potential release of asbestos fibers, and the clearance of the work area(s) for re-occupancy.

1. This Section describes air monitoring to verify that the building beyond the work area(s) and the outside environment remains uncontaminated.

2. This Section also sets forth work area clearance criterion.

B. AIR MONITORING REQUIRED BY OSHA IS WORK OF THE CONTRACTOR AND IS NOT COVERED IN THIS SECTION.

C. Daily air monitoring shall be completed along the work area perimeter. Sample collection and analysis shall be in accordance with the National Institute of Occupational Safety and Health (NIOSH) method #7400, most recent revision, by Phase Contrast Microscopy (PCM). The acceptable airborne fiber concentrations for this type of analysis shall be less than 0.01 fibers per cubic centimeter (f/cc) of air.

D. Final Clearance Air Monitoring

1. Final clearance air samples shall be collected at the completion of the asbestos abatement activities, upon receipt of a satisfactory Clean-up Inspection, in writing by the Environmental Consultant to the Contractor.

2. Engineering controls, critical barriers and the decontamination unit shall remain during final clearance air sampling.

3. A minimum of five (5) samples will be taken from the work area(s) and analyzed in accordance with the method set forth in the AHERA Regulation 40 CFR, Part 763, Appendix A, and N.J.A.C. 8:60 and 12:120.

   a. FOR ANY FULL CONTAINMENT WORK AREA IN ACCORDANCE WITH N.J.A.C. 5:23-8, FINAL CLEARANCE AIR SAMPLES SHALL BE COLLECTED/ANALYZED VIA TRANSMISSION ELECTRON MICROSCOPY (TEM).

   b. For work area(s) where more than 260 LF/160 SF of asbestos containing materials have been removed, final clearance samples shall be collected/analyzed utilizing Transmission Electron Microscopy (TEM).
c. For non-full containment work area(s) where less than 260 LF/160 SF of asbestos containing materials have been removed, final clearance samples shall be collected/analyzed utilizing Phase Contrast Microscopy (PCM).
d. TEM samples shall be analyzed at a laboratory accredited by the American Industrial Hygiene Association, participating in the National Voluntary Laboratory Accreditation Program (NVLAP). Analytical results shall be available to the Owner’s representative within six (6) hours upon receipt by the laboratory.
e. PCM samples shall be analyzed in accordance with the most recent revision to NIOSH method 7400.

4. Acceptable Clearance Criteria for work area(s) demobilization and re-occupancy shall be as follows:
   a. TEM: less than 70 Structures per millimeter squared.
   b. PCM: less than 0.01 fibers per cubic centimeter.

PART 6 – PROJECT COMPLETION

6.1 FINAL INSPECTION AND CLEARANCE AIR MONITORING

A. The ASCM Firm shall perform a final inspection and conduct final clearance air monitoring of the work area in accordance with the State of New Jersey, Department of Labor & Workforce Development, requirements. If analytical results are obtained that are higher than the allowable threshold the Contractor shall re-clean the work area and the Owner’s ASCM Firm shall re-test the area. This sequence shall be repeated until the final test results are acceptable.

1. The Contractor shall be financially responsible for additional cleaning, final clearance air sampling and analysis, at no cost to the owner.

B. Upon receipt of acceptable final air tests, the Contractor shall demobilize all critical and separation barriers, decontamination unit, engineering controls, from the abatement area. All waste containers shall be off-site and enroute to an USEPA ID #27 approved landfill for final disposal.

C. The Owner’s ASCM Firm, represented by the on-site AST, will perform a final visual inspection of the abatement work area, to document the project has been completed in accordance with these Technical Specifications and all applicable local, State and Federal regulations.

END OF SECTION 028200
SECCTION 033000 – CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

1. Footings.
2. Foundation walls.
3. Slabs-on-grade.

B. Related Sections:

1. Division 31 Section "Earth Moving" for drainage fill under slabs-on-grade.
2. Division 32 Section "Concrete Paving" for concrete pavement and walks.

1.3 DEFINITIONS

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

1.4 ACTION SUBMITTALS

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

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

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

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

D. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer detailing fabrication, assembly, and support of formwork.

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

1. Location of construction joints is subject to approval of the Architect.
F. Samples: For water-stops, vapor retarder

1.5 INFORMATION SUBMITTALS

A. Qualification Data: For Installer, manufacturer, and testing agency.

B. Welding Certificates

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

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

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

F. Field quality-control reports.

G. Minutes of pre-installation conference

1.6 QUALITY ASSURANCE

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

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

C. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.

2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.

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

E. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4/D 1.4M, "Structural Welding Code - Reinforcing Steel."

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

1. ACI 301, "Specifications for Structural Concrete," Sections 1 through 5.

2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

G. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

H. Pre-installation Conference: Conduct conference at Project site or another pre-approved location.

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

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

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

1.7 DELIVERY, STORAGE, AND HANDLING

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

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

1.8 MEASUREMENTS

A. Field Measurements: Obtain all field measurements required for proper fabrication and installation of work. Submit prior to installation, all measurements indicating discrepancies from the drawings.
Describe in writing, and where applicable, by sketches proposed methods of correcting the discrepancies. Measurements are the responsibility of the contractor.

B. Lay out each part of the work in strict accordance with the architectural, structural, mechanical, electrical, plumbing and all other drawings and be responsible for correct location of the same. Lay out from at least two pre-established benchmarks and axis lines, individually correct for length and bearing.

C. Templates: Furnish templates and layout drawings for exact locations of items to be embedded in concrete, with setting instructions required for installation of embedded items.

D. Contractor shall provide a certified survey showing the exact location of the centers of the columns at their top most level, exactly as installed. This information shall be incorporated into the “as built” drawings.

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

1. Plywood, metal, or other approved panel materials.

B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.

D. Void Forms: Biodegradable paper surface, treated for moisture resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads.

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

F. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.

G. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.


H. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

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

A. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 35 percent.

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

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

D. Steel Bar Mats: ASTM A 184/A 184M, fabricated from ASTM A 615/A 615M, Grade 60 (Grade 420), deformed bars, assembled with clips.

E. Plain-Steel Wire: ASTM A 82/A 82M, as drawn.

F. Deformed-Steel Wire: ASTM A 496/A 496M.

G. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, plain, fabricated from as-drawn steel wire into flat sheets.


2.3 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), plain-steel bars, cut true to length with ends square and free of burrs.

B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
   1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.

2.4 CONCRETE MATERIALS

A. Regional Materials: Concrete materials shall be manufactured from aggregates and cement that have been extracted or recovered, as well as manufactured, within 500 miles of Project site.

B. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
   1. Portland Cement: ASTM C 150, Type I/II, gray. Supplement with the following:
      a. Fly Ash: ASTM C 618, Class F or C
      b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120

C. Silica Fume: ASTM C 1240, amorphous silica.

D. Normal-Weight Aggregates: ASTM C 33, Class 3M coarse aggregate or better, graded. Provide aggregates from a single source.
   1. Maximum Coarse-Aggregate Size: 3/4 inch (19 mm) nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

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

2.5 ADMIXTURES


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

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

2.6 FIBER REINFORCEMENT

A. Synthetic Micro-Fiber: Monofilament or fibrillated polypropylene micro-fibers engineered and designed for use in concrete, complying with ASTM C 1116/C 1116M, Type III, 1/2 to 1-1/2 inches (13 to 38 mm) long.

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

   a. Monofilament Micro-Fibers:

      1) Axim Italcementi Group, Inc.; Fibrasol II P.
      2) Euclid Chemical Company (The), an RPM company; Fiberstrand 100.
      4) Sika Corporation; Sika Fiber PPM.

   b. Fibrillated Micro-Fibers:

      1) Axim Italcementi Group, Inc.; Fibrasol F.
      2) Euclid Chemical Company (The), an RPM company; Fiberstrand F.
      4) Sika Corporation; Sika Fiber PPF.

2.7 WATERSTOPS

A. Flexible PVC Waterstops: CE CRD-C 572, with factory-installed metal eyelets, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.

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

   a. BoMetals, Inc.
   b. Greenstreak.
2. Profile: Ribbed with center bulb
3. Dimensions: 4 inches by 3/16 inch thick (100 mm by 4.75 mm thick) non-tapered.

B. Self-Expanding Butyl Strip Waterstops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete, 3/4 by 1 inch (19 by 25 mm).

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. Carlisle Coatings & Waterproofing, Inc.; MiraSTOP.
   b. CETCO; Volclay Waterstop-RX.
   c. Concrete Sealants Inc.; Conseal CS-231.
   d. Greenstreak; Swellstop.

2.8 VAPOR RETARDERS

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

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. Carlisle Coatings & Waterproofing, Inc.; Blackline 400.
   c. Raven Industries Inc.; Vapor Block 15.
   d. Reef Industries, Inc.; Griffolyn Type-65G.

2.9 LIQUID FLOOR TREATMENTS

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

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. ChemMasters; Chemisil Plus.
   b. Dayton Superior Corporation; Day-Chem Sure Hard (J-17).
   c. Euclid Chemical Company (The), an RPM company; Euco Diamond Hard.
   d. L&M Construction Chemicals, Inc.; Seal Hard.
   e. Meadows, W. R., Inc.; LIQUI-HARD.
   f. Metalcrete Industries; Floorsaver.
   g. Vexcon Chemicals, Inc.; Vexcon StarSeal PS Clear.

2. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction and, for sealants applied at Project site, the following VOC limits, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

   a. Primers, Sealers, and Undercoaters: 200 g/L.
b. Waterproofing Concrete/Masonry Sealers: 400 g/L.
c. Concrete-Curing Compounds: 100 g/L.
d. Floor Coatings: 100 g/L.

2.10 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) when dry.
B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
C. Water: Potable.
D. Clear, Waterborne, Membrane-Forming Curing Compound (VOC Compliant): ASTM C 309, Type 1, Class B, dissipating.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. Anti-Hydro International, Inc.; AH Curing Compound #2 DR WB.
   b. BASF Construction Chemicals - Building Systems; Kure 200.
   c. ChemMasters; Safe-Cure Clear.
   d. Conspec by Dayton Superior; W.B. Resin Cure.
   e. Dayton Superior Corporation; Day-Chem Rez Cure (J-11-W).
   f. Edoco by Dayton Superior; Res X Cure WB.
   g. Euclid Chemical Company (The), an RPM company; Kurez W VOX; TAMMSCURE WB 30C.
   i. Lambert Corporation; AQUA KURE - CLEAR.
   j. L&M Construction Chemicals, Inc.; L&M Cure R.
   k. Meadows, W. R., Inc.; 1100-CLEAR.
   l. Symons by Dayton Superior; Resi-Chem Clear.

2. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction and, for sealants applied at Project site, the following VOC limits, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   a. Primers, Sealers, and Undercoaters: 200 g/L.
   b. Waterproofing Concrete/Masonry Sealers: 400 g/L.
   c. Concrete-Curing Compounds: 100 g/L.
   d. Floor Coatings: 100 g/L.

2.10 RELATED MATERIALS

B. Bonding agent in first paragraph below may be used directly from container or as an admixture in cement or sand-cement slurries and rubbing grout.
C. Epoxy Bonding Adhesive (VOC Compliant): ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:
1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
2. VOC Content: Epoxy Bonding Adhesive shall have a VOC content of 70 g/L or less.

D. Reglets: Fabricate reglets of not less than 0.022-inch- (0.55-mm-) thick, galvanized-steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.

E. Dovetail Anchor Slots: Hot-dip galvanized-steel sheet, not less than 0.034 inch (0.85 mm) thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

2.11 REPAIR MATERIALS

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

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

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

1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3.2 to 6 mm) or coarse sand as recommended by topping manufacturer.
4. Compressive Strength: Not less than 4000 psi (34.5 MPa) at 28 days when tested according to ASTM C 109/C 109M.

2.12 CONCRETE MIXTURES, GENERAL

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

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

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

C. Limit water-soluble, chloride-ion content in hardened concrete to 0.30 percent by weight of cement.

D. Admixtures: Use admixtures according to manufacturer's written instructions.
1. Use water-reducing high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.

2.13 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Footings & Foundation Walls: Proportion normal-weight concrete mixture as follows:
   1. Minimum Compressive Strength: 4000 psi (27.6 MPa) at 28 days.
   3. Slump Limit: 8 inches (200 mm) for concrete with verified slump of 2 to 4 inches (50 to 100 mm) before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch (25 mm).
   4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch (19-mm) nominal maximum aggregate size.

B. Slabs-on-Grade: Proportion normal-weight concrete mixture as follows:
   1. Minimum Compressive Strength: 4000 psi (27.6 MPa) at 28 days.
   3. Slump Limit: 4 inches (100 mm).
   4. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.
   5. Synthetic Micro-Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than 1.0 lb/cu. yd. (0.60 kg/cu. m).

2.14 FABRICATING REINFORCEMENT

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

2.15 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and ASTM C 1116/C 1116M, and furnish batch ticket information.
   1. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 FORMWORK

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:
   1. Class A, 1/8 inch (3.2 mm) for smooth-formed finished surfaces.
   2. Class B, 1/4 inch (6 mm) for rough-formed finished surfaces.

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

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

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

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

H. Do not chamfer exterior corners and edges of permanently exposed concrete.

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

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

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

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

3.2 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."
   2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
   3. Install dovetail anchor slots in concrete structures as indicated.
3.3 REMOVING AND REUSING FORMS

A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations and curing and protection operations need to be maintained.

   1. Leave formwork for beam soffits, joists, slabs, and other structural elements that supports weight of concrete in place until concrete has achieved at least 80 percent of its 28-day design compressive strength.
   2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

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

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

3.4 SHORES

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

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

3.5 VAPOR RETARDERS

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

   1. Lap joints 6 inches (150 mm) and seal with manufacturer's recommended tape.

3.6 STEEL REINFORCEMENT

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

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

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

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

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

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
E. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.7 JOINTS

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

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

1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches (38 mm) into concrete.
3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
5. Locate vertical joints in walls beside piers integral with walls, near corners, and in concealed locations where possible.
6. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

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

1. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3.2-mm-) wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.
2. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

3.8 WATERSTOPS

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

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

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.
   1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

C. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
   1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
   2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
   3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches (150 mm) into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

D. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
   1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
   3. Screed slab surfaces with a straightedge and strike off to correct elevations.
   4. Slope surfaces uniformly to drains where required.
   5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

E. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
   1. When average high and low temperature is expected to fall below 40 deg F (4.4 deg C) for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
   2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
   3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

F. Hot-Weather Placement: Comply with ACI 301 and as follows:
   1. Maintain concrete temperature below 90 deg F (32 deg C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.10 FINISHING FORMED SURFACES

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

1. Apply to concrete surfaces not exposed to view.

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

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

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

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

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

3.11 FINISHING FLOORS AND SLABS

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

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

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

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

1. Apply float finish to surfaces indicated or to receive trowel finish and to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.

D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
1. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.

2. Finish surfaces to the following tolerances, according to ASTM E 1155 (ASTM E 1155M), for a randomly trafficked floor surface:
   a. Specified overall values of flatness, F(F) 35; and levelness, F(L) 25; with minimum local values of flatness, F(F) 24; and levelness, F(L) 17; for slabs-on-grade.
   b. Specified overall values of flatness, F(F) 30; and levelness, F(L) 20; with minimum local values of flatness, F(F) 24; and levelness, F(L) 15; for suspended slabs.

3. Finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.- (3.05-m-) long straightedge resting on two high spots and placed anywhere on the surface does not exceed 3/16 inch (4.8 mm).

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

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

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

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

3.12 MISCELLANEOUS CONCRETE ITEMS

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

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

C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.

3.13 CONCRETE PROTECTING AND CURING

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

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.

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

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

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
   a. Water.
   b. Continuous water-fog spray.
   c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
   a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
   b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
   c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project.

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

3.14 LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment according to manufacturer's written instructions.
   1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
   2. Do not apply to concrete that is less than 14 days' old.
   3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water; remove excess material until surface is dry. Apply a second coat in a similar manner if surface is rough or porous.

B. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller according to manufacturer's written instructions.
3.15  JOINT FILLING

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
   1. Defer joint filling until concrete has aged at least 6 month(s). Do not fill joints until construction traffic has permanently ceased.

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

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

3.16  CONCRETE SURFACE REPAIRS

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

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

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
   1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch (13 mm) in any dimension to solid concrete. Limit cut depth to 3/4 inch (19 mm). Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
   2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
   3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
   1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch (0.25 mm) wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
   2. After concrete has cured at least 14 days, correct high areas by grinding.
   3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
   4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch (6 mm) to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.

6. Repair defective areas, except random cracks and single holes 1 inch (25 mm) or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch (19-mm) clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

7. Repair random cracks and single holes 1 inch (25 mm) or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

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

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

3.17 FIELD QUALITY CONTROL

A. Testing and Inspecting: Engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Inspections:

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

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

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

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

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

4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F (4.4 deg C) and below and when 80 deg F (27 deg C) and above, and one test for each composite sample.

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

6. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.

a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.

7. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.

8. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa).

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

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

11. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.

12. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

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

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

3.18 PROTECTION OF LIQUID FLOOR TREATMENTS

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

END OF SECTION 033000
SECTION 042200 - CONCRETE UNIT MASONRY

PART 1 - GENERAL

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

1.2 SUMMARY
   A. Section Includes:
      1. Concrete masonry units.
      2. Steel reinforcing bars.

1.3 DEFINITIONS
   A. CMU(s): Concrete masonry unit(s).
   B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.4 FIELD CONDITIONS

PART 2 - PRODUCTS

2.1 UNIT MASONRY, GENERAL
   A. Masonry Standard: Comply with TMS 602/ACI 530.1/ASCE 6, except as modified by requirements in the Contract Documents.
   B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects are exposed in the completed Work.
   C. Fire-Resistance Ratings: Comply with requirements for fire-resistance-rated assembly designs indicated.
      1. Where fire-resistance-rated construction is indicated, units shall be listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction.
2.2 CONCRETE MASONRY UNITS

A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.
   1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.

B. CMUs: ASTM C 90.
   1. Density Classification: Lightweight.

2.3 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C 150/C 150M, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

B. Hydrated Lime: ASTM C 207, Type S.

C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.

D. Aggregate for Mortar: ASTM C 144.

E. Aggregate for Grout: ASTM C 404.

F. Water: Potable.

2.4 REINFORCEMENT

A. Uncoated-Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60.

B. Masonry-Joint Reinforcement, General: ASTM A 951/A 951M.
   1. Interior Walls: Mill- galvanized, carbon steel.
   5. Spacing of Cross Rods: Not more than 16 inches o.c.
   6. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.

2.5 TIES AND ANCHORS

A. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:
   3. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
B. Partition Top Anchors: 0.105-inch- thick metal plate with a 3/8-inch- diameter metal rod 6 inches long welded to plate and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube. Fabricate from steel, hot-dip galvanized after fabrication.

### 2.6 MASONRY LINTELS

A. General: Provide one of the following:

B. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam CMUs matching adjacent CMUs in color, texture, and density classification, with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

### 2.7 MORTAR AND GROUT MIXES

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

1. Do not use calcium chloride in mortar or grout.
2. Use portland cement-lime mortar unless otherwise indicated.
3. For exterior masonry, use portland cement-lime mortar.
4. For reinforced masonry, use portland cement-lime mortar.
5. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

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

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

1. For masonry below grade or in contact with earth, use Type S.
2. For reinforced masonry, use Type N.
3. For exterior, above-grade, load-bearing and nonload-bearing walls and parapet walls; for interior load-bearing walls; for interior nonload-bearing partitions; and for other applications where another type is not indicated, use Type N.
4. For interior nonload-bearing partitions, Type O may be used instead of Type N.

D. Colored-Aggregate Mortar: Produce required mortar color by using colored aggregates and natural color or white cement as necessary to produce required mortar color.

E. Grout for Unit Masonry: Comply with ASTM C 476.

1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with TMS 602/ACI 530.1/ASCE 6 for dimensions of grout spaces and pour height.
2. Proportion grout in accordance with ASTM C 476, Table 1.
3. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C 143/C 143M.
PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

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

3.2 TOLERANCES

A. Dimensions and Locations of Elements:

1. For dimensions in cross section or elevation, do not vary by more than plus 1/2 inch or minus 1/4
inch.
2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2
inch.
3. For location of elements in elevation, do not vary from that indicated by more than plus or minus
1/4 inch in a story height or 1/2 inch total.

B. Lines and Levels:

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

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a
maximum thickness limited to 1/2 inch.
2. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or
minus 1/4 inch.
3. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8
inch.

3.3 LAYING MASONRY WALLS

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

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond;
do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.
C. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

D. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

E. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

3.4 MORTAR BEDDING AND JOINTING

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

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

3.5 MASONRY-JOINT REINFORCEMENT

A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.
   1. Space reinforcement not more than 16 inches o.c.
   2. Space reinforcement not more than 8 inches o.c. in foundation walls and parapet walls.
   3. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings.

B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.

C. Provide continuity at wall intersections by using prefabricated T-shaped units.

D. Provide continuity at corners by using prefabricated L-shaped units.

3.6 REINFORCED UNIT MASONRY INSTALLATION

A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
   1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
   2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and that of other loads that may be placed on them during construction.

B. Placing Reinforcement: Comply with requirements in TMS 602/ACI 530.1/ASCE 6.

C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
   1. Comply with requirements in TMS 602/ACI 530.1/ASCE 6 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
   2. Limit height of vertical grout pours to not more than 60 inches.
3.7 REPAIRING, POINTING, AND CLEANING

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

B. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
   1. Test cleaning methods on sample wall panel; leave one-half of panel uncleared for comparison purposes.
   2. Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.

3.8 MASONRY WASTE DISPOSAL

A. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.
   1. Do not dispose of masonry waste as fill within 18 inches of finished grade.

B. Masonry Waste Recycling: Return broken CMUs not used as fill to manufacturer for recycling.

C. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 042200
SECTION 051200 – STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes:
   1. Structural steel.
   2. Field-installed shear connectors.

B. Related Sections:
   1. Division 01 Section "Quality Requirements" for independent testing agency procedures and administrative requirements.
   2. Division 05 Section "Metal Fabrications" for miscellaneous steel fabrication and other steel items not defined as structural steel.

1.3 DEFINITIONS

A. Structural Steel: Elements of structural-steel frame, as classified by AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

1.4 COORDINATION

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

1.5 PERFORMANCE REQUIREMENTS

A. Connections: Provide details of simple shear connections required by the Contract Documents to be selected or completed by structural-steel fabricator, including comprehensive engineering design by a qualified professional engineer, to withstand loads indicated and comply with other information and restrictions indicated.

   1. Select and complete connections using general notes provided on the plans and AISC 360.

B. Moment Connections: Type FR, fully restrained.

C. Construction: Moment frames.
1.6 ACTION SUBMITTALS

A. Product Data: For each type of product.

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

1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
2. Include embedment Drawings.
3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections.
5. For structural-steel connections indicated to comply with design loads, include structural design data signed and sealed by the qualified professional engineer responsible for their preparation.
6. Prepare shop drawings in conformance with the best standards of the construction industry and not less complete than indicated by the applicable procedures shown in “Structural Steel Detailing” latest edition published by the AISC. Prepare shop drawings under the supervision of competent engineering personnel, licensed by the state in which the construction is taking place. During preparation of shop drawing, and prior to submittal, coordinate and cross check all shop drawings, including those prepared by subcontractors, for compliance with the Contract Documents. Each shop drawing shall bear the signature of the engineer in charge of structural steelwork for the steelwork subcontractor, and the initials of the individual actually preparing the drawing.
7. Show clearly all work, including relationship of structural steel to the adjacent work of other trades and to significant lines of finishes of other trades.
8. Do not fabricate or deliver work to the site before drawings reviewed by the Architect have been returned.
9. Show explicitly the type of connection used in each location, the grade, size and number of bolts; the type, number, position, designation and orientation of each hole, and the size of each hole, whether slotted or round. Ensure than an adequate wrench clearance for correct bolt tightening is provided and note special bolt tightening sequences were necessary.
10. Prepare original shop drawings. The use of the engineer’s or architect’s drawings as a base for photographic or other reproduction for shop drawings or details will not be permitted. Show clearly the size and location of each member and the erection mark assigned to each member. Show each field connection with all data and details necessary for assembling the structure. Direct special attention to the possible need for special guying, bracing, or shoring to prevent deformation of existing or new structure due to stresses caused by erection procedures and equipment, by construction loadings, and by forces of natural phenomena.
11. Prepare, keep up-to-date, and submit a complete drawing index cross-referencing each assigned piece mark with the drawing number in which the piece is detailed. Detail drawings submitted without an up-to-date index and the applicable erection drawing(s) showing the location of each piece will be deemed an incomplete submission and will not be accepted as subject to and agreed shop drawing review schedule.
12. Prepare anchor bolt and baseplate erection drawings containing complete location and placing details, including details of all templates. Provide anchor bolt erection drawings to the concrete trade in advance of applicable concrete work and in coordination with the concrete construction sequence.
13. Direct the architect’s attention in writing to any proposed deviations from the Contract Documents, prior to the submission of shop drawings showing the proposed deviation. Submit requests for deviations on the steelwork subcontractor’s letterhead. Deviations not identified, or identified only in letters of transmittal or in shop drawings or both, without the required written request, may not be accepted, and shall be sufficient cause for the architect to return each shop drawing containing such deviations without further action. Acceptance of shop drawings containing deviations not detected by the architect during shop drawing review shall not relieve the steelwork subcontractor from responsibility to conform strictly to the Contract Documents.
14. Prior to resubmission of shop drawings with additions or corrections, circle and identify all changes. Drawings submitted without each change being clearly identified are subject to return for resubmission.

15. Prior to making shop drawings for any portion of the work involving alterations to an existing structure, make all necessary field observations, measurements and surveys of existing conditions. If probes are required to accomplish such measurements, give timely notice where probes will be required.

C. Delegated-Design Submittal: For structural-steel connections indicated to comply with design loads, include analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.7 INFORMATIONAL SUBMITTALS

A. Qualification Data: For installer, fabricator, professional engineer, and testing agency.

B. Welding certificates.

C. Mill test reports for structural steel, including chemical and physical properties.

D. Product Test Reports: For the following:
   1. Bolts, nuts, and washers including mechanical properties and chemical analysis.
   2. Direct-tension indicators.
   3. Tension-control, high-strength, bolt-nut-washer assemblies.
   4. Shear stud connectors.
   5. Non-shrink grout.

E. Survey of existing conditions.

F. Source quality-control reports.

G. Field quality-control and special inspection reports.

1.8 QUALITY ASSURANCE

A. Fabricator Qualifications: A qualified structural steel fabricator headquartered in the United States that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category STD.

B. Installer Qualifications: A qualified installer, who to the satisfaction of the Architect and Owner, has successfully completed similar projects in size and complexity to the proposed project, and who can provide suitable documentation to confirm this experience and capabilities. Said documentation shall be data for recent project experience including, but not limited to; owner name and contact information, location, name and contact information for general contractor, gross area of building, use of building, contract amount, and any other information that is deemed appropriate to communicate the installer is appropriately qualified. Installer shall also provide a copy of their detailed written quality assurance plan/program. Qualified installer shall participate in the AISC Quality Certification Program and be designated an AISC-Certified Erector, Category CSE or provide a similar quality program acceptable to the Architect.
1. Upon completion of job, the installer shall provide an affidavit indicating that the structural steel frame is plumb and level within the normal tolerances specified by code, or the more stringent tolerances specified herein.

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

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

1. AISC 303.
2. AISC 360.
3. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

1.9 DELIVERY, STORAGE, AND HANDLING

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

1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.

1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
2. Clean and relubricate bolts and nuts that become dry or rusty before use.
3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F 1852 fasteners and for retesting fasteners after lubrication.

1.10 MEASUREMENTS

A. Field Measurements: Obtain all field measurements required for proper fabrication and installation of work. Submit prior to installation, all measurements indicating discrepancies from the drawings. Describe in writing, and where applicable, by sketches proposed methods of correcting the discrepancies. Measurements are the responsibility of the contractor.

B. Lay out each part of the work in strict accordance with the architectural, structural, mechanical, electrical, plumbing and all other drawings and be responsible for correct location of the same. Lay out from at least two pre-established benchmarks and axis lines, individually correct for length and bearing.

C. Templates: Furnish templates and layout drawings for exact locations of items to be embedded in concrete, with setting instructions required for installation of embedded items.

D. Contractor shall provide a certified survey showing the exact location of the centers of the columns at their top most level, exactly as installed. This information shall be incorporated into the “as built” drawings.
PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

A. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than the following:

1. W-Shapes: 35 percent.
2. Channels, Angles, M-, S-Shapes: 35 percent.
3. Plate and Bar: 25 percent.
4. Cold-Formed Hollow Structural Sections: 35 percent.
5. Steel Pipe: 25 percent.
6. All Other Steel Materials: 25 percent.

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

C. Channels, Angles, M-, S-Shapes: ASTM A 36/A 36M.

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

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


1. Weight Class: As indicated.
2. Finish: Black except where indicated to be galvanized.

G. Steel Castings: ASTM A 216/A 216M, Grade WCB with supplementary requirement S11.

H. Steel Forgings: ASTM A 668/A 668M.

I. Welding Electrodes: Comply with AWS requirements.

2.2 BOLTS, CONNECTORS, AND ANCHORS

A. High-Strength Bolts, Nuts, and Washers: ASTM A 325 or ASTM A490; Cold forged with rolled threads. Do not use A325 and A490 bolts of the same diameter. Different grade bolts must vary in diameter by a minimum of 1/4 inch.

B. Zinc-Coated High-Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade DH (ASTM A 563M, Class 10S) heavy-hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M), Type 1, hardened carbon-steel washers.

C. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1/D1.1M, Type B.

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

5. Finish: Plain except where indicated to be hot-dip zinc coating, ASTM A 153/A 153M, Class C.

E. Threaded Rods: ASTM A307 Grade A.

F. Torque Control Bolts: ASTM F1852 Type I:
   2. Tru-Tension Bolts, Nucor Corporation, St. Joe, Indiana.

G. Direct Tension Indicators, ASTM F959:
   1. "Coronet Load Indicators" by TurnaSure, LLC, Langhorne, PA.

H. Expansion Anchors – Install in accordance with Manufacturer’s printed instructions. Use only with prior review and acceptance by Architect/Engineer for the specified applications indicated.

I. Adhesive Anchors: Install in accordance with manufacturers printed instructions. Use only with prior review and acceptance by Architect/Engineer for specific applications indicated. Subject to compliance with requirements, provide one of the following:
   1. HIT HY-200 SafeSet by HILTI.
   2. An Approved equal.

2.3 PRIMER

A. Primer: (Steel not exposed to the elements) Fabricator's standard lead- and chromate-free, non-asphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.

B. Primer (exposed exterior structural steel): Primer compatible with Division 09 “High-Performance Coatings”.

C. Finish Paint: Provide first finish coat of paint in shop. Refer to Painting Specification.


2.4 GROUT

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

2.5 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC 360.
   1. Camber structural-steel members where indicated.
   2. Fabricate beams with rolling camber up.
   3. Identify high-strength structural steel according to ASTM A 6/A 6M and maintain markings until structural steel has been erected.
   4. Mark and match-mark materials for field assembly.
   5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.
B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
   1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.
C. Bolt Holes: Cut, drill or punch standard bolt holes perpendicular to metal surfaces.
D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.
E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 1, "Solvent Cleaning."
F. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.
G. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel framing members.
   1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
   2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
   3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

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

2.7 SHOP PRIMING
A. Shop prime steel surfaces except the following:
   1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches (50 mm).
   2. Surfaces to be field welded.
   3. Surfaces to be high-strength bolted with slip-critical connections.
   4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
   5. Galvanized surfaces.
B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
   1. Clean steel not exposed to the elements that is specified to be painted in accordance with SSPC-SP3. Steel not exposed to the elements is contained within the building envelope.
   2. Clean steel exposed to the elements that is to be painted in accordance with SSPC-SP6. Connections are to be included.
C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 2 mils (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

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

D. Painting: provide first finish coat of paint in shop facility. Steel will receive top coats per Division 09.

2.8 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/A 123M.

1. Fill vent and drain holes that will be exposed in the finished Work unless they will function as weep holes, by plugging with zinc solder and filing off smooth.
2. Galvanize lintels, shelf angles and members which are permanently exposed to weather.

2.9 SOURCE QUALITY CONTROL

A. Testing Agency: Engage an independent testing and inspecting agency to perform shop tests and inspections and prepare test reports.

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

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

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

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

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

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

1. Bend tests will be performed if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
2. Tests will be conducted on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1/D1.1M.
PART 3 - EXECUTION

3.1 EXAMINATION

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

1. Prepare a certified survey of bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.

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

3.2 PREPARATION

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

3.3 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.


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

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

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

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

E. Splice members only where indicated.

F. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.
G. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.

3.4 FIELD CONNECTIONS

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

1. Joint Type: Slip critical.

B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

   1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
   2. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
   3. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.

3.5 FIELD QUALITY CONTROL

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

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

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

   1. In addition to visual inspection, field welds will be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
      a. Liquid Penetrant Inspection: ASTM E 165.
      b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
      c. Ultrasonic Inspection: ASTM E 164.
      d. Radiographic Inspection: ASTM E 94.

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

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

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

A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780.

B. Touchup Painting: Immediately after erection, clean exposed areas where primer is damaged or missing and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

C. Touchup Painting: Cleaning and touchup painting are specified in Division 09 painting Sections.

END OF SECTION 051200
SECTION 055000 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Steel framing and supports for overhead doors and grilles.
   2. Steel framing and supports for countertops.
   3. Steel framing and supports for mechanical and electrical equipment.
   4. Steel framing and supports for applications where framing and supports are not specified in other Sections.
   5. Elevator machine beams, hoist beams, etc.
   6. Steel shapes for supporting elevator door sills.
   7. Steel pipe columns for supporting wood frame construction.
   8. Shelf angles.
   9. Metal ladders.
   10. Metal floor plate.
   11. Elevator pit sump covers.
   12. Pipe Downspout guards.

B. Related Requirements:
   1. Division 04 Section "Unit Masonry" for installing loose lintels, anchor bolts, and other items built into unit masonry.
   2. Division 05 Section "Structural Steel Framing" for steel framing, supports and other steel items attached to the structural-steel framing.

1.3 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of metal fabrications that are anchored to or that receive other work. 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.

1.4 ACTION SUBMITTALS

A. Shop Drawings: Show fabrication and installation details. Provide Shop Drawings for the following:
1. Steel framing and supports for overhead doors and grilles.
2. Steel framing and supports for countertops.
3. Steel framing and supports for mechanical and electrical equipment.
4. Steel framing and supports for applications where framing and supports are not specified in other Sections.
5. Elevator machine beams, hoist beams.
6. Steel shapes for supporting elevator door sills.
7. Shelf angles.
8. Metal ladders.

B. Delegated-Design Submittal: For ladders and elevator hoist beam, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS
A. Welding certificates.

1.6 QUALITY ASSURANCE
A. Welding Qualifications: Qualify procedures and personnel in accordance with the following:
   1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
   2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
   3. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

1.7 FIELD CONDITIONS
A. Field Measurements: Verify actual locations of walls, floor slabs, decks, and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS
A. Delegated Design: Engage a qualified professional engineer, as defined in Division 01 Section for Quality Requirements, to design ladders and elevator hoist beam.

2.2 METALS
A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

B. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

C. Rolled-Steel Floor Plate: ASTM A786/A786M, rolled from plate complying with ASTM A36/A36M or ASTM A283/A283M, Grade C or D.

D. Rolled-Stainless Steel Floor Plate: ASTM A793.
E. Steel Tubing: ASTM A500/A500M, cold-formed steel tubing.

F. Steel Pipe: ASTM A53/A53M, Standard Weight (Schedule 40) unless otherwise indicated.


2.3 FASTENERS

A. General: Unless otherwise indicated, provide stainless steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.

1. Provide stainless steel fasteners for fastening aluminum stainless steel or nickel silver.
2. Provide bronze fasteners for fastening bronze.

B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A; with hex nuts, ASTM A563; and, where indicated, flat washers.

C. High-Strength Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325, Type 3, heavy-hex steel structural bolts; ASTM A563, Grade DH3, heavy-hex carbon-steel nuts; and where indicated, flat washers.

D. Stainless Steel Bolts and Nuts: Regular hexagon-head annealed stainless steel bolts, ASTM F593; with hex nuts, ASTM F594; and, where indicated, flat washers; Alloy .

E. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563; and, where indicated, flat washers.

1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.

F. Anchors, General: Capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing in accordance with ASTM E488/E488M, conducted by a qualified independent testing agency.

G. Cast-in-Place Anchors in Concrete: Either threaded or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A47/A47M malleable iron or ASTM A27/A27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F2329/F2329M.

H. Post-Installed Anchors: Torque-controlled expansion anchors .

1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated.

2.4 MISCELLANEOUS MATERIALS

A. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.
2.5 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work with accurate angles and surfaces and straight edges.

E. Weld corners and seams continuously to comply with the following:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

J. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

2.6 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.
   1. Furnish inserts for units installed after concrete is placed.

C. Fabricate steel pipe columns for supporting wood frame construction from steel pipe with steel baseplates and top plates as indicated. Drill or punch baseplates and top plates for anchor and connection bolts and weld to pipe with fillet welds all around. Make welds the same size as pipe wall thickness unless otherwise indicated.
1. Unless otherwise indicated, fabricate from Schedule 40 steel pipe.
2. Unless otherwise indicated, provide 1/2-inch baseplates with four 5/8-inch anchor bolts and 1/4-inch top plates.

D. Galvanize miscellaneous framing and supports where indicated.
E. Prime miscellaneous framing and supports with zinc-rich primer where indicated.

2.7 SHELF ANGLES

A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch bolts, spaced not more than 6 inches from ends and 24 inches o.c., unless otherwise indicated.

1. Provide mitered and welded units at corners.
2. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately 2 inches larger than expansion or control joint.

B. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.

C. Galvanize and shop prime shelf angles located in exterior walls.

D. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

2.8 METAL LADDERS

A. General:

2. For elevator pit ladders, comply with ASME A17.1/CSA B44.

B. Steel Ladders:

1. Space siderails 16 inches apart unless otherwise indicated.
4. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
5. Provide nonslip surfaces on top of each rung, either by coating rung with aluminum-oxide granules set in epoxy-resin adhesive or by using a type of manufactured rung filled with aluminum-oxide grout.
7. Provide platforms as indicated fabricated from welded or pressure-locked steel bar grating, supported by steel angles. Limit openings in gratings to no more than 1/2 inch in least dimension.
8. Support each ladder at top and bottom and not more than 60 inches o.c. with welded or bolted steel brackets.
9. Galvanize and prime ladders, including brackets.

2.9 ELEVATOR PIT SUMP COVERS

A. Fabricate from 1/8-inch rolled-steel floor plate with four 1-inch-diameter holes for water drainage and for lifting.
B. Provide steel angle supports unless otherwise indicated.

2.10 PIPE DOWNSPOUT GUARDS

A. Fabricate pipe downspout guards from 3/8-inch-thick by 12-inch-wide, steel plate, bent to fit flat against the wall or column at both ends and to fit around pipe with 2-inch clearance between pipe and pipe guard. Drill each end for two 3/4-inch anchor bolts.

B. Galvanize and prime steel pipe downspout guards.

2.11 STEEL WELD PLATES AND ANGLES

A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

2.12 GENERAL FINISH REQUIREMENTS

A. Finish metal fabrications after assembly.

B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.13 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products.

1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

B. Preparation for Shop Priming Galvanized Items: After galvanizing, thoroughly clean galvanized surfaces of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.

C. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.

1. Shop prime with universal shop primer unless indicated.

D. Preparation for Shop Priming: Prepare surfaces to comply with requirements indicated below:

3. Other Steel Items: SSPC-SP 3, "Power Tool Cleaning."
4. Galvanized-Steel Items: SSPC-SP 16, "Brush-off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals."

E. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
2.14 ALUMINUM FINISHES

A. As-Fabricated Finish: AA-M12.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

F. Corrosion Protection: Coat concealed surfaces of aluminum that come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:

1. Cast Aluminum: Heavy coat of bituminous paint.
2. Extruded Aluminum: Two coats of clear lacquer.

3.2 INSTALLATION OF MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

B. Anchor supports for overhead doors and overhead grilles securely to, and rigidly brace from, building structure.

C. Anchor shelf angles securely to existing construction with expansion anchors.

D. Support steel girders on solid grouted masonry, concrete, or steel pipe columns. Secure girders with anchor bolts embedded in grouted masonry or concrete or with bolts through top plates of pipe columns.
1. Where grout space under bearing plates is indicated for girders supported on concrete or masonry, install as specified in "Installing Bearing and Leveling Plates" Article.

E. Install pipe columns on concrete footings with grouted baseplates. Position and grout column baseplates as specified in "Installation of Bearing and Leveling Plates" Article.

1. Grout baseplates of columns supporting steel girders after girders are installed and leveled.

3.3 INSTALLATION OF PIPE GUARDS

A. Provide pipe guards at exposed vertical pipes in at locations indicated on Drawings where not protected by curbs or other barriers. Install by bolting to wall or column with expansion anchors. Provide four 3/4-inch bolts at each pipe guard. Mount pipe guards with top edge 26 inches above driving surface.

3.4 INSTALLATION OF BEARING AND LEVELING PLATES


B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with shrinkage-resistant grout. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.5 REPAIRS

A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION 055000
SECTION 061000 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Framing with dimension lumber.
2. Rooftop equipment bases and support curbs.
3. Wood blocking and nailers.
4. Wood sleepers.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Grade lumber by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece.
3. Dress lumber, S4S, unless otherwise indicated.

B. Maximum Moisture Content of Lumber: 19 percent unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED LUMBER

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

D. Application: Treat all rough carpentry unless otherwise indicated.

2.3 DIMENSION LUMBER FRAMING

ROUGH CARPENTRY
A. Non-Load-Bearing Interior Partitions: Construction, Stud, or No. 3 grade.
   1. Application: All interior partitions.
   2. Species: Western woods; WCLIB or WWPA

2.4 SHEAR WALL PANELS
A. Wood-Framed Shear Wall Panels: Prefabricated assembly consisting of wood perimeter framing, tie downs, and Exposure I, Structural I plywood or OSB sheathing.
B. Allowable design loads, as published by manufacturer, shall meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

2.5 MISCELLANEOUS LUMBER
A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
   1. Blocking.
   2. Nailers.

2.6 FASTENERS
A. General: Fasteners shall be of size and type indicated and shall comply with requirements specified in this article for material and manufacture.
   1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153.
B. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

2.7 METAL FRAMING ANCHORS
A. Allowable design loads, as published by manufacturer, shall meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency. Framing anchors shall be punched for fasteners adequate to withstand same loads as framing anchors.
   1. Use for interior locations unless otherwise indicated.
C. Joist Hangers: U-shaped joist hangers with 2-inch-long seat and 1-1/4-inch-wide nailing flanges at least 85 percent of joist depth.
1. Thickness: Manufacturer’s standard for use indicated, but no less than 0.050 inch.

D. Top Flange Hangers: U-shaped joist hangers, full depth of joist, formed from metal strap with tabs bent to extend over and be fastened to supporting member.
   1. Strap Width: Manufacturer’s standard for use indicated, but no less than 1-1/2 inches.
   2. Thickness: Manufacturer’s standard for use indicated, but no less than 0.050 inch.

E. Rafter Tie-Downs (Hurricane): Bent strap tie for fastening rafters or roof trusses to wall studs below, 2-1/4 inches wide by 0.062 inch thick. Tie fits over top of rafter or truss and fastens to both sides of rafter or truss, face of top plates, and side of stud below.

F. Hold-Downs: Brackets for bolting to wall studs and securing to foundation walls with anchor bolts or to other hold-downs with threaded rods and designed with first of two bolts placed seven bolt diameters from reinforced base.
   2. Width: 2-1/2 inches.
   3. Body Thickness: 0.108 inch.
   4. Base Reinforcement Thickness: 0.108 inch.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

B. Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer's written instructions.

C. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry accurately to other construction. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.

D. Install shear wall panels to comply with manufacturer's written instructions.

E. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.

F. Do not splice structural members between supports unless otherwise indicated.

G. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

H. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

I. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
   2. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.
3. ICC-ES evaluation report for fastener.

3.2 PROTECTION

A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 061000
SECTION 061600 - SHEATHING

PART 1 - GENERAL

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

1.2 SUMMARY
   A. Section Includes:
      1. Wall sheathing.
      2. Roof sheathing.

1.3 ACTION SUBMITTALS
   A. Product Data: For each type of process and factory-fabricated product.

PART 2 - PRODUCTS

2.1 PRESERVATIVE-TREATED PLYWOOD
   A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2.
   B. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.

2.2 WALL SHEATHING
   A. Plywood Sheathing: Exterior sheathing.
   B. Extruded-Polystyrene-Foam Sheathing: ASTM C 578, Type IV, in manufacturer's standard lengths and widths with tongue-and-groove or shiplap long edges as standard with manufacturer.
      1. Thickness: 1 inch.

2.3 ROOF SHEATHING
   A. Plywood Sheathing: Exterior sheathing.
2.4 SUBFLOORING AND UNDERLAYMENT

A. Plywood Combination Subfloor-Underlayment: DOC PS 1, Exposure 1, Structural I, Underlayment single-floor panels.
   1. Span Rating: Not less than 16.
   2. Nominal Thickness: As shown, but not less than 23/32 inch.
   3. Edge Detail: Square.

B. Plywood Subflooring: DOC PS 1, Exposure 1, Structural I single-floor panels or sheathing.
   1. Span Rating: Not less than 16.
   2. Nominal Thickness: As shown, but not less than 23/32 inch.

C. Underlayment: Provide underlayment in nominal thicknesses indicated or, if not indicated, not less than 1/4 inch over smooth subfloors and not less than 3/8 inch over board or uneven subfloors.
   1. Plywood Underlayment for Resilient Flooring: DOC PS 1, Exposure 1 Underlayment with fully sanded face.
   2. Plywood Underlayment for Ceramic Tile: DOC PS 1, Exterior, C-C Plugged, not less than 5/8-inch nominal thickness.

2.5 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
   1. For roof and wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

2.6 MISCELLANEOUS MATERIALS

A. Adhesives for Field Gluing Panels to Wood Framing: Formulation complying with APA AFG-01 that is approved for use with type of construction panel indicated by manufacturers of both adhesives and panels.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.

B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.

C. Securely attach to substrate by fastening as indicated, complying with the following:
1. Table 2304.9.1, "Fastening Schedule," in the ICC's International Building Code.
2. ICC-ES evaluation report for fastener.

D. Coordinate wall and roof sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

E. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

3.2 WOOD STRUCTURAL PANEL INSTALLATION


B. Fastening Methods: Fasten panels as indicated below:

1. Combination Subfloor-Underlayment:
   a. Glue and nail to wood framing.
   b. Screw to cold-formed metal framing.
   c. Space panels 1/8 inch apart at edges and ends.

2. Subflooring:
   a. Glue and nail to wood framing.
   b. Screw to cold-formed metal framing.
   c. Space panels 1/8 inch apart at edges and ends.

3. Wall and Roof Sheathing:
   a. Nail to wood framing. Apply a continuous bead of glue to framing members at edges of wall sheathing panels.
   b. Screw to cold-formed metal framing.
   c. Space panels 1/8 inch apart at edges and ends.

4. Underlayment:
   a. Nail to subflooring.
   b. Space panels 1/32 inch apart at edges and ends.
   c. Fill and sand edge joints of underlayment receiving resilient flooring immediately before installing flooring.

3.3 FOAM-PLASTIC SHEATHING INSTALLATION

A. Comply with manufacturer's written instructions.

B. Foam-Plastic Wall Sheathing: Install vapor-relief strips or equivalent for permitting escape of moisture vapor that otherwise would be trapped in stud cavity behind sheathing.

C. Apply sheathing tape to joints between foam-plastic sheathing panels and at items penetrating sheathing. Apply at upstanding flashing to overlap both flashing and sheathing.
SECTION 061753 – SHOP-FABRICATED WOOD TRUSSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes:

1. Wood Roof Trusses.
2. Wood Truss Bracing.
3. Metal Truss Accessories.

B. Related Sections:

1. Division 06 Section "Sheathing" for plywood roof sheathing and fastening to wood trusses.

1.3 DEFINITIONS

A. Metal-Plate-Connected Wood Trusses: Planar structural units consisting of metal-plate-connected members fabricated from dimension lumber and cut and assembled before delivery to Project site.

B. TPI: Truss Plate Institute, Inc.

C. Lumber Grading Agencies, and the abbreviations used to reference them, include the following:

2. NLGA: National Lumber Grades Authority.
4. WCLIB: West Coast Lumber Inspection Bureau.
5. WWPA: Western Wood Products Association.

1.4 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide metal-plate-connected wood trusses capable of withstanding design loads within limits and under conditions indicated. Comply with requirements in TPI 1 unless more stringent requirements are specified below.

1. Design Loads: As indicated on the structural drawings.
2. Maximum Deflection under Design Loads:

      Vertical total load deflection of l/240 of span.
1.5 SUBMITTALS

A. Product Data: For metal-plate connectors, metal truss accessories, and fasteners.
   1. Include data for metal-plate connectors, metal truss accessories and fasteners from manufacturer.

B. Shop Drawings: Show fabrication and installation details for trusses.
   1. Show location, pitch, span, camber, configuration, and spacing for each type of truss required.
   2. Indicate sizes, stress grades, and species of lumber.
   3. Indicated locations of permanent bracing required to prevent buckling of individual truss members due to design loads.
   4. Indicated locations, size, and materials for permanent bracing required to prevent buckling of individual trusses due to design loads.
   5. Indicate type, size, material, finish, design values, orientation, and location of metal connector plates.
   6. Show splice details and bearing details.

C. Delegated-Design Submittal: For metal-plate-connected wood trusses indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

D. Product Certificates: For metal-plate-connected wood trusses, signed by officer of truss fabricating firm.

E. Qualification Data: For metal-plate manufacturer, professional engineer, fabricator, and installer.

F. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.

G. Research/Evaluation Reports: For the following, showing compliance with building code in effect for Project:
   1. Metal-plate connectors.
   2. Metal-plate accessories.

1.6 QUALITY ASSURANCE

A. Metal Connector-Plate Manufacturer Qualifications: A manufacturer that is a member of TPI and that complies with quality-control procedures in TPI 1 for manufacture of connector plates.
   1. Manufacturer's responsibilities include providing professional engineering services needed to assume engineering responsibility.
   2. Engineering Responsibility: Preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.

B. Fabricator Qualifications: Shop that participates in a recognized quality-assurance program, complies with quality-control procedures in TPI 1, and involves third-party inspection by an independent testing and inspecting agency acceptable to Architect and authorities having jurisdiction.

C. Source Limitations for Connector Plates: Obtain metal connector plates from a single manufacturer.

D. Comply with applicable requirements and recommendations of the following publications:
1. TPI 1, "National Design Standard for Metal Plate Connected Wood Truss Construction."
2. TPI DSB, "Recommended Design Specification for Temporary Bracing of Metal Plate Connected Wood Trusses."
3. TPI HIB, "Commentary and Recommendations for Handling, Installing & Bracing Metal Plate Connected Wood Trusses."

E. Wood Structural Design Standard: Comply with applicable requirements in AF&PA's "National Design Specifications for Wood Construction" and it’s "Supplement."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Handle and store trusses to comply with recommendations in SBCA BCSI, "Building Component Safety Information: Guide to Good Practice for Handling, Installing, Restraining, & Bracing Metal Plate Connected Wood Trusses."

1. Store trusses flat, and off of the ground, and adequately supported to prevent lateral bending.
2. Protect trusses from weather by covering with waterproof sheeting, securely anchored.
3. Provide for air circulation around stacks and under coverings.

B. Inspect trusses showing discoloration, corrosion, or other evidence of deterioration. Discard and replace trusses that are damaged or defective.

1.8 COORDINATION

A. Time delivery and erection of trusses to avoid extended on-site storage and to avoid delaying progress of other trades whose work must follow erection of trusses.

1.9 MEASUREMENTS

A. Field Measurements: Obtain all field measurements required for proper fabrication and installation of work. Submit prior to installation, all measurements indicating discrepancies from the drawings. Describe in writing, and where applicable, by sketches proposed methods of correcting the discrepancies. Measurements are the responsibility of the contractor.

B. Lay out each part of the work in strict accordance with the architectural, structural, mechanical, electrical, plumbing and all other drawings and be responsible for correct location of the same. Lay out from at least two pre-established benchmarks and axis lines, individually correct for length and bearing.

PART 2 - PRODUCTS

2.1 DIMENSION LUMBER

A. Lumber: DOC PS 20 and applicable rules of any rules-writing agency certified by the American Lumber Standard Committee (ALSC) Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. Provide dressed lumber, S4S.
3. Provide dry lumber with 15 percent maximum moisture content at time of dressing.
B. Grade and Species: For truss chord and web members, provide dimension lumber of any species, graded visually or mechanically, and capable of supporting required loads without exceeding allowable design values according to AF&PA's "National Design Specifications for Wood Construction" and its "Supplement."

C. Permanent Bracing: Provide wood bracing that complies with requirements for miscellaneous lumber in Division 06 "Rough Carpentry."

2.2 METAL CONNECTOR PLATES

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

1. Alpine Engineered Products, Inc.
2. Cherokee Metal Products, Inc.; Masengill Machinery Company
3. CompuTrus, Inc.
4. Eagle Metal Products.
5. Jager Building Systems, Inc.
6. MiTek Industries, Inc.; a subsidiary of Berkshire Hathaway Inc.
7. Robbins Engineering, Inc.
8. TEE-LOK Corporation; a subsidiary of Berkshire Hathaway Inc.

B. General: Fabricate connector plates to comply with TPI 1.

C. Stainless-Steel Sheet: ASTM A 666, Type 304, and not less than 0.035 inch thick.
   1. Use where in contract with fire treated wood.

2.3 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

   1. Provide fasteners for use with metal framing anchors that comply with written recommendations of metal framing manufacturer.
   2. Where trusses are made from fire treated wood, provide fasteners of Type 304 stainless steel. Nails, Brads, and Staples: ASTM F 1667.


D. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.

E. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.

   1. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2.
2.4 METAL TRUSS AND ACCESSORIES

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

1. Cleveland Steel Specialty Co.
2. Harlen Metal Products, Inc.
3. KC Metals Products, Inc.
4. Simpson Strong-Tie Co., Inc.
5. Southeastern Metals Manufacturing Co., Inc.
6. USP Structural Connectors.

B. Allowable design loads, as published by manufacturer, shall comply with or exceed those indicated on the drawings. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency. Framing anchors shall be punched for fasteners adequate to withstand same loads as framing anchors.

C. Stainless-Steel Sheet: ASTM A 666, Type 304.

1. Use where in contact with fire treated wood.

D. Provide the following:

1. Roof truss tie-downs (hurricane or seismic ties).
2. Roof truss clips.
3. Roof truss bracing/spacers.
4. Design and install items listed above to conform to structural requirements listed on the structural drawings.

2.5 FABRICATION

A. Cut truss members to accurate lengths, angles, and sizes to produce close-fitting joints.

B. Fabricate metal connector plates to sizes, configurations, thicknesses, and anchorage details required to withstand design loads for types of joint designs indicated.

C. Assemble truss members in design configuration indicated; use jigs or other means to ensure uniformity and accuracy of assembly, with joints closely fitted to comply with tolerances in TPI 1. Position members to produce design camber indicated.

1. Fabricate wood trusses within manufacturing tolerances in TPI 1.

D. Connect truss members by metal connector plates located and securely embedded simultaneously in both sides of wood members by air or hydraulic press

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install wood trusses only after supporting construction is in place and is braced and secured.
B. If trusses are delivered to Project site in more than one piece, assemble trusses before installing.

C. Hoist trusses in place by lifting equipment suited to sizes and types of trusses required, exercising care not to damage truss members or joints by out-of-plane bending or other causes.

D. Install and brace trusses according to TPI recommendations and as indicated.

E. Install trusses plumb, square, and true to line and securely fasten to supporting construction.

F. Space trusses as indicated; adjust and align trusses in location before permanently fastening.

G. Anchor trusses securely at bearing points; use metal truss tie-downs or roof truss hangers as applicable. Install fasteners through each fastener hole in metal framing anchors according to manufacturer's fastening schedules and written instructions.

H. Securely connect each truss ply required for forming built-up girder trusses.
   1. Anchor trusses to girder trusses as indicated.

I. Install and fasten permanent bracing during truss erection and before construction loads are applied. Anchor ends of permanent bracing where terminating at walls or beams.
   1. Install bracing to comply with Division 06 Section “Rough Carpentry.”

J. Install wood trusses within installation tolerances in TPI 1.

K. Do not alter trusses in field. Do not cut, drill, notch, or remove truss members.

L. Replace wood trusses that are damaged or do not comply with requirements.
   1. Damaged trusses may be repaired according to truss repair details signed and sealed by the qualified professional engineer responsible for truss design, when approved by Architect.

3.2 REPAIRS AND PROTECTION

A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

B. Protect wood trusses from weather. If, despite protection, wood trusses become wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

C. Repair damaged galvanized coatings on exposed surfaces according to ASTM A 780/A 780M and manufacturer's written instructions.

END OF SECTION 061753
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Exterior primed hardboard trim.
2. Siding.
3. Soffits.

1.3 DEFINITIONS

A. MDO: Plywood with a medium-density overlay on the face.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Factory mark each piece of lumber with grade stamp of inspection agency, indicating grade, species, moisture content at time of surfacing, and mill.

1. For exposed lumber, mark grade stamp on end or back of each piece.

B. Softwood Plywood: DOC PS 1.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC3a.

1. Kiln dry lumber and plywood after treatment to a maximum moisture content of 19 and 18 percent, respectively.
2. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
3. Application: All exterior lumber and plywood.
2.3 EXTERIOR TRIM

A. Moldings for: MMPA WM 4, N-grade wood moldings, without finger jointing. Made from kiln-dried stock to patterns included in MMPA's "WM/Series Wood Moulding Patterns."
   
   1. Species: Eastern white, Idaho white, lodgepole, ponderosa, radiata, or sugar pine.

B. Primed Hardboard Trim: ANSI A135.6, primed with manufacturer's standard exterior primer. Recommended by manufacturer for exterior use.

2.4 EXTERIOR RAILINGS

A. Railings: Clear, kiln-dried, solid, yellow poplar; railing stock of pattern indicated.

B. Balusters: 1-1/16-inch-square, clear, kiln-dried, solid, yellow poplar.

C. Newel Posts: 2-3/4-inch-square, clear, kiln-dried, yellow poplar; either solid or laminated.

2.5 MISCELLANEOUS MATERIALS

A. Fasteners for Exterior Finish Carpentry: Provide nails or screws, in sufficient length to penetrate not less than 1-1/2 inches into wood substrate.
   
   1. For face-fastening siding, provide ringed-shank siding nails or hot-dip galvanized-steel siding nails.
   2. For prefinished items, provide matching prefinished aluminum fasteners where face fastening is required.
   3. For applications not otherwise indicated, provide hot-dip galvanized-steel or aluminum fasteners.

B. Sealants: Latex, complying with ASTM C 834 Type OP, Grade NF and applicable requirements in Division 07 Section "Joint Sealants" and recommended by sealant and substrate manufacturers for intended application.
   
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      
      a. Bostik, Inc; Chem-Calk 600.
      b. Pecora Corporation; AC-20+.
      c. Tremco, Inc.; Tremflex 834.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prime lumber and moldings to be painted, including both faces and edges, unless factory primed. Cut to required lengths and prime ends. Comply with requirements in Division 09 Section "Painting."
3.2 INSTALLATION, GENERAL

A. Install exterior finish carpentry level, plumb, true, and aligned with adjacent materials. Use concealed shims where necessary for alignment.

1. Scribe and cut exterior finish carpentry to fit adjoining work. Refinish and seal cuts as recommended by manufacturer.
2. Install stairs with no more than 3/16-inch variation between adjacent treads and risers and with no more than 3/8-inch variation between largest and smallest treads and risers within each flight.

3.3 STANDING AND RUNNING TRIM INSTALLATION

A. Install flat-grain lumber with bark side exposed to weather.

B. Install cellular PVC trim to comply with manufacturer's written instructions.

C. Install trim with minimum number of joints as is practical, using full-length pieces from maximum lengths of lumber available. Do not use pieces less than 24 inches long, except where necessary.

1. Use scarf joints for end-to-end joints.
2. Stagger end joints in adjacent and related members.

D. Fit exterior joints to exclude water. Cope at returns and miter at corners to produce tight-fitting joints, with full-surface contact throughout length of joint. Plane backs of casings to provide uniform thickness across joints, where necessary for alignment.

3.4 RAILING INSTALLATION

A. Balusters: Fit balusters to treads, glue, and nail in place. Countersink nail heads, fill flush, and sand filler. Let into railings and glue in place.

B. Newel Posts: Secure newel posts with through bolts or lag screws.

C. Railings: Fasten freestanding railings to newel posts and to trim at walls with glue and countersunk-head wood screws or rail bolts.

END OF SECTION 062013
SECTION 064023 - INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

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

1.2 SUMMARY
   A. Section Includes:
     1. Interior standing and running trim, including but not limited to casings, crown and base moulding.
     2. Interior wood wainscoting.
     3. Wood furring, blocking, shims, and hanging strips for installing interior architectural woodwork
        items that are not concealed within other construction.
     4. Shop priming of interior architectural woodwork.
     5. Shop finishing of interior architectural woodwork.

1.3 ACTION SUBMITTALS
   A. Product Data: For each type of product.
      1. Wood-Preservative Treatment: Include data and warranty information from chemical-treatment
         manufacturer and certification by treating plant that treated materials comply with requirements.
      2. Fire-Retardant Treatment: Include data and warranty information from chemical-treatment
         manufacturer and certification by treating plant that treated materials comply with requirements.
   B. Shop Drawings: For interior architectural woodwork.
      1. Include plans, elevations, sections, and attachment details.
      2. Apply AWI Quality Certification or WI Certified Compliance Program label to Shop Drawings.
   C. Samples: For each exposed product and for each color and finish specified.

1.4 FIELD CONDITIONS
   A. Environmental Limitations: Do not deliver or install interior architectural woodwork until building is
      enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature and
      relative humidity at levels planned for building occupants during the remainder of the construction
      period.

PART 2 - PRODUCTS

2.1 INTERIOR ARCHITECTURAL WOODWORK, GENERAL
A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements.

1. Provide inspections of fabrication and installation together with labels and certificates from AWI or WI certification program indicating that woodwork complies with requirements of grades specified.

2.2 INTERIOR STANDING AND RUNNING TRIM

A. Grade: Premium.

B. Wood Species and Cut for Shop Applied Transparent Finish (SB1, SC1): Red or White oak as selected, unless otherwise indicated or directed.

C. Wood Species for Field Applied Opaque Finish (PB1, PC1): Any closed-grain hardwood.

2.3 INTERIOR WAINSCOTING

A. Grade: Premium.

B. Wood Species and Cut for Shop Applied Transparent Finish (SW1): Red or White oak, unless otherwise indicated or directed.

1. Panels: Flat panels or Raised panels made from edge-glued solid lumber, as required to match existing

C. Wood Species for Field Applied Opaque Finish (PW1): Any closed-grain hardwood.

1. Panels: Flat panels or Raised panels made from MDF, machined to profile to match existing

D. Stiles and Rails: At fabricator's option, stiles and rails may be either lumber or veneered construction with edges banded or with lumber moldings, as indicated, to conceal core and veneer joints.

1. Shop assemble stile and rail paneling into largest units practical for delivery and installation. Provide shop-prepared detachable joints for necessary field connections. Sand and pull joints tight in shop so field joints will comply with joint tolerances for specified grade. Unless otherwise indicated, provide continuous mortise-and-tenon joints between panel units and provide removable temporary protection for joints during handling and delivery.

2. Outside Corner of Stile and Rail Paneling: Shop prepare using lock-mitered or mitered-and-splined construction. Assemble, sand, and glue in shop if site conditions permit.

2.4 WOOD MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of interior architectural woodwork and quality grade specified unless otherwise indicated.

1. Do not use plain-sawn softwood lumber with exposed, flat surfaces more than 3 inches wide.

2. Wood Moisture Content: 5 to 10 percent.

2.5 MISCELLANEOUS MATERIALS
A. Furring, Blocking, Shims, and Nailers: Kiln-dried to less than 15 percent moisture content.

B. Provide self-drilling screws for metal-framing supports, as recommended by metal-framing manufacturer.

C. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.

D. Installation Adhesive: Product recommended by fabricator for each substrate for secure anchorage.

2.6 SHOP PRIMING

A. Interior Architectural Woodwork for Opaque Finish: Shop prime with one coat of wood primer as specified in Division 09 Section "Painting."

2.7 SHOP FINISHING

A. General: Finish interior architectural woodwork with transparent finish at fabrication shop. Defer only final touchup, cleaning, and polishing until after installation.

B. Transparent Finish: Refer to Division 09 Section "Staining and Transparent Finishing."

C. Opaque Finish: Refer to Division 09 Section "Painting."
   1. Grade: Premium.
   3. Color: As selected by Architect from manufacturer's full range.
   4. Sheen: Satin, 31-45 Semigloss, 46-60 gloss units measured on 60-degree gloss meter per ASTM D 523.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Before installation, condition interior architectural woodwork to average prevailing humidity conditions in installation areas.

B. Grade: Install interior architectural woodwork to comply with same grade as item to be installed.

C. Install interior architectural woodwork level, plumb, true in line, and without distortion. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.

D. Scribe and cut interior architectural woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

E. Preservative-Treated Wood: Where cut or drilled in field, treat cut ends and drilled holes according to AWPA M4.
F. Fire-Retardant-Treated Wood: Handle, store, and install fire-retardant-treated wood to comply with chemical treatment manufacturer's written instructions, including those for adhesives used to install woodwork.

G. Anchor interior architectural woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing. Use fine finishing nails for exposed fastening, countersunk and filled flush with interior architectural woodwork.

1. For shop-finished items, use filler matching finish of items being installed.

H. Standing and Running Trim: Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible. Do not use pieces less than 36 inches long except where shorter single-length pieces are necessary.

1. Scarf running joints and stagger in adjacent and related members.
2. Fill gaps, if any, between top of base and wall with latex sealant, painted to match wall.
3. Install standing and running trim with no more variation from a straight line than 1/8 inch in 96 inches.

I. Wainscot Paneling: Install paneling level, plumb, true in line, and without distortion. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches. Install with no more than 1/16 inch in 96-inch vertical cup or bow and 1/8 inch in 96-inch horizontal variation from a true plane.

1. Scribe and cut paneling to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
2. Anchor paneling to supporting substrate with blind nailing.
   a. Do not use face fastening unless otherwise indicated.

J. Railings: Install rails with no more than 1/8 inch in 96-inch variation from a straight line.

1. Stair Rails: Refer to Division 06 Section “Wood Stairs and Railings.”
2. Wall Rails: Support rails on indicated metal brackets securely fastened to wall framing.
   a. Space rail brackets not more than 48 inches o.c.

3.2 ADJUSTING AND CLEANING

A. Repair damaged and defective paneling, where possible, to eliminate functional and visual defects. Where not possible to repair, replace paneling. Adjust for uniform appearance.

B. Fill nail holes with matching filler where exposed.

C. Clean paneling on exposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

D. Retain either or both of two paragraphs below; coordinate with selections made in "Shop Finishing" Article.

E. See Division 09 Sections for “Painting” and "Staining and Transparent Finishing" for final finishing of installed interior architectural woodwork not indicated to be shop finished.
SECTION 064113 - WOOD-VENEER-FACED ARCHITECTURAL CABINETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Wood-veneer-faced architectural cabinets.
2. Wood furring, blocking, shims, and hanging strips for installing architectural cabinets that are not concealed within other construction.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.

B. Shop Drawings: For architectural cabinets.

1. Include plans, elevations, sections, and attachment details.

C. Samples: For each exposed product and for each color and finish specified.

PART 2 - PRODUCTS

2.1 CABINETS, GENERAL

A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of architectural cabinets indicated for construction, finishes, installation, and other requirements.

2.2 WOOD CABINETS FOR TRANSPARENT FINISH (WD2)

A. Grade and Species: Premium grade; refer to Finish Schedule on Drawings.

B. Type of Construction: Frameless.

C. Door and Drawer-Front Style: Flush overlay.

D. Wood for Exposed Surfaces: Refer to Finish Schedule on Drawings.
E. Drawer Construction: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.

1. Join subfronts, backs, and sides with glued rabbeted joints supplemented by mechanical fasteners or glued dovetail joints.

2.3 WOOD MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.

1. Do not use plain-sawn softwood lumber with exposed, flat surfaces more than 3 inches wide.
2. Wood Moisture Content: 5 to 10 percent.

B. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.

2.4 CABINET HARDWARE AND ACCESSORIES

A. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, degrees of opening.

B. Back-Mounted Pulls: BHMA A156.9, B02011.

C. Shelf Rests: BHMA A156.9, B04013; metal.

D. Drawer Slides: BHMA A156.9.

1. Grade 1 and Grade 2: Side mounted.
   a. Type: Full extension.
   b. Material: Zinc-plated steel with polymer rollers.

2. For drawers not more than 3 inches high and not more than 24 inches wide, provide Grade 2.
3. For drawers more than 3 inches high, but not more than 6 inches high and not more than 24 inches wide, provide Grade 1.
4. For drawers more than 6 inches high or more than 24 inches wide, provide Grade 1HD-100.

E. Door and Drawer Silencers: BHMA A156.16, L03011.

F. Grommets for Cable Passage: 1-1/4-inch OD, molded-plastic grommets and matching plastic caps with slot for wire passage.


G. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.

1. Dark, Oxidized, Satin Bronze, Oil Rubbed: BHMA 613 for bronze base; BHMA 640 for steel base; match Architect's sample.

H. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.
2.5 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln-dried to less than 15 percent moisture content.

B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.

C. Installation Adhesive: Product recommended by fabricator for each substrate for secure anchorage.

2.6 FABRICATION

A. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.

B. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

C. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

2.7 SHOP FINISHING

A. General: Finish architectural cabinets at fabrication shop as specified in this Section. Defer only final touchup, cleaning, and polishing until after installation.

B. Transparent Finish: To match Architect’s sample

1. Grade: Premium.
3. Staining: None required.
4. Sheen: Satin, 31-45 Semigloss, 46-60 gloss units measured on 60-degree gloss meter per ASTM D 523.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Before installation, condition cabinets to humidity conditions in installation areas for not less than 72 hours.

B. Grade: Install cabinets to comply with quality standard grade of item to be installed.

C. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing. Use fine finishing nails for exposed fastening, countersunk and filled flush with cabinet surface.

1. For shop-finished items, use filler matching finish of items being installed.
D. Install cabinetry level, plumb, and true in line to a tolerance of 1/8 inch in 96 inches using concealed shims.

1. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
2. Install cabinets without distortion so doors and drawers fit openings and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
3. Maintain veneer sequence matching of cabinets with transparent finish.
4. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches o.c. with No. 10 wafer-head screws sized for not less than 1-1/2-inch penetration into wood framing, blocking, or hanging strips.

E. Shop Finishes: Touch up finishing after installation of architectural cabinets. Fill nail holes with matching filler.

END OF SECTION 064113
SECTION 064116 - PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Plastic-laminate-faced architectural cabinets.
2. Wood furring, blocking, shims, and hanging strips for installing plastic-laminate-faced architectural cabinets unless concealed within other construction before cabinet installation.

B. Related Sections:

1. Division 06 Section "Miscellaneous Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing cabinets and concealed within other construction before cabinet installation.
2. Division 12 Section "Plastic-Laminate-Clad Countertops".

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product, including, panel products, high-pressure decorative laminate, adhesive for bonding plastic laminate, and cabinet hardware and accessories.

1. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.

B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

1. Show details full size.
2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
3. Show locations and sizes of cutouts and holes for electrical switches and outlets installed in architectural plastic-laminate cabinets.
4. Apply WI Certified Compliance Program label to Shop Drawings.

C. Samples for Verification:

1. Plastic laminates, 8 by 10 inches, for each color, pattern, and surface finish, with one sample applied to core material and specified edge material applied to one edge.
2. Corner pieces as follows:
   a. Cabinet-front frame joints between stiles and rails, as well as exposed end pieces, 18 inches high by 18 inches wide by 6 inches deep.
   b. Miter joints for standing trim.
3. Exposed cabinet hardware and accessories, one unit for each type.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

B. Product Certificates: For the following:
   1. Composite wood and agrifiber products.
   2. Thermoset decorative panels.
   3. High-pressure decorative laminate.
   4. Adhesives.

C. Evaluation Reports: For fire-retardant-treated materials, from ICC-ES.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

B. Installer Qualifications: Fabricator of products or approved by fabricator.

C. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver cabinets until painting and similar operations that could damage woodwork have been completed in installation areas. If cabinets must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install cabinets until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Field Measurements: Where cabinets are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

   1. Locate concealed framing, blocking, and reinforcements that support cabinets by field measurements before being enclosed, and indicate measurements on Shop Drawings.

C. Established Dimensions: Where cabinets are indicated to fit to other construction, establish dimensions for areas where cabinets are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.
1.8 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that cabinets can be supported and installed as indicated.

PART 2 - PRODUCTS

2.1 PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS (PL1)

A. Basis of Design Manufacturers/Products: Provide the Basis of Design products per Finish Schedule. Subject to compliance with requirements provide the Basis of Design or products by comparable manufacturers.

B. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of architectural plastic-laminate cabinets indicated for construction, finishes, installation, and other requirements.

C. Grade: Premium.

D. Type of Construction: Frameless.

E. Cabinet, Door, and Drawer Front Interface Style: Flush overlay.

F. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or if not indicated, as required by woodwork quality standard.

G. Laminate Cladding for Exposed Surfaces: Refer to Finish Schedule

H. Materials for Semiexposed Surfaces:
   1. Surfaces Other Than Drawer Bodies: Thermoset decorative panels.
      a. Edges of Thermoset Decorative Panel Shelves: PVC or polyester edge banding.
   2. Drawer Sides and Backs: Thermoset decorative panels with PVC or polyester edge banding.
   3. Drawer Bottoms: Hardwood plywood.

I. Drawer Construction: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.

   1. Join subfronts, backs, and sides with glued rabbeted joints supplemented by mechanical fasteners or glued dovetail joints.

2.2 WOOD MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.

   1. Wood Moisture Content: 5 to 10 percent.
PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition cabinets to average prevailing humidity conditions in installation areas.

B. Before installing cabinets, examine shop-fabricated work for completion and complete work as required.

3.2 INSTALLATION

A. Grade: Install cabinets to comply with same grade as item to be installed.

B. Assemble cabinets and complete fabrication at Project site to the extent that it was not completed in the shop.

C. Install cabinets level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.

D. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

E. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork.

   1. Use filler matching finish of items being installed.

F. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.

   1. Install cabinets with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
   2. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches o.c. with No. 10 wafer-head screws sized for not less than 1-1/2-inch penetration into wood framing, blocking, or hanging strips.

3.3 ADJUSTING AND CLEANING

A. Repair damaged and defective cabinets, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

B. Clean, lubricate, and adjust hardware.

C. Clean cabinets on exposed and semi-exposed surfaces.

END OF SECTION 064116
SECTION 064300 - WOOD STAIRS AND RAILINGS

PART 1 - GENERAL

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

1.2 SUMMARY
   A. Section Includes:
      1. Wood stairs and railings.
      2. Shop finishing of wood stairs and railings.

1.3 ACTION SUBMITTALS
   A. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
   B. Samples:
      1. Shop-applied transparent finishes.
      2. Shop-applied opaque finishes.

1.4 INFORMATIONAL SUBMITTALS
   A. Woodwork Quality Standard Compliance Certificates: AWI Quality Certification Program certificates or WI Certified Compliance Program certificates.

1.5 FIELD CONDITIONS
   A. Environmental Limitations: Do not deliver or install wood stairs and railings until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 WOOD STAIRS AND RAILINGS (WS1)
   A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements.
   B. Wood for Transparent Finish: Refer to Finish Schedule on Drawings for wood species.
C. Wood for Opaque Finish: Any closed-grain hardwood.

D. Finishes for Stair Parts: As follows:
   1. Treads: Transparent.
   2. Risers: Transparent.
   5. Handrails: Transparent.

2.2 WOOD MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.

   1. Wood Moisture Content: 5 to 10 percent.

2.3 MISCELLANEOUS MATERIALS

A. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.

2.4 FABRICATION

A. Fabricate wood stairs and railings to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:


B. Complete fabrication, including assembly, finishing, and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

C. Cut carriages to accurately fit treads and risers. Glue treads to risers, and glue and nail treads and risers to carriages.

   1. Fabricate stairs with treads and risers no more than 1/8 inch from indicated position and no more than 1/16 inch out of relative position for adjacent treads and risers.

2.5 SHOP FINISHING

A. General: Finish wood stairs and railings at fabrication shop as specified in this Section. Defer only final touchup, cleaning, and polishing until after installation.

B. Preparation for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing architectural woodwork, as applicable to each unit of work.

   1. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed
surfaces of woodwork.

C. Transparent Finish:
   1. Grade: Premium.
   2. Finish: System - 12, water-based polyurethane.

D. Opaque Finish:
   1. Grade: Premium.
   3. Color: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 PREPARATION
   A. Before installation, condition wood stairs and railings to average prevailing humidity conditions in installation areas.

3.2 INSTALLATION
   A. Grade: Install wood stairs and railings to comply with same grade as item to be installed.
   B. Railings:
      1. General: Install rails with no more than 1/8 inch in 96-inch variation from a straight line.
      2. Stair Rails: Glue and dowel or pin balusters to treads and railings, and railings to newel posts.
      3. Wall Rails: Support rails on indicated metal brackets securely fastened to wall framing.
   C. Touch up finishing work specified in this Section after installation of wood stairs and railings. Fill nail holes with matching filler where exposed.

END OF SECTION 064300
SECTION 064919 - WOOD SHUTTERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Exterior shutters.
2. Shop priming exterior shutters.
3. Shop finishing exterior shutters.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product and process indicated and incorporated into exterior wood shutters during fabrication, finishing, and installation.

1. Include data for wood-preservative treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained. Include chemical-treatment manufacturer's written instructions for finishing treated material.
2. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.
3. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
4. Include copies of warranties from chemical-treatment manufacturers for each type of treatment.

1.4 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation of exterior wood shutters only when existing and forecasted weather conditions permit work to be performed and at least one coat of specified finish to be applied without exposure to rain, snow, or dampness.

B. Field Measurements: Verify dimensions of related construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
PART 2 - PRODUCTS

2.1 EXTERIOR SHUTTERS, GENERAL

A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for construction, finishes, installation, and other requirements.

1. The Contract Documents contain selections chosen from options in the quality standard and additional requirements beyond those of the quality standard. Comply with those selections and requirements in addition to the quality standard.

2.2 EXTERIOR SHUTTERS FOR OPAQUE FINISH

A. Grade: Premium.

B. Wood Species: Ponderosa pine or sugar pine.

2.3 WOOD MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.

1. Do not use plain-sawn softwood lumber with exposed, flat surfaces more than 3 inches wide.

2. Wood Moisture Content: 9 to 15 percent.

B. Water-Repellent Preservative Treated Materials: Comply with AWPA N1 (dip, spray, flood, or vacuum-pressure treatment).

1. Preservative Chemicals: 3-iodo-2-propynyl butyl carbamate (IPBC).

2. Use chemical formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants in solution to distinguish treated material from untreated material.

3. Extent of Water-Repellent Preservative Treatment: Treat all shutters.

2.4 INSTALLATION MATERIALS

A. Screws: hot-dip galvanized.

1. Provide self-drilling screws for metal-framing supports, as recommended by metal-framing manufacturer.

B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous-metal or hot-dip-galvanized anchors and inserts unless otherwise indicated. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

2.5 FABRICATION

A. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.

B. Fabricate shutters to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:

C. Complete fabrication to maximum extent possible before shipment to Project site. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

2.6 SHOP PRIMING

A. Wood Shutters for Opaque Finish: Shop prime wood shutters for paint finish with one coat of wood primer specified in Division 09 Section "Exterior Painting."

B. Preparations for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing architectural woodwork, as applicable to each unit of work.
   1. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of shutters. Apply two coats to surfaces installed in contact with concrete or masonry and to end-grain surfaces.

2.7 SHOP FINISHING

A. Grade: Premium.

B. General: Entire finish of exterior wood shutters is specified in this Section. To greatest extent possible, finish wood shutters at fabrication shop. Defer only final touchup and cleaning until after installation.

C. Woodwork for Opaque Finish: Finish wood shutters to comply with Section 099113 "Exterior Painting."

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition wood shutters to average prevailing humidity conditions in installation areas.

B. Before installing wood shutters, examine shop-fabricated work for completion and complete work as required, including backpriming.

3.2 INSTALLATION

A. Quality Standard: Install wood shutters to comply with same grade as item to be installed.

B. Install wood shutters true and straight with no distortions. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.

C. Scribe and cut wood shutters to fit adjoining work, and refinish cut surfaces or repair damaged finish at cuts.

D. Fire-Retardant-Treated Wood: Handle, store, and install fire-retardant-treated wood to comply with chemical-treatment manufacturer's written instructions.
E. Complete finishing work specified in this Section to extent not completed at shop or before installation of wood shutters. Fill nail and screw holes with matching filler where exposed.

F. Refer to Division 09 Section "Painting" for final finishing of installed wood shutters.

3.3 ADJUSTING AND CLEANING

A. Repair damaged and defective wood shutters, where possible, to eliminate functional and visual defects; replace wood shutters where not possible to repair. Adjust joinery for uniform appearance.

B. Clean wood shutters on exposed and semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION 064919
SECTION 071413 - HOT FLUID-APPLIED RUBBERIZED ASPHALT WATERPROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Rubberized-asphalt waterproofing membrane, unreinforced.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
B. Shop Drawings: Show details for substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins to adjoining waterproofing, and other termination conditions.

1.4 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace waterproofing and sheet flashings that do not comply with requirements or that fail to remain watertight within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 WATERPROOFING MEMBRANE

A. Hot Fluid-Applied, Rubberized-Asphalt Waterproofing Membrane: Single component; 100 percent solids; hot fluid-applied, rubberized asphalt.

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

   b. Barrett Company; Ram-Tough 250.
   c. Henry Company; 790-11.
   d. Tremco Incorporated; Tremproof 150.
2.2  AUXILIARY MATERIALS

A. Protection Course: ASTM D 6506, semirigid sheets of fiberglass or mineral-reinforced-asphaltic core, pressure laminated between two asphalt-saturated fibrous liners and as follows:

   1. Thickness: 1/8 inch, nominal, for vertical applications; 1/4 inch, nominal, elsewhere.

B. Protection Course: Manufacturer's standard, 80- to 90-mil- thick, fiberglass-reinforced rubberized asphalt or modified bituminous sheet.

2.3  MOLDED-SHEET DRAINAGE PANELS

A. Nonwoven-Geotextile-Faced, Molded-Sheet Drainage Panel: Manufactured composite subsurface drainage panels consisting of a nonwoven, needle-punched geotextile facing with an apparent opening size not exceeding No. 70 sieve, laminated to one side a polymeric film bonded to the other side of a studded, nonbiodegradable, molded-plastic-sheet drainage core, with a vertical flow rate of 9 to 15 gpm/ft.

PART 3 - EXECUTION

3.1  PREPARATION

A. Clean and prepare substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for waterproofing application.

B. Close off deck drains and other deck penetrations to prevent spillage and migration of waterproofing fluids.

3.2  JOINTS, CRACKS, AND TERMINATIONS

A. Prepare and treat substrates to receive waterproofing membrane, including joints and cracks, deck drains, corners, and penetrations according to manufacturer's written instructions.

   1. Adhere strip of elastomeric sheet to substrate in a layer of hot rubberized asphalt. Extend elastomeric sheet a minimum of 6 inches on each side of moving joints and cracks or joints and cracks exceeding 1/8 inch thick, and beyond deck drains and penetrations. Apply second layer of hot fluid-applied, rubberized asphalt over elastomeric sheet.

   2. Embed strip of reinforcing fabric into a layer of hot rubberized asphalt. Extend reinforcing fabric a minimum of 6 inches on each side of nonmoving joints and cracks not exceeding 1/8 inch thick, and beyond roof drains and penetrations.

      a. Apply second layer of hot fluid-applied, rubberized asphalt over reinforcing fabric.

B. At expansion joints and discontinuous deck-to-wall or deck-to-deck joints, bridge joints with elastomeric sheet extended a minimum of 6 inches on each side of joints and adhere to substrates in a layer of hot rubberized asphalt. Apply second layer of hot fluid-applied, rubberized asphalt over elastomeric sheet.
3.3 FLASHING INSTALLATION
   A. Install elastomeric sheets at terminations of waterproofing membrane according to manufacturer's written instructions.

3.4 MEMBRANE APPLICATION
   A. Heat and apply rubberized asphalt according to manufacturer's written instructions.
   B. Unreinforced Membrane: Apply hot rubberized asphalt to substrates and adjoining surfaces indicated. Spread to form a uniform, unreinforced, seamless membrane, 180-mil average thickness, but not less than 125 mils thick.
   C. Apply waterproofing over prepared joints and up wall terminations and vertical surfaces to heights indicated or required by manufacturer.
   D. Cover waterproofing with protection course with overlapped joints before membrane is subject to backfilling.

3.5 MOLDED-SHEET DRAINAGE PANEL INSTALLATION
   A. Place and secure molded-sheet drainage panels, with geotextile facing away from wall or deck substrate according to manufacturer's written instructions. Use methods that do not penetrate waterproofing. Lap edges and ends of geotextile to maintain continuity. Protect installed molded-sheet drainage panels during subsequent construction.
      1. For vertical applications, install protection course before installing drainage panels.

3.6 CLEANING AND PROTECTION
   A. Protect waterproofing from damage and wear during remainder of construction period.
   B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 071413
SECTION 071616 - CRYSTALLINE WATERPROOFING

PART 1 - GENERAL

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

1.2 SUMMARY
   A. Section includes crystalline waterproofing at interior face of elevator pit and elsewhere as may be indicated.
   B. Related Sections:
      1. Division 03 Section "Cast-In-Place Concrete" for elevator pit walls.
      2. Division 14 Section "Hydraulic Elevators" for elevator assembly.

1.3 ACTION SUBMITTALS
   A. Product Data: For each type of product.
      1. Include construction details, material descriptions, and installation instructions.

1.4 QUALITY ASSURANCE
   A. Applicator Qualifications: A firm experienced in applying crystalline waterproofing similar in material, design, and extent to that indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.

1.5 FIELD CONDITIONS
   A. Weather Limitations: Proceed with application only when existing and forecasted weather conditions permit crystalline waterproofing to be performed according to manufacturer's written instructions.
   B. Proceed with waterproofing work only after pipe sleeves, vents, curbs, inserts, drains, and other projections through the substrate to be waterproofed have been completed. Proceed only after substrate defects, including honeycombs, voids, and cracks, have been repaired to provide a sound substrate free of forming materials, including reveal inserts.
   C. Ambient Conditions: Proceed with waterproofing work only if temperature is maintained at 40 deg F above during work and cure period, and space is well ventilated and kept free of water.

PART 2 - PRODUCTS

2.1 WATERPROOFING MATERIALS
   A. Crystalline Waterproofing: Prepackaged, gray-colored proprietary blend of portland cement, specially treated sand, and active chemicals that, when mixed with water and applied, penetrates into concrete and concrete unit masonry and reacts chemically with the byproducts of cement hydration in the presence of
water to develop crystalline growth within substrate capillaries to produce an impervious, dense, waterproof substrate; with properties complying with or exceeding the criteria specified below.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
   a. American PERMAQUIK Inc.
   b. Anti-Hydro International, Inc.
   c. Euclid Chemical Company (The); an RPM company.
   d. ICS Penetron International Ltd.
   e. Vandex USA LLC.
   f. Xypex Chemical Corporation.

2. Water Permeability: Maximum zero for water at 30 feet when tested according to COE CRD-C 48.
3. Compressive Strength: Minimum 4000 psi at 28 days when tested according to ASTM C 109/C 109M.

2.2 ACCESSORY MATERIALS

A. Water: Potable.

2.3 MIXES

A. Crystalline Waterproofing: Add prepackaged dry ingredients to water according to manufacturer's written instructions. Mix together with mechanical mixer or by hand to required consistency.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Applicator present, for suitable conditions where waterproofing is to be applied.

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

C. Notify Architect in writing of active leaks or defects that would affect system performance.

3.2 PREPARATION

A. Comply with manufacturer's written instructions.

B. Protect other work from damage caused by cleaning, preparation, and application of waterproofing. Provide temporary enclosure to ensure adequate ambient temperatures and ventilation conditions for application.

C. Do not allow waterproofing, patching, and plugging materials to enter reveals or annular spaces intended for resilient sealants or gaskets, such as joint spaces between pipes and pipe sleeves.

D. Surface Preparation: Remove efflorescence, chalk, dust, dirt, mortar spatter, grease, oils, paint, curing compounds, and form-release agents to ensure that waterproofing bonds to surfaces.
1. Clean concrete surfaces according to ASTM D 4258.
   a. Scratch- and Float-Finished Concrete: Etch with 10 percent muriatic acid solution according to ASTM D 4260.

2. Concrete Joints: Clean reveals.

3.3 APPLICATION

A. General: Comply with waterproofing manufacturer's written instructions for application and curing.
   1. Saturate surface with water for several hours and maintain damp condition until applying waterproofing. Remove standing water.
   2. Number of Coats: Number required for specified water permeability.
   3. Application Method: Apply to ensure that each coat fills voids and is in full contact with substrate or previous coat.
   4. Dampen surface between coats.

B. Final Coat Finish: Smooth.

C. Curing: Moist-cure waterproofing for three days immediately after final coat has set, followed by air drying, unless otherwise recommended in writing by manufacturer.

END OF SECTION 071616
SECTION 072100 - THERMAL INSULATION

PART 1 - GENERAL

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

1.2 SUMMARY
   A. Section Includes:
      1. Foam-plastic board insulation.
      2. Glass-fiber blanket insulation.
   B. Related Sections:
      1. Division 04 Section "Unit Masonry" for insulation installed in cavity walls.

1.3 ACTION SUBMITTALS
   A. Product Data: For each type of product indicated.

1.4 INFORMATIONAL SUBMITTALS
   A. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each product.
   B. Research/Evaluation Reports: For foam-plastic insulation, from ICC-ES.

1.5 QUALITY ASSURANCE
   A. 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.

1.6 DELIVERY, STORAGE, AND HANDLING
   A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.
   B. Protect foam-plastic board insulation as follows:
      1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
      2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site before installation time.
3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.1 FOAM-PLASTIC BOARD INSULATION

A. Extruded-Polystyrene Board Insulation: ASTM C 578, of type and minimum compressive strength indicated below, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
   a. DiversiFoam Products.
   b. Dow Chemical Company (The).
   C. Owens Corning.

2. Type IV, 25 psi.

B. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

2.2 GLASS-FIBER BLANKET INSULATION

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. CertainTeed Corporation.
2. Johns Manville; a Berkshire Hathaway company.
3. Owens Corning.

B. Unfaced, Glass-Fiber Blanket Insulation: ASTM C 665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.

C. Reinforced-Foil-Faced, Glass-Fiber Blanket Insulation: ASTM C 665, Type III (reflective faced), Class A (faced surface with a flame-spread index of 25 or less); Category 1 (membrane is a vapor barrier), faced with foil scrim, foil-scrim kraft, or foil-scrim polyethylene.

D. Eave Ventilation Troughs: Preformed, rigid fiberboard or plastic sheets designed and sized to fit between roof framing members and to provide cross ventilation between insulated attic spaces and vented eaves.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean substrates of substances that are harmful to insulation or that interfere with insulation attachment.
3.2 INSTALLATION, GENERAL
   A. Comply with insulation manufacturer's written instructions applicable to products and applications indicated.
   B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.
   C. Extend insulation to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
   D. Provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

3.3 INSTALLATION OF BELOW-GRADE INSULATION
   A. On vertical footing and foundation wall surfaces, set insulation units using manufacturer's recommended adhesive according to manufacturer's written instructions.
      1. If not otherwise indicated, extend insulation a minimum of 24 inches below exterior grade line.
   B. On horizontal surfaces under slabs, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.
      1. If not otherwise indicated, extend insulation a minimum of 24 inches in from exterior walls.

3.4 INSTALLATION OF CAVITY-WALL INSULATION
   A. Foam-Plastic Board Insulation: Install pads of adhesive spaced approximately 24 inches o.c. both ways on inside face, and as recommended by manufacturer. Fit courses of insulation between wall ties and other obstructions, with edges butted tightly in both directions. Press units firmly against inside substrates.
      1. Supplement adhesive attachment of insulation by securing boards with two-piece wall ties designed for this purpose and specified in Division 04 Section "Unit Masonry."

3.5 INSTALLATION OF INSULATION FOR FRAMED CONSTRUCTION
   A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.
   B. Foam-Plastic Board Insulation: Seal joints between units by applying adhesive, mastic, or sealant to edges of each unit to form a tight seal as units are shoved into place. Fill voids in completed installation with adhesive, mastic, or sealant as recommended by insulation manufacturer.
   C. Glass-Fiber or Mineral-Wool Blanket Insulation: Install in cavities formed by framing members according to the following requirements:
      1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
      2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.

4. Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves.

5. For wood-framed construction, install blankets according to ASTM C 1320 and as follows:
   a. With faced blankets having stapling flanges, secure insulation by inset, stapling flanges to sides of framing members.
   b. With faced blankets having stapling flanges, lap blanket flange over flange of adjacent blanket to maintain continuity of vapor retarder once finish material is installed over it.

3.6 INSTALLATION OF INSULATION IN CEILINGS FOR SOUND ATTENUATION

A. Where glass-fiber blankets are indicated for sound attenuation above ceilings, install blanket insulation over entire ceiling area in thicknesses indicated. Extend insulation 48 inches up either side of partitions.

3.7 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

3.8 INSULATION SCHEDULE

A. Exterior Continuous Board Insulation Type: Type IV extruded-polystyrene board insulation.

B. Interior Wall Sound Attenuation Insulation Type: Unfaced, glass-fiber blanket insulation.

C. Perimeter Wall Sound Attenuation Insulation Type: Faced, glass-fiber blanket insulation.

END OF SECTION 072100
SECTION 072119 - FOAMED-IN-PLACE INSULATION

PART 1 - GENERAL

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

1.2 SUMMARY
   A. Section Includes:
      1. Open-cell spray polyurethane foam.
   B. Related Requirements:
      1. Division 07 Section "Thermal Insulation" for foam-plastic board insulation.

1.3 ACTION SUBMITTALS
   A. Product Data: For each type of product.

1.4 QUALITY ASSURANCE
   A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

PART 2 - PRODUCTS

2.1 OPEN-CELL SPRAY POLYURETHANE FOAM
   A. Open-Cell Spray Polyurethane Foam: Spray-applied polyurethane foam using water as a blowing agent. Minimum density of 0.4 lb/cu. ft. and minimum aged R-value at 1-inch thickness of 3.4 deg F x h x sq. ft./Btu at 75 deg F.
      1. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
         a. Flame-Spread Index: 25 or less.
         b. Smoke-Developed Index: 450 or less.

2.2 MISCELLANEOUS MATERIALS
   A. Primer: Material recommended by insulation manufacturer where required for adhesion of insulation to substrates.
PART 3 - EXECUTION

3.1 PREPARATION

A. Verify that substrates are clean, dry, and free of substances that are harmful to insulation.

B. Priming: Prime substrates where recommended by insulation manufacturer. Apply primer to comply with insulation manufacturer's written instructions. Confine primers to areas to be insulated; do not allow spillage or migration onto adjoining surfaces.

3.2 INSTALLATION

A. Comply with insulation manufacturer's written instructions applicable to products and applications.

B. Spray insulation to envelop entire area to be insulated and fill voids.

C. Apply in multiple passes to not exceed maximum thicknesses recommended by manufacturer. Do not spray into rising foam.

3.3 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes.

END OF SECTION 072119
SECTION 072500 - WEATHER BARRIERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Building wrap.

B. Related Requirements:
   1. Division 06 Section "Sheathing" for sheathing joint and penetration treatment.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. For building wrap, include data on air and water-vapor permeance based on testing according to referenced standards.

1.4 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For water-resistive barrier, from ICC-ES.

PART 2 - PRODUCTS

2.1 WATER-RESISTIVE BARRIER

A. Building Wrap: ASTM E 1677, Type I air barrier; with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, when tested according to ASTM E 84; UV stabilized; and acceptable to authorities having jurisdiction.

   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      a. DuPont (E. I. du Pont de Nemours and Company); Tyvek HomeWrap and HeaderWrap.
      b. Pactiv, Inc.; GreenGuard Classic Wrap.

   2. Water-Vapor Permeance: Not less than 75 perms per ASTM E 96/E 96M, Desiccant Method (Procedure A).
3. Air Permeance: Not more than 0.004 cfm/sq. ft. at 0.3-inch wg when tested according to ASTM E 2178.
4. Allowable UV Exposure Time: Not less than three months.

B. Building-Wrap Tape: Pressure-sensitive plastic tape recommended by building-wrap manufacturer for sealing joints and penetrations in building wrap.

2.2 MISCELLANEOUS MATERIALS

A. Nails and Staples: ASTM F 1667.

PART 3 - EXECUTION

3.1 WATER-RESISTIVE BARRIER INSTALLATION

A. Cover exposed exterior surface of sheathing with water-resistant barrier securely fastened to framing immediately after sheathing is installed.

B. Cover sheathing with water-resistant barrier as follows:
   1. Cut back barrier 1/2 inch on each side of the break in supporting members at expansion- or control-joint locations.
   2. Apply barrier to cover vertical flashing with a minimum 4-inch overlap unless otherwise indicated.

C. Building Wrap: Comply with manufacturer's written instructions.
   1. Seal seams, edges, fasteners, and penetrations with tape.
   2. Extend into jambs of openings and seal corners with tape.

END OF SECTION 072500
SECTION 074113 - FORMED METAL ROOF PANELS

PART 1 - GENERAL

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

1.2 SUMMARY
   A. Section includes concealed-fastener, lap-seam, metal roof panels.

1.3 ACTION SUBMITTALS
   A. Product Data: For each type of product.
   B. Shop Drawings: Include fabrication and installation layouts of metal panels; details of edge conditions,
      joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories;
      and special details.
   C. Samples: For each type of metal panel indicated.

1.4 INFORMATIONAL SUBMITTALS
   A. Product test reports.
   B. Warranties: Sample of special warranties.

1.5 CLOSEOUT SUBMITTALS
   A. Maintenance data.

1.6 WARRANTY
   A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace
      components of metal panel systems that fail in materials or workmanship within specified warranty
      period.
      1. Warranty Period: Two years from date of Substantial Completion.
   B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to
      repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes
      within specified warranty period.
      1. Finish Warranty Period: 10 years from date of Substantial Completion.
PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E 1592:

1. Wind Loads: 100 mph.

B. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. when tested according to ASTM E 1680 or ASTM E 283 at the following test-pressure difference:


C. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E 1646 or ASTM E 331 at the following test-pressure difference:


D. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift-resistance class indicated.


E. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

2.2 UNDERLAYMENT MATERIALS

A. Self-Adhering, High-Temperature Underlayment: Provide self-adhering, cold-applied, sheet underlayment, a minimum of 30 mils thick, specifically designed to withstand high metal temperatures beneath metal roofing. Provide primer when recommended by underlayment manufacturer.

2. Low-Temperature Flexibility: Passes after testing at minus 20 deg F; ASTM D 1970.
3. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. Carlisle Residential; a division of Carlisle Construction Materials; WIP 300HT.
   b. Grace Construction Products; W.R. Grace & Co. -- Conn.; Grace Ice and Water Shield HT.
   c. Owens Corning; WeatherLock Specialty Tile and Metal Underlayment.

2.3 MISCELLANEOUS MATERIALS

A. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.
B. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.

2.4 FINISHES

A. Panels and Accessories:

1. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat.

PART 3 - EXECUTION

3.1 PREPARATION

A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C 754 and metal panel manufacturer's written recommendations.

3.2 UNDERLAYMENT INSTALLATION

A. Self-Adhering Sheet Underlayment: Apply primer if required by manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation. Apply at locations indicated below, wrinkle free, in shingle fashion to shed water, and with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Roll laps with roller. Cover underlayment within 14 days.

1. Apply over the roof area indicated below:
   a. Roof perimeter for a distance up from eaves of 24 inches beyond interior wall line.
   b. Valleys, from lowest point to highest point, for a distance on each side of 18 inches. Overlap ends of sheets not less than 6 inches.
   c. Rake edges for a distance of 18 inches.
   d. Hips and ridges for a distance on each side of 12 inches.
   e. Roof-to-wall intersections for a distance from wall of 18 inches.
   f. Around dormers, chimneys, skylights, and other penetrating elements for a distance from element of 18 inches.

B. Flashings: Install flashings to cover underlayment to comply with requirements specified in Division 07 Section "Sheet Metal Flashing and Trim."

3.3 METAL PANEL INSTALLATION

A. Lap-Seam Metal Panels: Fasten metal panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.

1. Lap ribbed or fluted sheets one full rib. Apply panels and associated items true to line for neat and weathertight enclosure.
2. Provide metal-backed washers under heads of exposed fasteners bearing on weather side of panels.
3. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
4. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.
5. Flash and seal panels with weather closures at perimeter of all openings.
6. Watertight Installation:
   a. Apply a continuous ribbon of sealant or tape to seal lapped joints of metal panels, using sealant or tape as recommend by manufacturer on side laps of nesting-type panels and elsewhere as needed to make panels watertight.
   b. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
   c. At panel splices, nest panels with minimum 6-inch end lap, sealed with sealant and fastened together by interlocking clamping plates.

B. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

C. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level. Install work with laps, joints, and seams that are permanently watertight.

3.4 HORIZONTAL-SEAM METAL ROOF PANELS

A. Horizontal-Seam Metal Roof Panels: Formed with horizontal seam at panel edges and smooth, flat pan; designed to be installed in sequential installation by engaging lower edge of each panel to upper edge of panel below and mechanically attaching panels to supports using concealed clips located under upper edge of panels.

1. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with ASTM A 653, G90 coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A 792, Class AZ50 coating designation; structural quality. Prepainted to comply with ASTM A 755.
   a. Nominal Thickness: 0.022 inch.
   c. Color: As selected by Architect from manufacturer's full range.
2. Clips: One piece.
   a. Material: 0.028-inch- nominal thickness, zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet.
3. Seal: Factory-applied sealant or vinyl weatherseal in seam.
4. Exposure: 9.5 inches nominal.

3.5 CLEANING

A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

END OF SECTION 074113
SECTION 074646 - FIBER-CEMENT SIDING

PART I - GENERAL

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

1.2 SUMMARY
   A. Section includes fiber-cement siding and soffit.
   B. Related Requirements: Retain subparagraphs below to cross-reference requirements Contractor might expect to find in this Section but are specified in other Sections.
      1. Division 06 Section "Rough Carpentry" for wood furring, grounds, nailers, and blocking.
      2. Division 07 Section "Weather Barriers" for weather-resistive barriers.

1.3 COORDINATION
   A. Coordinate siding installation with flashings and other adjoining construction to ensure proper sequencing.

1.4 ACTION SUBMITTALS
   A. Product Data: For each type of product.
   B. Samples for Initial Selection: For fiber-cement siding and soffit including related accessories.

1.5 INFORMATIONAL SUBMITTALS
   A. Product Certificates: For each type of fiber-cement siding and soffit.
   B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for fiber-cement siding.
   C. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS
   A. Maintenance Data: For each type of product, including related accessories, to include in maintenance manuals.
1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Furnish full lengths of fiber-cement siding including related accessories, in a quantity equal to 2 percent of amount installed.

1.8 QUALITY ASSURANCE

A. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and to set quality standards for fabrication and installation.

1. Build mockups for fiber-cement siding and soffit including accessories.

   a. Size: 48 inches long by 60 inches high.

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with labels intact until time of use.

B. Store materials on elevated platforms, under cover, and in a dry location.

1.10 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace products that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

   a. Structural failures including cracking and deforming.

   b. Deterioration of materials beyond normal weathering.

2. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain products, including related accessories, from single source from single manufacturer.

2.2 FIBER-CEMENT SIDING

A. General: ASTM C 1186, Type A, Grade II, fiber-cement board, noncombustible when tested according to ASTM E 136; with a flame-spread index of 25 or less when tested according to ASTM E 84.
B. Labeling: Provide fiber-cement siding that is tested and labeled according to ASTM C 1186 by a qualified testing agency acceptable to authorities having jurisdiction.

C. Nominal Thickness: Not less than 5/16 inch.

D. Shingle Pattern: 48-inch-wide, straight-edge notched sheets with smooth texture.

E. Panel Texture: 48-inch-wide sheets with smooth texture.

F. Factory Priming: Manufacturer's standard acrylic primer.

2.3 FIBER-CEMENT SOFFIT

A. General: ASTM C 1186, Type A, Grade II, fiber-cement board, noncombustible when tested according to ASTM E 136; with a flame-spread index of 25 or less when tested according to ASTM E 84.

B. Nominal Thickness: Not less than 5/16 inch.

C. Pattern: Insert dimension wide sheets with smooth texture.

D. Ventilation: Provide unperforated soffit.

E. Factory Priming: Manufacturer's standard acrylic primer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of fiber-cement siding and soffit and related accessories.

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

3.2 PREPARATION

A. Clean substrates of projections and substances detrimental to application.

3.3 INSTALLATION

A. General: Comply with manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply.

1. Do not install damaged components.
2. Install fasteners no more than 24 inches o.c.

B. Install joint sealants as specified in Division 07 Section "Joint Sealants" and to produce a weathertight installation.

3.4 ADJUSTING AND CLEANING

A. Remove damaged, improperly installed, or otherwise defective materials and replace with new materials complying with specified requirements.
B. Clean finished surfaces according to manufacturer's written instructions and maintain in a clean condition during construction.

END OF SECTION 074646
SECTION 075323 - ETHYLENE-PROPYLENE-DIENE-MONOMER (EPDM) ROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

   A. Section Includes:

       1. Adhered ethylene-propylene-diene-terpolymer (EPDM) roofing system.
       2. Roof insulation.

1.3 ACTION SUBMITTALS

   A. Product Data: For each type of product.

   B. Shop Drawings: Include roof plans, sections, details, and attachments to other work, including the following:

       1. Layout and thickness if insulation.
       2. Base flashings and membrane terminations.
       3. Flashing details at penetrations.
       4. Tapered insulation, thickness, and slopes.
       5. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.
       6. Tie-in with air barrier.

1.4 WARRANTY

   A. Special Warranty: Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.

   B. Warranty Period: 20 years from Date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

   A. Accelerated Weathering: Roof membrane shall withstand 2000 hours of exposure when tested according to ASTM G 152, ASTM G 154, or ASTM G 155.

   B. Impact Resistance: Roof membrane shall resist impact damage when tested according to ASTM D 3746, ASTM D 4272, or the Resistance to Foot Traffic Test in FM Approvals 4470.
C. Energy Performance: Roofing system shall have an initial solar reflectance of not less than 0.70 and an emissivity of not less than 0.75 when tested according to CRRC-1.

D. Fire-Resistance Ratings: Comply with fire-resistance-rated assembly designs indicated. Identify products with appropriate markings of applicable testing agency.

2.2 ETHYLENE-PROPYLENE-DIENE-TERPOLYMER (EPDM) ROOFING

A. EPDM Sheet: ASTM D 4637/D 4637M, Type I, nonreinforced, EPDM sheet.
   1. Manufacturers: Subject to compliance with requirements, provide products by the following:
      a. Firestone Building Products.
   2. Thickness: 90 mils nominal.

2.3 ROOF INSULATION

A. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class 1, Grade 2, felt or glass-fiber mat facer on both major surfaces.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide “ISO 95+ GL” by Firestone Building Products.
   2. Size: 48 by 48 inches or 48 by 96 inches if recommended by manufacturer.

B. Tapered Insulation: Provide factory-tapered insulation boards.
   1. Material: Match roof insulation.
   3. Slope Roof Field: 1/4 inch per foot unless otherwise indicated on Drawings:
      a. Saddles and Crickets: 1/2 inch per foot unless otherwise indicated on Drawings.

2.4 INSULATION ACCESSORIES

A. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation to substrate, and acceptable to roofing system manufacturer.

B. Insulation Adhesive: Insulation manufacturer’s recommended adhesive formulated to attach roof insulation to substrate or to another insulation layer as follows:

   Modified asphaltic, asbestos-free, cold-applied adhesive.

PART 3 - EXECUTION

3.1 EXAMINATION

ETHYLENE-PROPYLENE-DIENE-MONOMER (EPDM) ROOFING 075323 - 2
A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

3.2 PREPARATION

A. Perform fastener-pullout tests according to roof system manufacturer's written instructions.
   1. Submit test result within 24 hours of performing tests.
   2. Include manufacturer's requirements for any revision to previously submitted fastener patterns required to achieve specified wind uplift requirements.

3.3 ROOFING INSTALLATION, GENERAL

A. Install roofing system according to roofing system manufacturer's written instructions, FM Approvals' RoofNav assembly requirements, and FM Global Property Loss Prevention Data Sheet 1-29.

B. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at end of workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

C. Coordinate installation and transition of roofing system component serving as an air barrier with air barrier specified under Section 072713 "Modified Bituminous Sheet Air Barriers."

3.4 INSULATION INSTALLATION

A. Coordinate installing roofing system components so insulation is not exposed to precipitation or left exposed at end of workday.

B. Comply with roofing system and insulation manufacturer's written instructions for installing roof insulation.

C. Installation Over Wood Decking:
   1. Mechanically fasten slip sheet to roof deck using mechanical fasteners specifically designed and sized for fastening slip sheet to wood decks.
      a. Fasten slip sheet according to requirements in FM Approvals' RoofNav for specified Windstorm Resistance Classification.
      b. Fasten slip sheet to resist specified uplift pressure at corners, perimeter, and field of roof.
   2. Install base layer of insulation with joints staggered not less than 24 inches in adjacent rows or end joints staggered not less than 12 inches in adjacent rows for larger boards.
      a. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
      b. Make joints between adjacent insulation boards not more than 1/4 inch in width.
      c. At internal roof drains, slope insulation to create a square drain sump with each side equal to the diameter of the drain bowl plus 24 inches.
      d. Trim insulation so that water flow is unrestricted.
      e. Fill gaps exceeding 1/4 inch with insulation.
      f. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.
      g. Mechanically attach base layer of insulation using mechanical fasteners specifically
designed and sized for fastening specified board-type roof insulation to wood decks.

h. Fasten insulation according to requirements in FM Approvals' RoofNav for specified Windstorm Resistance Classification.

1) Fasten insulation to resist specified uplift pressure at corners, perimeter, and field of roof.

3. Install upper layers of insulation and tapered insulation with joints of each layer offset not less than 12 inches from previous layer of insulation.

   a. Staggered end joints within each layer not less than 24 inches in adjacent rows.
   b. Install with long joints continuous and with end joints staggered not less than 12 inches in adjacent rows for larger boards.
   c. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
   d. Make joints between adjacent insulation boards not more than 1/4 inch in width.
   e. At internal roof drains, slope insulation to create a square drain sump with each side equal to the diameter of the drain bowl plus 24 inches.
   f. Trim insulation so that water flow is unrestricted.
   g. Fill gaps exceeding 1/4 inch with insulation.
   h. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.
   i. Adhere each layer of insulation to substrate using adhesive according to FM Approvals' RoofNav assembly requirements and FM Global Property Loss Prevention Data Sheet 1-29 for specified Windstorm Resistance Classification, as follows:

      1) Set each layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.
      2) Set each layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

3.5 ADHERED ROOFING INSTALLATION

A. Adhere roof membrane over area to receive roofing according to roofing system manufacturer's written instructions.

B. Unroll membrane roof membrane and allow to relax before installing.

C. Accurately align roof membrane, and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

D. Bonding Adhesive: Apply to substrate and underside of roof membrane at rate required by manufacturer, and allow to partially dry before installing roof membrane. Do not apply to splice area of roof membrane.

E. In addition to adhering, mechanically fasten roof membrane securely at terminations, penetrations, and perimeters.

F. Apply roof membrane with side laps shingled with slope of roof deck where possible.

G. Adhesive Seam Installation: Clean both faces of splice areas, apply splicing cement.

   1. Firmly roll side and end laps of overlapping roof membrane to ensure a watertight seam installation.
   2. Apply lap sealant and seal exposed edges of roofing terminations.
   3. Apply a continuous bead of in-seam sealant before closing splice if required by roofing system.
H. Spread sealant or mastic bed over deck-drain flange at roof drains, and securely seal roof membrane in place with clamping ring.

3.6 PROTECTING AND CLEANING

A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction does not affect or endanger roofing system, inspect roofing system for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

END OF SECTION 075323
SECTION 076200 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Wall flashing with counterflashings.
2. Formed steep-slope roof sheet metal fabrications.

B. Related Sections:

1. Division 06 Section "Rough Carpentry" for wood nailers, curbs, and blocking.
2. Division 07 Sections "Roof Accessories" and "Roof Specialties" for set-on-type curbs, equipment supports, copings, scuppers, conductor heads, downspouts, and other manufactured roof accessory units.

1.3 COORDINATION

A. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.

B. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.

B. Shop Drawings: For sheet metal flashing and trim.

1. Include plans, elevations, sections, and attachment details.
2. Detail fabrication and installation layouts, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled work.
3. Include details for forming, including profiles, shapes, seams, and dimensions.
4. Include details of roof-penetration flashing.
5. Include details of edge conditions, including eaves, ridges, valleys, rakes, crickets, and counterflashings as applicable.
6. Include details of connections to adjoining work.
1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.

B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal flashing and trim installation.

1.7 WARRANTY

A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.

b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.

c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General: Sheet metal flashing and trim assemblies shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.

B. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's "The NRCA Roofing Manual" and SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 SHEET METALS

A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.

B. Stainless-Steel Sheet: ASTM A 240, Type 304, dead soft, fully annealed; with smooth, flat surface.
2.3 UNDERLAYMENT MATERIALS

A. Self-Adhering, High-Temperature Sheet: Minimum 30 mils thick, consisting of a slip-resistant polyethylene- or polypropylene-film top surface laminated to a layer of butyl- or SBS-modified asphalt adhesive, with release-paper backing; specifically designed to withstand high metal temperatures beneath metal roofing. Provide primer according to written recommendations of underlayment manufacturer.

2. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F. or lower.

2.4 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, solder, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal unless otherwise indicated.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.

1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
   a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
   b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.

2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.

C. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.

D. Elastomeric Sealant: ASTM C 920, elastomeric polysulfide polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

E. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

F. Bituminous Coating: Cold-applied asphalt emulsion according to ASTM D 1187.


2.5 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with details shown and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
2. Obtain field measurements for accurate fit before shop fabrication.
3. Form sheet metal flashing and trim to fit substrates without excessive oil canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
4. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.

B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

C. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.
   1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
   2. Use lapped expansion joints only where indicated on Drawings.

D. Sealant Joints: Where movable, non-expansion-type joints are required, form metal to provide for proper installation of elastomeric sealant according to cited sheet metal standard.

E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

F. Seams: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use.

2.6 STEEP-SLOPE ROOF SHEET METAL FABRICATIONS

A. Valley and Roof-Penetration Flashing and Counterflashing: Fabricate from the following materials:
   1. Stainless Steel: 0.019 inch thick.

B. Drip Edges, Eave, Rake Flashing: Fabricate from the following materials:
   1. Stainless Steel: 0.016 inch thick.

2.7 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

A. Roof to Wall and Roof Edge Flashing (Gravel Stop): Fabricate in minimum 96-inch-long, but not exceeding 12-foot-long sections. Furnish with 6-inch-wide, joint cover plates. Shop fabricate interior and exterior corners.
   2. Fabricate from the Following Materials:
      a. Stainless Steel: 0.025 inch thick.

2.8 WALL SHEET METAL FABRICATIONS

A. Through-Wall Flashing: Fabricate continuous flashings in minimum 96-inch-long, but not exceeding 12-foot-long, sections, under copings, and at shelf angles. Fabricate discontinuous lintel, sill, and similar
flashing to extend 6 inches beyond each side of wall openings; and form with 2-inch-high, end dams. Fabricate from the following materials:

1. Stainless Steel: 0.016 inch thick.

B. Opening Flashings in Frame Construction: Fabricate head, sill and similar flashings to extend 4 inches beyond wall openings. Form head and sill flashing with 2-inch-high, end dams. Fabricate from the following materials:

1. Stainless Steel: 0.016 inch thick.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, substrate, and other conditions affecting performance of the Work.

1. Verify compliance with requirements for installation tolerances of substrates.
2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
3. Verify that air- or water-resistant barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

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

3.2 UNDERLAYMENT INSTALLATION

A. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free. Prime substrate if recommended by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer for installing underlayment at low temperatures. Apply in shingle fashion to shed water, with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Roll laps and edges with roller. Cover underlayment within 14 days.

3.3 INSTALLATION, GENERAL

A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.

1. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
3. Space cleats not more than 12 inches apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
4. Install exposed sheet metal flashing and trim with limited oil canning, and free of buckling and tool marks.
5. Torch cutting of sheet metal flashing and trim is not permitted.
6. Do not use graphite pencils to mark metal surfaces.

B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact
surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.

1. Coat concealed side of uncoated-aluminum and stainless-steel sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at maximum of 10 feet with no joints within 24 inches of corner or intersection.

1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
2. Use lapped expansion joints only where indicated on Drawings.

D. Fasteners: Use fastener sizes that penetrate wood blocking or sheathing not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.

E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.

F. Seal joints as required for watertight construction.

1. Use sealant-filled joints unless otherwise indicated. Embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F.
2. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants."

G. Rivets: Rivet joints in uncoated aluminum where necessary for strength.

3.4 WALL FLASHING INSTALLATION

A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to cited sheet metal standard unless otherwise indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

B. Opening Flashings in Frame Construction: Install continuous head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings.

3.5 MISCELLANEOUS FLASHING INSTALLATION

A. Equipment Support Flashing: Coordinate installation of equipment support flashing with installation of roofing and equipment. Weld or seal flashing with elastomeric sealant to equipment support member.
3.6 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

B. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."

3.7 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder.

C. Clean off excess sealants.

D. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended by sheet metal flashing and trim manufacturer. Maintain sheet metal flashing and trim in clean condition during construction.

E. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 076200
SECTION 077100 - ROOF SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Copings.
2. Roof-edge drainage systems.

B. Related Sections:

1. Division 06 Section "Miscellaneous Rough Carpentry" for wood nailers, curbs, and blocking.
2. Division 07 Section "Joint Sealants" for field-applied sealants between roof specialties and adjacent materials.

C. Submittals: Product Data, Shop Drawings, and color Samples.

PART 2 - PRODUCTS

2.1 EXPOSED METALS

A. Aluminum Sheet: ASTM B 209, alloy as standard with manufacturer for finish required, with temper to suit forming operations and performance required.

1. Surface: Smooth, flat finish.
2. Exposed Coil-Coated Finishes: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers’ written instructions.

2.2 CONCEALED METALS

A. Aluminum Sheet: ASTM B 209, alloy and temper recommended by manufacturer for type of use and structural performance indicated, mill finished.

B. Aluminum Extrusions: ASTM B 221, alloy and temper recommended by manufacturer for type of use and structural performance indicated, mill finished.

C. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304.
2.3 UNDERLAYMENT MATERIALS

A. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.

2. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F.
3. Acceptable Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. Carlisle Coatings & Waterproofing; CCW WIP 300HT.
   c. Henry Company; Blueskin PE200 HT.
   d. Metal-Fab Manufacturing, LLC; MetShield.
   e. Owens Corning; WeatherLock Metal High Temperature Underlayment.

2.4 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.

B. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to meet performance requirements. Furnish the following unless otherwise indicated:

1. Exposed Penetrating Fasteners: Gasketed screws with hex washer heads matching color of sheet metal.
2. Fasteners for Aluminum: Aluminum or Series 300 stainless steel.
3. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.

C. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane polymer sealant of type, grade, class, and use classifications required by roofing-specialty manufacturer for each application.

D. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

E. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.

F. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.5 COPINGS

A. Copings: Manufactured coping system consisting of straight formed-metal coping caps. Provide concealed anchorage; corner units, end cap units, and concealed splice plates with same finish as coping caps.

1. Basis-of-Design Product: Subject to compliance with requirements, provide coping covers by Hickman Company, W.P. or comparable product by one of the following:
   a. ATAS International, Inc.
   b. Cheney Flashing Company.
   c. Petersen Aluminum Corporation.
2. Coping-Cap Material: Formed aluminum as follows:
   a. Back, Front and Tops at Straight Sections: 0.063 inch thick.
   b. Finish: Fluoropolymer (2 coat) finish matching metal panels at fascia.
3. Fabrication: Factory mitered and continuously welded.
4. Coping-Cap Attachment Method: Snap-on, fabricated from coping-cap material.
5. Snap-on-Coping Anchor Plates: Concealed, galvanized-steel sheet, 12 inches wide, with integral cleats.
6. Face Leg Cleats: Concealed, continuous galvanized-steel sheet.

2.6 ROOF-EDGE DRAINAGE SYSTEMS
A. Gutters: Manufactured in uniform section lengths, with matching corner units, ends, outlet tubes, and other accessories. Elevate back edge at least 1 inch above front edge. Furnish expansion joints, and expansion-joint covers.
   1. Gutter Style: Rectangular.
   2. Aluminum: 0.040 inch thick.
      a. Gutter Supports: Gutter brackets with finish matching the gutters.
B. Downspouts: Plain rectangular with smooth curved elbows. Furnish wall brackets of same material and finish as downspouts, with anchors.
   1. Formed Aluminum: 0.040 inch thick.

2.7 GENERAL FINISH REQUIREMENTS
A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
D. Aluminum Sheet and Extrusion Finishes:
   1. High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
      a. Three-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.

B. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

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

3.2 UNDERLAYMENT INSTALLATION

A. Self-Adhering Sheet Underlayment: Install wrinkle free. Apply primer if required by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer rather than nails for installing underlayment at low temperatures. Apply in shingle fashion to shed water. Overlap edges not less than 3-1/2 inches. Roll laps with roller. Cover underlayment within 14 days.

3.3 INSTALLATION, GENERAL

A. General: Install roof specialties according to manufacturer's written instructions. Anchor roof specialties securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete roof-specialty systems.

1. Install roof specialties level, plumb, true to line and elevation; with limited oil-canning and without warping, jogs in alignment, buckling, or tool marks.
2. Provide uniform, neat seams with minimum exposure of solder and sealant.
3. Install roof specialties to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture.
4. Torch cutting of roof specialties is not permitted.
5. Do not use graphite pencils to mark metal surfaces.

B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

1. Coat concealed side of uncoated aluminum roof specialties with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of self-adhering, high-temperature sheet underlayment.


1. Space movement joints at a maximum of 12 feet with no joints within 18 inches of corners or intersections unless otherwise shown on Drawings.
2. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures.
D. Fastener Sizes: Use fasteners of sizes that will penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.

E. Seal joints with elastomeric sealant as required by roofing-specialty manufacturer.

F. Seal joints as required for watertight construction. Place sealant to be completely concealed in joint. Do not install sealants at temperatures below 40 deg F.

3.4 COPING INSTALLATION

A. Install cleats, anchor plates, and other anchoring and attachment accessories and devices with concealed fasteners.

B. Anchor copings to meet performance requirements.

1. Interlock face and back leg drip edges of snap-on coping cap into cleated anchor plates anchored to substrate at manufacturer's required spacing that meets performance requirements.

3.5 ROOF-EDGE DRAINAGE SYSTEM INSTALLATION

A. Gutters: Join and seal gutter lengths. Allow for thermal expansion. Attach gutters to firmly anchored gutter supports spaced not more than 12 inches apart. Attach ends with rivets and seal with sealant to make watertight. Slope to downspouts.

B. Downspouts: Join sections with manufacturer's standard telescoping joints. Provide hangers with fasteners designed to hold downspouts securely to walls and 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches o.c.

3.6 CLEANING AND PROTECTION

A. Clean and neutralize flux materials. Clean off excess solder and sealants.

B. Remove temporary protective coverings and strippable films as roof specialties are installed. On completion of installation, clean finished surfaces including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain roof specialties in a clean condition during construction.

C. Replace roof specialties that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 077100
SECTION 077200 - ROOF ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Roof curbs.
2. Preformed flashing sleeves.

B. Related Sections:

1. Division 05 Section "Metal Fabrications" for metal vertical ladders, ships' ladders, and stairs for access to roof hatches.
2. Division 06 Section "Wood Stairs and Railings" for rooftop railings.
3. Division 07 Section "Sheet Metal Flashing and Trim" for shop- and field-formed metal flashing, roof-drainage systems, roof expansion-joint covers, and miscellaneous sheet metal trim and accessories.
4. Division 07 Section "Roof Specialties" for manufactured fasciae, copings, gutters and downspouts, and counterflashing.
5. Division 23 Section "HVAC Power Ventilators" for power roof-mounted ventilators.
6. Division 23 Section "Packaged, Outdoor, Central-Station Air-Handling Units" for standard curbs specified with rooftop units.

1.3 COORDINATION

A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.

B. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of roof accessory.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Roof accessories shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

2.2 ROOF CURBS

A. Roof Curbs: Internally reinforced roof-curb units capable of supporting superimposed live and dead loads, including equipment loads and other construction indicated on Drawings, bearing continuously on roof structure, and capable of meeting performance requirements; with welded or mechanically fastened and sealed corner joints, straight sides, and integrally formed deck-mounting flange at perimeter bottom.

B. Size: Coordinate dimensions with roughing-in information or Shop Drawings of equipment to be supported.

C. Material: Zinc-coated (galvanized) steel sheet, 0.064 inch thick.
   1. Finish: Two-coat fluoropolymer.
   2. Color: As selected by Architect from manufacturer's full range.

D. Construction:
   1. Curb Profile: Manufacturer's standard compatible with roofing system.
   2. Fabricate curbs to minimum height of 12 inches above roofing surface unless otherwise indicated.
   3. Top Surface: Level top of curb, with roof slope accommodated by sloping deck-mounting flange.
   4. Insulation: Factory insulated with 1-1/2-inch-thick glass-fiber board insulation.
   5. Metal Counterflashing: Manufacturer's standard, removable, fabricated of same metal and finish as curb.

2.3 PREFORMED FLASHING SLEEVES

A. Exhaust Vent Flashing: Double-walled metal flashing sleeve or boot, insulation filled, with integral deck flange, 12 inches high, with removable metal hood and slotted metal collar.

   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Custom Solution Roof and Metal Products.
      b. Menzies Metal Products.
      c. Thaler Metal Industries Ltd.

   2. Metal: Aluminum sheet, 0.063 inch thick.
   3. Diameter: As indicated on Drawings.

B. Vent Stack Flashing: Metal flashing sleeve, uninsulated, with integral deck flange.

   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Custom Solution Roof and Metal Products.
b. Menzies Metal Products.
c. Milcor; Commercial Products Group of Hart & Cooley, Inc.
d. Thaler Metal Industries Ltd.

2. Metal: Aluminum sheet, 0.063 inch thick.
3. Height: 7 inches.
4. Diameter: As indicated on Drawings.
5. Finish: Manufacturer's standard.

2.4 METAL MATERIALS

A. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653, G90 coating designation.
   1. Exposed Coil-Coated Finish: Prepainted by the coil-coating process to comply with ASTM A 755.
      Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
      a. Two-Coat Fluoropolymer Finish: AAMA 621. System consisting of primer and fluoropolymer color topcoat containing not less than 70 percent PVDF resin by weight.

B. Aluminum Sheet: ASTM B 209, manufacturer's standard alloy for finish required, with temper to suit forming operations and performance required.
   1. Mill Finish: As manufactured.
   2. Factory Prime Coating: Where field painting is indicated, apply pretreatment and white or light-colored, factory-applied, baked-on epoxy primer coat, with a minimum dry film thickness of 0.2 mil.
      a. Two-Coat Fluoropolymer Finish: AAMA 2605. System consisting of primer and fluoropolymer color topcoat containing not less than 70 percent PVDF resin by weight.
   3. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
   4. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester-backer finish consisting of prime coat and wash coat, with a minimum total dry film thickness of 0.5 mil.

C. Aluminum Extrusions and Tubes: ASTM B 221, manufacturer's standard alloy and temper for type of use, finished to match assembly where used; otherwise mill finished.

D. Stainless-Steel Sheet and Shapes: ASTM A 240 or ASTM A 666, Type 304.

E. Steel Shapes: ASTM A 36, hot-dip galvanized according to ASTM A 123 unless otherwise indicated.

F. Steel Tube: ASTM A 500, round tube.

G. Galvanized-Steel Tube: ASTM A 500, round tube, hot-dip galvanized according to ASTM A 123.

2.5 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.

B. Cellulosic-Fiber Board Insulation: ASTM C 208, Type II, Grade 1, thickness as indicated.

C. Glass-Fiber Board Insulation: ASTM C 726, nominal density of 3 lb/cu. ft., thermal resistivity of 4.3 deg F x h x sq. ft./Btu x in. at 75 deg F, thickness as indicated.

D. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.

E. Underlayment:
   1. Felt: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, nonperforated.
   3. Slip Sheet: Building paper, 3 lb/100 sq. ft. minimum, rosin sized.
   4. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
   5. Fasteners: Roof accessory manufacturer's recommended fasteners suitable for application and metals being fastened. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners. Furnish the following unless otherwise indicated:
      6. Fasteners for Zinc-Coated or Aluminum-Zinc Alloy-Coated Steel: Series 300 stainless steel or hot-dip zinc-coated steel according to ASTM A 153 or ASTM F 2329.
      7. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
      8. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.

F. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, PVC, or silicone or a flat design of foam rubber, sponge neoprene, or cork.

G. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane or silicone polymer sealant as recommended by roof accessory manufacturer for installation indicated; low modulus; of type, grade, class, and use classifications required to seal joints and remain watertight.

H. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for expansion joints with limited movement.


2.6 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
PART 3 - EXECUTION

3.1 EXAMINATION
A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.
B. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
C. Verify dimensions of roof openings for roof accessories.
D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION
A. General: Install roof accessories according to manufacturer's written instructions.
   1. Install roof accessories level; plumb; true to line and elevation; and without warping, jogs in alignment, buckling, or tool marks.
   2. Anchor roof accessories securely in place so they are capable of resisting indicated loads.
   3. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof accessories and fit them to substrates.
   4. Install roof accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.
B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
   1. Coat concealed side of uncoated aluminum roof accessories with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
   2. Underlayment: Where installing roof accessories directly on cementitious or wood substrates, install a course of underlayment and cover with manufacturer's recommended slip sheet.
C. Roof Curb Installation: Install each roof curb so top surface is level.
D. Preformed Flashing-Sleeve Installation: Secure flashing sleeve to roof membrane according to flashing-sleeve manufacturer's written instructions; flash sleeve flange to surrounding roof membrane according to roof membrane manufacturer's instructions.
E. Seal joints with elastomeric or butyl sealant as required by roof accessory manufacturer.

3.3 REPAIR AND CLEANING
A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing according to ASTM A 780.
B. Clean exposed surfaces according to manufacturer's written instructions.
C. Clean off excess sealants.
D. Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 077200
SECTION 077253 - SNOW GUARDS

PART 1 - GENERAL

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

1.2 SUMMARY
   A. Section Includes:
      1. Pad-type, flat-mounted snow guards.

1.3 ACTION SUBMITTALS
   A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS
   A. Performance Requirements: Provide snow guards that withstand exposure to weather and resist thermally induced movement without failure, rattling, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.
      1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
   B. Structural Performance:

2.2 PAD-TYPE SNOW GUARDS
   A. Flat-Mounted Metal Snow Guard Pads:

PART 3 - EXECUTION

3.1 EXAMINATION
   A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, snow guard attachment, and other conditions affecting performance of the Work.
3.2 INSTALLATION

A. Install snow guards according to manufacturer's written instructions. Space rows as recommended by manufacturer.

B. Attachment for Metal Shingle Roofing:
   
   1. Flat-Mounted, Snow Guard Pads: Mechanical anchor and counterflashing sleeve system.
SECTION 078413 - PENETRATION FIRESTOPPING

PART 1 - GENERAL

1. RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Penetrations in fire-resistance-rated walls.
2. Penetrations in horizontal assemblies.

B. Related Sections:

1. Division 07 Section "Fire-Resistive Joint Systems" for joints in or between fire-resistance-rated construction, at exterior curtain-wall/floor intersections, and in smoke barriers.

1.3 ACTION SUBMITTALS

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

B. Product Schedule: For each penetration firestopping system. Include location and design designation of qualified testing and inspecting agency.

1. Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping condition, submit illustration, with modifications marked, approved by penetration firestopping manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Installer Certificates: From Installer indicating penetration firestopping has been installed in compliance with requirements and manufacturer's written recommendations.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for penetration firestopping.
1.5 QUALITY ASSURANCE

A. Installer Qualifications: A firm experienced in installing penetration firestopping similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements. Manufacturer's willingness to sell its penetration firestopping products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.

B. Fire-Test-Response Characteristics: Penetration firestopping shall comply with the following requirements:

1. Penetration firestopping tests are performed by a qualified testing agency acceptable to authorities having jurisdiction.
2. Penetration firestopping is identical to those tested per testing standard referenced in "Penetration Firestopping" Article. Provide rated systems complying with the following requirements:
   a. Penetration firestopping products bear classification marking of qualified testing and inspecting agency.
   b. Classification markings on penetration firestopping correspond to designations listed by the following:
      1) UL in its "Fire Resistance Directory."

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not install penetration firestopping when ambient or substrate temperatures are outside limits permitted by penetration firestopping manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.

B. Install and cure penetration firestopping per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

1.7 COORDINATION

A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping is installed according to specified requirements.

B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping.

C. Notify Owner's testing agency at least seven days in advance of penetration firestopping installations; confirm dates and times on day preceding each series of installations.

PART 2 - PRODUCTS

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

2. Grace Construction Products.
3. Hilti, Inc.
5. 3M Fire Protection Products.
7. USG Corporation.

2.2 PENETRATION FIRESTOPPING

A. Provide penetration firestopping that is produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.

B. Penetrations in Fire-Resistance-Rated Walls: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.

1. Fire-resistance-rated walls include fire-barrier walls and fire partitions.
2. F-Rating: Not less than the fire-resistance rating of constructions penetrated.

C. Penetrations in Horizontal Assemblies: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.

1. Horizontal assemblies include floors.
2. F-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated.
3. T-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.

D. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping manufacturer and approved by qualified testing and inspecting agency for firestopping indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.

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

3.2 PREPARATION

A. Surface Cleaning: Clean out openings immediately before installing penetration firestopping to comply with manufacturer's written instructions and with the following requirements:
1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of penetration firestopping.
2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping. Remove loose particles remaining from cleaning operation.
3. Remove laitance and form-release agents from concrete.

B. Priming: Prime substrates where recommended in writing by manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

3.3 INSTALLATION
A. General: Install penetration firestopping to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.
B. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.

3.4 FIELD QUALITY CONTROL
A. Engage a qualified testing agency to perform tests and inspections.
B. Where deficiencies are found or penetration firestopping is damaged or removed because of testing, repair or replace penetration firestopping to comply with requirements.
C. Proceed with enclosing penetration firestopping with other construction only after inspection reports are issued and installations comply with requirements.

3.5 CLEANING AND PROTECTION
A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping manufacturers and that do not damage materials in which openings occur.
B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping is without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping and install new materials to produce systems complying with specified requirements.

3.6 PENETRATION FIRESTOPPING SCHEDULE
A. Where UL-classified systems are indicated, they refer to system numbers in UL's "Fire Resistance Directory" under product Category XHEZ.
B. Firestopping with No Penetrating Items:
C. Firestopping for Metallic Pipes, Conduit, or Tubing:

D. Firestopping for Nonmetallic Pipe, Conduit, or Tubing:

END OF SECTION 078413
SECTION 078446 - FIRE-RESISTIVE JOINT SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Joints in or between fire-resistance-rated constructions.

B. Related Sections:
   1. Division 07 Section "Penetration Firestopping" for penetrations in fire-resistance-rated walls, horizontal assemblies, and smoke barriers.

1.3 ACTION SUBMITTALS

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

1.4 QUALITY ASSURANCE

A. Installer Qualifications: A firm experienced in installing fire-resistive joint systems similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements. Manufacturer's willingness to sell its fire-resistant joint system products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.

B. Fire-Test-Response Characteristics: Fire-resistant joint systems shall comply with the following requirements:
   1. Fire-resistant joint system tests are performed by a qualified testing agency acceptable to authorities having jurisdiction.
   2. Fire-resistant joint systems are identical to those tested per testing standard referenced in "Fire-Resistive Joint Systems" Article. Provide rated systems complying with the following requirements:
      a. Fire-resistant joint system products bear classification marking of qualified testing agency.
      b. Fire-resistant joint systems correspond to those indicated by reference to designations listed by the following:
         1) UL in its "Fire Resistance Directory."
1.5 PROJECT CONDITIONS

A. Environmental Limitations: Do not install fire-resistive joint systems when ambient or substrate temperatures are outside limits permitted by fire-resistive joint system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

B. Install and cure fire-resistive joint systems per manufacturer's written instructions using natural means of ventilation or, where this is inadequate, forced-air circulation.

1.6 COORDINATION

A. Coordinate construction of joints to ensure that fire-resistive joint systems are installed according to specified requirements.

B. Coordinate sizing of joints to accommodate fire-resistive joint systems.

C. Notify Owner's testing agency at least seven days in advance of fire-resistive joint system installations; confirm dates and times on day preceding each series of installations.

PART 2 - PRODUCTS

2.1 FIRE-RESISTIVE JOINT SYSTEMS

A. Where required, provide fire-resistive joint systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assemblies in or between which fire-resistive joint systems are installed. Fire-resistive joint systems shall accommodate building movements without impairing their ability to resist the passage of fire and hot gases.

B. Joints in or between Fire-Resistance-Rated Construction: Provide fire-resistive joint systems with ratings determined per ASTM E 1966 or UL 2079:

1. Joints include those installed in or between fire-resistance-rated walls, floor or floor/ceiling assemblies.
2. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of construction they will join.
3. Acceptable Manufacturers: Subject to compliance with requirements, acceptable manufacturers offering products that may be incorporated into the Work include, but are not necessarily limited to the following:

   b. Grace Construction Products.
   c. Hilti, Inc.
   d. Johns Manville.
   e. Nelson Firestop Products.
   f. 3M Fire Protection Products.
   h. USG Corporation.

C. Exposed Fire-Resistive Joint Systems: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.
D. Accessories: Provide components of fire-resistive joint systems, including primers and forming materials that are needed to install fill materials and to maintain ratings required. Use only components specified by fire-resistive joint system manufacturer and approved by the qualified testing agency for systems indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for joint configurations, substrates, and other conditions affecting performance of the Work.

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

3.2 PREPARATION

A. Surface Cleaning: Clean joints immediately before installing fire-resistive joint systems to comply with fire-resistive joint system manufacturer's written instructions and the following requirements:

1. Remove from surfaces of joint substrates foreign materials that could interfere with adhesion of fill materials.
2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with fill materials. Remove loose particles remaining from cleaning operation.
3. Remove laitance and form-release agents from concrete.

B. Priming: Prime substrates where recommended in writing by fire-resistive joint system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

3.3 INSTALLATION

A. General: Install fire-resistive joint systems to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.

B. Install forming materials and other accessories of types required to support fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.

1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of fire-resistive joint system.

C. Install fill materials for fire-resistive joint systems by proven techniques to produce the following results:

1. Fill voids and cavities formed by joints and forming materials as required to achieve fire-resistance ratings indicated.
2. Apply fill materials so they contact and adhere to substrates formed by joints.
3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.
3.4 CLEANING AND PROTECTING

A. Clean off excess fill materials adjacent to joints as the Work progresses by methods and with cleaning materials that are approved in writing by fire-resistive joint system manufacturers and that do not damage materials in which joints occur.

B. Provide final protection and maintain conditions during and after installation that ensure fire-resistive joint systems are without damage or deterioration at time of Substantial Completion. If damage or deterioration occurs despite such protection, cut out and remove damaged or deteriorated fire-resistive joint systems immediately and install new materials to produce fire-resistive joint systems complying with specified requirements.

3.5 FIRE-RESISTIVE JOINT SYSTEM SCHEDULE

A. Where UL-classified systems are indicated, they refer to system numbers in UL's "Fire Resistance Directory" under product Category XHBN or Category XHDG.

B. Floor-to-Floor, Fire-Resistive Joint Systems:
   1. UL-Classified Systems: FF-D- 0000-0999.

C. Wall-to-Wall, Fire-Resistive Joint Systems:
   1. UL-Classified Systems: WW-D- 0000-0999.

D. Floor-to-Wall, Fire-Resistive Joint Systems:

END OF SECTION 078446
SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Silicone joint sealants.
   2. Urethane joint sealants.
   3. Polysulfide joint sealants.
   4. Latex joint sealants.
   5. Acoustical joint sealants.

B. Related Sections:
   1. Division 08 Section "Glazing" for glazing sealants.
   2. Division 09 Section "Gypsum Board" for sealing perimeter joints.
   3. Division 09 Section "Tiling" for sealing tile joints.

1.3 SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

C. Joint-Sealant Schedule: Include the following information:
   1. Joint-sealant application, joint location, and designation.
   2. Joint-sealant manufacturer and product name.

D. Product Certificates: For each kind of joint sealant and accessory, from manufacturer.

E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that sealants comply with requirements.

F. Preconstruction Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:
   1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

G. Field-Adhesion Test Reports: For each sealant application tested.

H. Warranties: Sample of special warranties.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

B. Liquid-Applied Joint Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied joint sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

C. Stain-Test-Response Characteristics: Where sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.

D. Suitability for Contact with Food: Where sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.

E. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.2 SILICONE JOINT SEALANTS

A. Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use NT.

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

   a. Dow Corning Corporation; 799.
   b. GE Advanced Materials - Silicones; UltraGlaze SSG4000.

B. Mildew-Resistant, Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use NT.

2.3 URETHANE JOINT SEALANTS

A. Single-Component, Nonsag, Urethane Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use NT.

1. Acceptable Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
a. BASF Building Systems; Sonolastic NP1.
c. Pecora Corporation; Dynatrol I-XL.
d. Sika Corporation, Construction Products Division; Sikaflex - 1a.
e. Tremco Incorporated; Dymonic, Vulkem 116.

B. Single-Component, Nonsag, Traffic-Grade, Urethane Joint Sealant: ASTM C 920. Type S, Grade NS, Class 25, for Use T.

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

   a. BASF Building Systems; Sonolastic NP1.
   b. Pacific Polymers International, Inc.; Elasto-Thane 230 Type II.
   c. Sika Corporation, Construction Products Division; Sikaflex - 1a.
   d. Tremco Incorporated; Vulkem 116.

C. Multicomponent, Nonsag, Traffic-Grade, Urethane Joint Sealant: ASTM C 920, Type M, Grade NS, Class 50, for Use T.

2.4 POLYSULFIDE JOINT SEALANTS

A. Single-Component, Nonsag, Polysulfide Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use NT.

2.5 LATEX JOINT SEALANTS

A. Latex Joint Sealant: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.

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

   a. BASF Building Systems; Sonolac.
   c. Pecora Corporation; AC-20+.
   d. Tremco Incorporated; Tremflex 834.

2.6 ACOUSTICAL JOINT SEALANTS

A. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

2.7 JOINT SEALANT BACKING

A. General: Provide sealant backings of material that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), Type B (bicellular material with a surface skin) or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.8 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

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

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.

2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:

   a. Concrete.
   b. Masonry.
   c. Unglazed surfaces of ceramic tile.
3. Remove laitance and form-release agents from concrete.
4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
   a. Metal.
   b. Glass.
   c. Porcelain enamel.
   d. Glazed surfaces of ceramic tile.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer’s written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint profile per Figure 8A in ASTM C 1193, unless otherwise indicated.
4. Provide flush joint profile where indicated per Figure 8B in ASTM C 1193.
5. Provide recessed joint configuration of recess depth and at locations indicated per Figure 8C in ASTM C 1193.
   a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

G. Acoustical Sealant Installation: At sound-rated assemblies and elsewhere as indicated, seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations.

3.4 CLEANING
A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION
A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.6 JOINT-SEALANT SCHEDULE
   1. Joint Locations:
      a. Construction joints in and joints between exterior fiber-cement panels.
      b. Perimeter joints between materials listed above and frames of doors windows and louvers.
      c. Joints between different materials listed above.
   5. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
   1. Joint Locations:
      a. Perimeter joints of exterior openings where indicated.
      b. Tile control and expansion joints.
      c. Vertical joints on exposed surfaces of interior unit masonry concrete walls and partitions.
      d. Perimeter joints between interior wall surfaces and frames of interior doors windows and elevator entrances.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

C. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Sealant Location:
   a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
   b. Tile control and expansion joints where indicated.

2. Joint Sealant: Mildew resistant, single component, nonsag, neutral curing, Silicone.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.


1. Joint Location:
   a. Acoustical joints where indicated.
   b. Other joints as indicated.

3. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

END OF SECTION 079200
SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Standard and custom hollow metal frames, including sidelight frames.
2. Standard and custom hollow metal doors.

B. Related Sections:

1. Division 04 Section "Unit Masonry" for embedding anchors for hollow metal work into masonry construction.
2. Division 08 Sections for AMP and Flush Wood Doors.
3. Division 08 Section "Glazing" for glass view panels in hollow metal doors.
4. Division 08 Section "Door Hardware".
5. Division 09 Sections Painting for field painting hollow metal doors and frames.

C. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ANSI/SDI A250.8 - Recommended Specifications for Standard Steel Doors and Frames.
2. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, Frames Anchors and Hardware Reinforcing.
3. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames.
4. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.
5. ANSI/SDI A250.11 - Recommended Erection Instructions for Steel Frames.
6. ASTM A1008 - Standard Specification for Steel Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
7. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
13. UL 10C - Positive Pressure Fire Tests of Door Assemblies.
1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, hardware reinforcements, profiles, anchors, fire-resistance rating, and finishes.

B. Door hardware supplier is to furnish templates, template reference number and/or physical hardware to the steel door and frame supplier in order to prepare the doors and frames to receive the finish hardware items.

C. Shop Drawings: Include the following:
   1. Elevations of each door design.
   2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
   3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
   4. Locations of reinforcement and preparations for hardware.
   5. Details of anchorages, joints, field splices, and connections.
   6. Details of accessories.
   7. Details of moldings, removable stops, and glazing.
   8. Details of conduit and preparations for power, signal, and control systems.

D. Samples for Verification:
   1. Samples are only required by request of the architect and for manufacturers that are not current members of the Steel Door Institute.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain hollow metal doors and frames through one source from a single manufacturer wherever possible.

B. Quality Standard: In addition to requirements specified, comply with ANSI/SDI A250.8, latest edition, "Recommended Specifications for Standard Steel Doors and Frames".

C. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 (neutral pressure at 40" above sill) or UL 10C.
   1. Oversize Fire-Rated Door Assemblies Construction: For units exceeding sizes of tested assemblies, attach construction label certifying doors are built to standard construction requirements for tested and labeled fire rated door assemblies except for size.
   2. Temperature-Rise Limit: Where indicated and at vertical exit enclosures (stairwell openings) and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.
      a. Smoke "S" Label: Doors to bear “S” label, and include smoke and draft control gasketing applied to frame and on meeting stiles of pair doors.

D. Fire-Rated, Borrowed-Light Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled, by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257. Provide labeled glazing material.
1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project site storage. Do not use non-vented plastic.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and Mullions.

C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch high wood blocking. Do not store in a manner that traps excess humidity.
   1. Provide minimum 1/4-inch space between each stacked door to permit air circulation. Door and frames to be stacked in a vertical upright position.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.7 COORDINATION

A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.

B. Warranty includes installation and finishing that may be required due to repair or replacement of defective doors.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Manufacturers: The design for hollow metal doors and frames are based on specified products by Curries Company.

B. Subject to compliance with requirements, provide the Basis of Design product or comparable approved products.

2.2 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.
C. Frame Anchors: ASTM A 653/A 653M, Commercial Steel (CS), Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

2.3 INTERIOR STANDARD HOLLOW METAL DOORS

A. Interior Doors: Face sheets fabricated of commercial quality cold rolled steel that complies with ASTM A 1008/A 1008M. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:

1. Design: Flush panel.
2. Core Construction: Manufacturer's standard kraft-paper honeycomb, or one-piece polystyrene core, securely bonded to both faces.
   a. Fire Door Core: As required to provide fire-protection and temperature-rise ratings indicated.
3. Level/Model: Level 2 and Physical Performance Level B (Heavy Duty), Minimum 18 gauge (0.042-inch - 1.0-mm) thick steel, Model 2.
4. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet.
5. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9" or minimum 14 gauge continuous channel with pierced holes, drilled and tapped.
6. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.

B. Basis-of-Design Product: The design for interior doors is based on the following:

2. Subject to compliance with requirements, provide the named product or comparable approved product.

2.4 EXTERIOR ENERGY-EFFICIENT HOLLOW METAL DOORS

A. General: Provide 1-3/4 inch doors of design specified, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8 and ANSI/NAAMM HMMA 867.

B. Energy Efficient Exterior Doors: Face sheets fabricated of commercial quality hot-dipped zinc coated steel that complies with ASTM A924 A60. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model, ANSI/SDI A250.4 for physical performance level, and HMMA 867 for door construction.

1. Design: Flush panel.
2. Core Construction: Foamed in place polyurethane and steel stiffened laminated core with no stiffener face welds, in compliance with HMMA 867 “Laminated Core”:
   a. Provide 22 gauge steel stiffeners at 6 inches on-center internally welded at 5" on-center to integral core assembly, foamed in place polyurethane core chemically bonded to all interior surfaces. No stiffener face welding is permitted.
   b. Thermal properties to rate at a fully operable minimum U-Factor 0.29 and R-Value 3.4, including insulated door, thermal-break frame and threshold.

   1) Kerf Type Frames: Thermal properties to rate at a fully operable minimum U-Factor 0.36 and R-Value 2.7, including insulated door, kerf type frame, and threshold.
3. **Level/Model:** Level 2 and Physical Performance Level A (Heavy Duty), Minimum 18 gauge (0.042 inch - 1.1-mm) thick steel, Model 2.

4. **Vertical Edges:** Vertical edges to be mechanically interlocked with hairline seam. Beveled Lock Edge, 1/8 inch in 2 inches (3 mm in 50 mm).

5. **Top and Bottom Edges:** Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet. Doors with an inverted top channel to include a steel closure channel, screw attached, with the web of the channel flush with the face sheets of the door. Plastic or composite channel fillers are not acceptable.

6. **Hinge Reinforcement:** Minimum 7 gauge (3/16") plate 1-1/4" x 9".

7. **Hardware Reinforcements:** Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.

**C. Basis-of-Design Product:** The design for energy efficient exterior doors is based on the following:

2. Subject to compliance with requirements, provide the named product or a comparable approved product.

### 2.5 STANDARD HOLLOW METAL FRAMES

**A. General:** Comply with ANSI/SDI A250.8 and with details indicated for type and profile.

**B. Exterior Frames:** Fabricated of hot-dipped zinc coated steel that complies with ASTM A 653/A 653M, Coating Designation A60.

1. Fabricate frames with mitered or coped corners.
2. Fabricate frames with "closed and tight" miter seams continuously welded on face, finished smooth with no visible seam unless otherwise indicated.
3. **Frames for Doors:** Minimum 14 gauge (0.067-inch -1.7-mm) thick steel sheet.
4. **Basis-of-Design Product:** The design for exterior frames is based on the following:
   
   a. Curries Company M/G Series.
   b. Subject to compliance with requirements, provide the named product or a comparable approved product.

**C. Interior Frames:** Fabricated from cold-rolled steel sheet that complies with ASTM A 1008/A 1008M.

1. Fabricate frames with mitered or coped corners.
2. Fabricate frames with "closed and tight" miter seams continuously welded on face, finished smooth with no visible seam unless otherwise indicated.
3. **Frames for Openings (up to 48 inches in width):** Minimum 16 gauge (0.053-inch -1.3-mm) thick steel sheet.
4. **Frames for Openings (48 inches and up in width):** Minimum 14 gauge (0.067-inch -1.7-mm) thick steel sheet.
5. **Frames for Borrowed Lights:** Minimum 16 gauge (0.053-inch-1.3-mm-) thick steel sheet.
6. **Basis-of-Design Product:** The design for interior frames is based on the following:
   
   a. Curries Company M/G Series (Masonry Profile).
   b. Subject to compliance with requirements, provide the named product or a comparable approved product.

**D. Fire rated frames:** Fabricate frames in accordance with NFPA 80, listed and labeled by a qualified testing agency, for fire-protection ratings indicated.
E. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 Table 4 with reinforcement plates from same material as frames.

2.6 FRAME ANCHORS

A. Jamb Anchors:
   1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, formed from A60 metallic coated material, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
   2. Stud Wall Type: Designed to engage stud and not less than 0.042 inch thick.

B. Floor Anchors: Floor anchors to be provided at each jamb, formed from A60 metallic coated material, not less than 0.042 inches thick.

C. Mortar Guards: Formed from same material as frames, not less than 0.016 inches thick.

2.7 HOLLOW METAL PANELS

A. Provide hollow metal panels of same materials, construction, and finish as specified for adjoining hollow metal work.

2.8 LOUVERS

A. Metal Louvers: Door manufacturer's standard metal louvers unless otherwise indicated.
   1. Blade Type: Vision proof inverted V or inverted Y.
   2. Metal and Finish: Galvanized steel, 0.040 inch thick, factory primed for paint finish with baked enamel or powder coated finish. Match pre-finished door paint color where applicable.

B. Louvers for Fire Rated Doors: Metal louvers with fusible link and closing device, listed and labeled for use in doors with fire protection rating of 1-1/2 hours and less.
   1. Manufacturers: Subject to compliance with requirements, provide door manufacturers standard louver to meet rating indicated.
   2. Metal and Finish: Galvanized steel, 0.040 inch thick, factory primed for paint finish with baked enamel or powder coated finish. Match pre-finished door paint color where applicable.

2.9 LIGHT OPENINGS AND GLAZING

A. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints at fabricator’s shop. Fixed and removable stops to allow multiple glazed lites each to be removed independently. Coordinate frame rabbet widths between fixed and removable stops with the type of glazing and installation indicated.

B. Moldings for Glazed Lites in Doors and Loose Stops for Glazed Lites in Frames: Minimum 20 gauge thick, fabricated from same material as door face sheet in which they are installed.

C. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch (16 mm) high unless otherwise indicated. Provide fixed frame moldings and stops on outside of exterior and on secure side of interior doors and frames
D. Preformed Metal Frames for Light Openings: Manufacturer's standard frame formed of 0.048-inch-thick, cold rolled steel sheet; with baked enamel or powder coated finish; and approved for use in doors of fire protection rating indicated. Match pre-finished door paint color where applicable.

E. Glazing: Comply with requirements in Division 08 Section "Glazing" and with the hollow metal door manufacturer's written instructions.

1. Factory Glazing: Factory install glazing in doors as indicated. Doors with factory installed glass to include all of the required glazing material.

2.10 ACCESSORIES

A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.

B. Grout Guards: Formed from same material as frames, not less than 0.016 inches thick.

2.11 FABRICATION

A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. When shipping limitations so dictate, frames for large openings are to be fabricated in sections for splicing or splining in the field by others.

B. Tolerances: Fabricate hollow metal work to tolerances indicated in ANSI/SDI A250.8.

C. Hollow Metal Doors:

1. Exterior Doors: Provide optional weep-hole openings in bottom of exterior doors to permit moisture to escape where specified.

2. Glazed Lites: Factory cut openings in doors with applied trim or kits to fit. Factory install glazing where indicated.

3. Astragals: Provide overlapping astragals as noted in door hardware sets in Division 08 Section "Door Hardware" on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted.

4. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge strap for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".

D. Hollow Metal Frames:

1. Shipping Limitations: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.

2. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.

   a. Welded frames are to be provided with two steel spreaders temporarily attached to the bottom of both jambs to serve as a brace during shipping and handling. Spreader bars are for bracing only and are not to be used to size the frame opening.

3. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.

4. High Frequency Hinge Reinforcement: Provide high frequency hinge reinforcements at door openings 48-inches and wider with mortise butt type hinges at top hinge locations.
5. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge straps for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".
6. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated for removable stops, provide security screws at exterior locations.
7. Mortar Guards: Provide guard boxes at back of hardware mortises in frames at all hinges and strike preps regardless of grouting requirements.
8. Floor Anchors: Weld anchors to bottom of jambs and Mullions with at least four spot welds per anchor.
9. Jamb Anchors: Provide number and spacing of anchors as follows:
   a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
      1) Two anchors per jamb up to 60 inches high.
      2) Three anchors per jamb from 60 to 90 inches high.
      3) Four anchors per jamb from 90 to 120 inches high.
      4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.
   b. Stud Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
      1) Three anchors per jamb up to 60 inches high.
      2) Four anchors per jamb from 60 to 90 inches high.
      3) Five anchors per jamb from 90 to 96 inches high.
      4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
      5) Two anchors per head for frames above 42 inches wide and mounted in metal stud partitions.
10. Door Silencers: Except on weatherstripped or gasketed doors, drill stops to receive door silencers. Silencers to be supplied by frame manufacturer regardless if specified in Division 08 Section "Door Hardware".

E. Hardware Preparation: Factory prepare hollow metal work to receive template mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."
   1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
   2. Reinforce doors and frames to receive non-template, mortised and surface mounted door hardware.
   3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
   4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections.

2.12 STEEL FINISHES

A. Prime Finishes: Doors and frames to be cleaned, and chemically treated to insure maximum finish paint adhesion. Surfaces of the door and frame exposed to view to receive a factory applied coat of rust inhibiting shop primer.
   1. Shop Primer: Manufacturer's standard, fast-curing, lead and chromate free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; and compatible with substrate and field-applied coatings.
PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Verify the accuracy of dimensions given to the steel door and frame manufacturer for existing openings or existing frames (strike height, hinge spacing, hinge back set, etc.).

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

3.2 PREPARATION

A. Remove welded in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

B. Prior to installation, adjust and securely brace welded hollow metal frames for squareness, alignment, twist, and plumbness.

C. Tolerances shall comply with SDI-117 "Manufacturing Tolerances Standard Steel Doors and Frames."

D. Drill and tap doors and frames to receive non-template, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.

B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11 and NFPA 80 at fire rated openings.

1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete and frames properly set and secured, remove temporary braces, leaving surfaces smooth and undamaged. Shim as necessary to comply with installation tolerances.

2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with post-installed expansion anchors.

3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with mortar.

4. Grout Requirements: Do not grout head of frames unless reinforcing has been installed in head of frame. Do not grout vertical or horizontal closed mullion members.

C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.

1. Non-Fire-Rated Standard Steel Doors:
   a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
   b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
   c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.

D. Field Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with hollow metal manufacturer's written instructions.

3.4 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.

B. Remove grout and other bonding material from hollow metal work immediately after installation.

C. Prime-Coat and Painted Finish Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat, or painted finishes, and apply touchup of compatible air drying, rust-inhibitive primer, zinc rich primer (exterior and galvanized openings) or finish paint.

END OF SECTION 081113
SECTION 081433 - STILE AND RAIL WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

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

1.2 SUMMARY

A. Section Includes:

1. Interior stile and rail wood doors.
2. Interior fire-rated, stile and rail wood doors.
3. Finishing stile and rail wood doors.
4. Fitting stile and rail wood doors to frames and machining for hardware.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For stile and rail wood doors. Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; and other pertinent data.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Use only materials that comply with referenced standards and other requirements specified. Assemble exterior doors and sidelites with wet-use adhesives.

2.2 INTERIOR STILE AND RAIL WOOD DOORS (D1)


1. Basis of Design Manufacturer: Refer to Finish Schedule on Drawings for the Basis of Design for Interior Stile and Rail Wood Doors. Subject to compliance with requirements, provide doors by the Basis of Design manufacturer or one of the following:

   a. JELD-WEN, Inc.
   b. Simpson Door Company.

2. Finish and Grade: Transparent and Premium or Select.

3. Wood Species: Refer to Finish Schedule.
2.3 INTERIOR FIRE-RATED, STILE AND RAIL WOOD DOORS (D1)

A. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.

1. Edge Construction: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.
2. Pairs: Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.


1. Basis of Design Manufacturer: Refer to Finish Schedule on Drawings for the Basis of Design for Interior Fire-Rated Stile and Rail Wood Doors. Subject to compliance with requirements, provide doors by the Basis of Design manufacturer or one of the following:
   a. Algoma Hardwoods, Inc.
   b. Eggers Industries.
2. Grade: Premium.
3. Finish: Opaque.
4. Door Construction for Opaque Finish: 1-3/4-inch-thick stiles and rails and veneered raised panels not less than 1-1/8 inches thick.

2.4 STILE AND RAIL WOOD DOOR FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated, with the following uniform clearances and bevels unless otherwise indicated:

1. Clearances: Provide 1/8 inch at heads, jambs, and between pairs of doors. Provide 1/2 inch from bottom of door to top of decorative floor finish or covering. Where threshold is shown or scheduled, provide not more than 3/8 inch from bottom of door to top of threshold.
   a. Comply with NFPA 80 for fire-rated doors.
2. Bevel non-fire-rated doors 1/8 inch in 2 inches at lock and hinge edges.
3. Bevel fire-rated doors 1/8 inch in 2 inches on lock edge; trim stiles and rails only to extent permitted by labeling agency.

B. Factory machine doors for hardware that is not surface applied.

2.5 FINISHING

A. Finish wood doors at factory that are indicated to receive transparent finish.
B. For doors indicated to be factory finished, comply with WDMA I.S.6A, "Industry Standard for Architectural Stile and Rail Doors," and with other requirements specified.

C. Use only paints and coatings that comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

D. Transparent Finish:
   1. Staining: As selected by Architect from manufacturer's full range.
   2. Effect: Open-grain finish.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Hardware: For installation, see Division 08 Section "Door Hardware."

B. Installation Instructions: Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.

   1. Install fire-rated doors according to NFPA 80.

C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

END OF SECTION 081433
SECTION 081743 - FLUSH AMP DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Acrylic modified polyester (AMP) woodgrain flush doors with aluminum frames.

B. Related Sections:

1. Division 08 Section "Glazing" for glass view panels in flush AMP doors.

1.3 SUBMITTALS

A. Product Data: For each type of door indicated. Include details of core and edge construction and trim for openings. Include factory-finishing specifications.

B. Test Reports: Submit certified test reports from qualified independent testing agency indicating doors comply with specified performance requirements.

C. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door, construction details not covered in Product Data, location and extent of hardware reinforcement and other pertinent data.

1. Indicate dimensions and locations of mortises and holes for hardware.
2. Indicate dimensions and locations of cutouts.
3. Indicate doors to be factory finished and finish requirements.
4. Indicate fire-protection ratings for fire-rated doors.

D. Samples for Initial Selection: For factory-finished doors.

E. Samples for Verification:

1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches, for each material and finish. For each wood species and transparent finish, provide set of three samples showing typical range of color and grain to be expected in the finished work.

2. Corner sections of doors, approximately 8 by 10 inches, with door faces and edges representing actual materials to be used.

   a. Provide samples for each species of veneer and solid lumber required.

   b. Finish veneer-faced door samples with same materials proposed for factory-finished doors.

3. Frames for light openings, 6 inches long, for each material, type, and finish required.
F. Warranty: Sample of special warranty.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying opening door mark and manufacturer.

B. Storage: Store materials in clean, dry area indoors in accordance with manufacturer's instructions.

C. Handling: Protect materials and finish from damage during handling and installation.

1.5 WARRANTY

A. Warrant doors, frames, and factory hardware against failure in materials and workmanship, including excessive deflection, faulty operation, defects in hardware installation, and deterioration of finish or construction in excess of normal weathering.

B. Warranty Period: Ten years starting on date of shipment. In addition, a limited lifetime (while the door is in its specified application in its original installation) warranty covering: failure of corner joinery, core deterioration, delamination or bubbling of door skin.

C. Warranty Period for Painted and Stained Finish: Five years starting on date of shipment.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Basis of Design Manufacturer: The Basis of Design for AMP woodgrain flush doors and frames is Model “SL-19 Flush Woodgrain Doors” manufactured by Special-Lite, Inc. Subject to compliance with requirements, provide AMP woodgrain flush doors and frames manufactured by the Basis of Design manufacturer or approved equal.

2.2 DOOR CONSTRUCTION, GENERAL

A. Construction

2. Stiles and Rails: Aluminum extrusions made from prime-equivalent billet that is produced from 100% reprocessed 6063-T6 alloy, minimum of 2-5/16-inch depth.
4. Provide joinery of 3/8-inch diameter full-width tie rods through extruded splines top and bottom integral to standard tubular shaped stiles and rails reinforced to accept hardware as specified.
5. Securing Internal Door Extrusions: 3/16-inch angle blocks and locking hex nuts for joinery.
6. Furnish extruded stiles and rails with integral reglets to accept face sheets. Lock face sheets into place to permit flush appearance.
7. Extrude top and bottom rail legs for interlocking continuous weather bar.
8. Meeting Stiles: Pile brush weatherseals. Extrude meeting stile to include integral pocket to accept pile brush weatherseals.
9. Bottom of Door: Install bottom weather bar with nylon brush weatherstripping into extruded interlocking edge of bottom rail.
B. Face Sheet: AMP, 0.120-inch thickness, painted surface finish with woodgrain texture.
   1. Cutouts: Manufacture doors with cutouts for required vision lites, louvers, and panels and factory install vision lites, louvers, and panels.

C. Door Core: Poured-in-place polyurethane foam with the following characteristics:
   1. Density: 5 pounds per cubic foot, minimum.
   2. R-Value: 9 minimum.

D. Hardware:
   1. Premachine doors in accordance with templates from specified hardware manufacturers and hardware schedule.
   2. Factory install hardware.

2.3 MATERIALS

A. Aluminum Members:
   1. Aluminum extrusions made from prime-equivalent billet that is produced from 100% reprocessed 6063-T6 alloy recovered from industrial processes: ASTM B 221.
   2. Sheet and Plate: ASTM B 209.
   3. Alloy and Temper: As required by manufacturer for strength, corrosion resistance, application of required finish, and control of color.

B. Components: Door and frame components from same manufacturer.

C. Fasteners:
   1. Material: Aluminum, 18-8 stainless steel, or other noncorrosive metal.
   2. Compatibility: Compatible with items to be fastened.
   3. Exposed Fasteners: Screws with finish matching items to be fastened.

2.4 ALUMINUM DOOR FRAMING SYSTEMS

A. Tubular Framing: Shop fabricate all framing and sidelites.
   1. Applied Door Stops: 0.625-inch high, with screws and weatherstripping. Door stop shall incorporate pressure gasketing for weathering seal. Counterpunch fastener holes in door stop to preserve full metal thickness under fastener head.
   2. Frame Members: Box type with 4 enclosed sides. Open-back framing is not acceptable.
   3. Caulking: Caulk joints before assembling frame members.
   6. Hardware: Premachine and reinforce frame members for hardware in accordance with manufacturer's standards and hardware schedule. Factory install hardware.

B. Aluminum Finishes: Clear anodized; Class I finish, 0.7 mils thick.
PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive doors. Notify Architect of conditions that would adversely affect installation or subsequent use. Do not proceed with installation until unsatisfactory conditions are corrected.

B. Ensure openings to receive frames are plumb, level, square, and in tolerance.

3.2 INSTALLATION

A. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

B. Install doors in accordance with manufacturer's instructions.

C. Install doors plumb, level, square, true to line, and without warp or rack.

D. Anchor frames securely in place.

E. Separate aluminum from other incompatible metal surfaces.

F. Set thresholds in bed of mastic and backseal.

G. Install exterior doors to be weathertight in closed position.

H. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site. Repair minor damages to finish in accordance with manufacturer's instructions.

I. Hardware: For installation, see Division 08 Section "Door Hardware."

3.3 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

C. Clean doors promptly after installation in accordance with manufacturer's instructions.

D. Protect installed doors to ensure that, except for normal weathering, doors will be without damage or deterioration at time of substantial completion.

END OF SECTION 081743
SECTION 083313 - COILING COUNTER DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Counter doors, manual operation.

B. Related Requirements:

1. Division 05 Section "Metal Fabrications" for door-opening framing and corner guards.

1.3 ACTION SUBMITTALS

A. Product Data: For each type and size of coiling counter door and accessory.

B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.

1. Include points of attachment and their corresponding static and dynamic loads imposed on structure.

2. Include diagrams for power, signal, and control wiring.

PART 2 - PRODUCTS

2.1 COUNTER DOOR ASSEMBLY

A. Counter Door: Coiling counter door formed with curtain of interlocking metal slats.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

   a. Cookson Company.
   b. Cornell Iron Works, Inc.
   c. McKeon Rolling Steel Door Company, Inc.

B. Operation Cycles: Door components and operators capable of operating for not less than 10,000.

C. Door Curtain Material: Galvanized steel.

D. Door Curtain Slats: Curved profile slats of 1-1/4-inch center-to-center height.
E. Curtain Jamb Guides: Galvanized steel with exposed finish matching curtain slats.

F. Hood: Match curtain material and finish.
   1. Mounting: Face of wall.

G. Locking Devices: Equip door with locking device assembly.
   1. Locking Device Assembly: Single-jamb side locking bars, operable from inside with thumbturn.


I. Curtain Accessories: Equip door with push/pull handles.

J. Door Finish:
   1. Baked-Enamel or Powder-Coated Finish: Color as selected by Architect from manufacturer's full range.

2.2 DOOR CURTAIN MATERIALS AND CONSTRUCTION

A. Curtain Jamb Guides: Manufacturer's standard angles or channels and angles of same material and finish as curtain slats unless otherwise indicated, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain.

2.3 HOODS

A. General: Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting that projects beyond wall face. Equip hood with intermediate support brackets as required to prevent sagging.

2.4 LOCKING DEVICES

A. Locking Device Assembly: Fabricate with cylinder lock, spring-loaded dead bolt, operating handle, cam plate, and adjustable locking bars to engage through slots in tracks.
   1. Lock Cylinders: As standard with manufacturer.
   2. Keys: Two for each cylinder.

2.5 CURTAIN ACCESSORIES

A. Push/Pull Handles: Equip each push-up-operated or emergency-operated door with lifting handles on each side of door, finished to match door.

2.6 COUNTERBALANCE MECHANISM

A. General: Counterbalance doors by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel.
connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.

B. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.

2.7 MANUAL DOOR OPERATORS

A. General: Equip door with manual door operator by door manufacturer.

B. Push-up Door Operation: Design counterbalance mechanism so that required lift or pull for door operation does not exceed 25 lbf.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install coiling counter doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.

END OF SECTION 083313
SECTION 083819 - RIGID TRAFFIC DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Medium to heavy duty traffic doors, hardware and accessories.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, hardware reinforcements, profiles, anchors and finishes.

B. Shop Drawings: Include the following:

1. Elevations of each door design.
2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
4. Details of anchorages, joints, field splices, and connections.
5. Details of accessories.
6. Details of moldings, removable stops, and glazing.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain traffic doors through one source from a single manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

1.6 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.7 WARRANTY

A. Manufacturer's standard two-year warranty that products are free of defects in material and workmanship, guaranteeing to replace parts proven defective within two years after date of substantial completion.
PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design Manufacturer: The Basis of Design for rigid traffic doors is Model “SPC-5 Aluminum Traffic Door” manufactured by Eliason Corp., Inc. Subject to compliance with requirements, provide AMP woodgrain flush doors and frames manufactured by the Basis of Design manufacturer or approved equal.

2.2 MEDIUM TO HEAVY DUTY TRAFFIC DOORS

A. Construction: 3/4 inch (19 mm) exterior grade solid wood core; 1 inch total thickness

1. Facing: Reinforcing metal plates.
2. Top Panels: 0.032 inch tempered aluminum alloy, satin anodized finish, both sides.
3. Center Plates: 33 inches high, 18 gauge steel, stainless steel front, galvanized steel back.
4. Base Plates: 17-3/8 inches high, 14 gauge grade D structural quality mill galvanized steel, both sides.
5. Window Size: 9 inches wide by 14 inches high.

B. Hardware and Accessories

1. Hinges: Manufacturer’s standard double action swing hinges.
2. Finish: Zinc coated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. Verify jambs plumb and square.

C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 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.

3.3 INSTALLATION

A. General: Install work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer’s written instructions.

B. Minimum jamb construction of double studded construction or equivalent.
C. Reinforce hollow metal jambs at hardware locations.

D. Steel channel jambs are required for heavy duty traffic doors.

3.4 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including work that is warped, bowed, or otherwise unacceptable.

B. Touch-up, repair or replace damaged products before Substantial Completion.
SECTION 085200 - WOOD COMPOSITE WINDOWS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes wood fiberglass composite windows.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include plans, elevations, sections, hardware, accessories, insect screens, operational clearances, and details of installation, including anchor, flashing, and sealant installation.

C. Samples: For each exposed product and for each color specified.

1.4 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace wood windows that fail in materials or workmanship within specified warranty period.

1. Warranty Period:

   a. Window: 10 years from date of Substantial Completion.
   b. Glazing Units: 10 years from date of Substantial Completion.
   c. Fiberglass Cladding: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 WINDOW PERFORMANCE REQUIREMENTS

A. Product Standard: Comply with AAMA/WDMA/CSA 101/1.S.2/A440 for definitions and minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.

   1. Window Certification: WDMA certified with label attached to each window.

B. Performance Class and Grade: AAMA/WDMA/CSA 101/1.S.2/A440 as follows:

   1. Minimum Performance Class: LC.
   2. Minimum Performance Grade: 35.
C. NFRC Values:
   1. Thermal Transmittance: NFRC 100 maximum whole-window U-factor of 0.30 Btu/sq. ft x h x deg F.
   2. Solar Heat-Gain Coefficient (SHGC): NFRC 200 maximum whole-window SHGC of 0.40.
   3. Condensation-Resistance Factor (CRF): Provide aluminum windows tested for thermal performance according to AAMA 1503, showing a CRF of 50-54.
   4. Outside-Inside Transmission Class (OITC): Rated for not less than 23 OITC when tested for laboratory sound transmission loss according to ASTM E 90 and determined by ASTM E 1332.
   5. Sound Transmission Class (STC): Rated for not less than 27 STC when tested for laboratory sound transmission loss according to ASTM E 90 and determined by ASTM E 413.

2.2 WOOD COMPOSITE WINDOWS

A. Wood Composite Windows:
   1. Basis of Design Manufacturer: The Basis of Design for wood composite windows is Model “Wood-Ultrex” manufactured by Marvin Windows and Doors. Subject to compliance with requirements, provide the Basis of Design manufacturer or approved equal.

B. Operating Types: As indicated on Drawings.

C. Frames and Sashes: Pultruded fiberglass complying with AAMA/WDMA/CSA 101/I.S.2/A440 and with exposed exterior fiberglass surfaces finished with manufacturer's standard enamel coating complying with AAMA 613.
   1. Exterior Finish: Pultruded reinforced fiberglass, color to be selected.
   2. Interior Finish: Manufacturer's standard clear pine factory paint finish, color to be selected.

D. Insulating-Glass Units: ASTM E 2190.
   1. Lites: Two.
   2. Filling: Fill space between glass lites with air.
   3. Low-E Coating: Manufacturer’s standard sputter or pyrolytic coating.

E. Glazing System: Manufacturer's standard factory-glazing system that produces weathertight seal.

F. Projected Window Hardware:
   1. Single-Handle Locking System: Operates positive-acting arms that pull sash into locked position. Provide one arm on sashes up to 29 inches tall and two arms on taller sashes.

G. Fasteners: Noncorrosive and compatible with window members, trim, hardware, anchors, and other components.
   1. Exposed Fasteners: Do not use exposed fasteners to greatest extent possible. For application of hardware, use fasteners that match finish hardware being fastened.

2.3 ACCESSORIES

A. Dividers (False Muntins): Provide divider grilles in designs indicated for each sash lite.
   1. Material: Manufacturer's standard.
2. Pattern: As indicated on Drawings.
3. Profile: As selected by Architect from manufacturer's full range.
4. Color: As selected by Architect from manufacturer's full range.

2.4 FABRICATION

A. Fabricate wood composite windows in sizes indicated. Include a complete system for installing and anchoring windows.

B. Glaze wood composite windows in the factory.

C. Weather strip each operable sash to provide weathertight installation.

D. Mullions: Provide mullions and cover plates, matching window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections. Provide mullions and cover plates capable of withstanding design wind loads of window units.

E. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation. Allow for scribing, trimming, and fitting at Project site.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Verify rough opening dimensions, levelness of sill plate, and operational clearances.

C. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure weathertight window installation.

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

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing windows, hardware, accessories, and other components. For installation procedures and requirements not addressed in manufacturer's written instructions, comply with installation requirements in ASTM E 2112.

B. Install composite windows level, plumb, square, true to line, without distortion, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction to produce weathertight construction.

C. Adjust operating sashes and hardware for a tight fit at contact points and weather stripping for smooth operation and weathertight closure.

D. Clean exposed surfaces immediately after installing windows. Remove excess sealants, glazing materials,
dirt, and other substances.

E. Remove and replace sashes if glass has been broken, chipped, cracked, abraded, or damaged during construction period.

3.3 ADJUSTING, CLEANING, AND PROTECTION

A. Adjust operating sashes and hardware for a tight fit at contact points and weather stripping for smooth operation and weathertight closure.

B. Clean exposed surfaces immediately after installing windows. Remove excess sealants, glazing materials, dirt, and other substances.
   1. Keep protective films and coverings in place until final cleaning.

C. Remove and replace sashes if glass has been broken, chipped, cracked, abraded, or damaged during construction period.

D. Protect window surfaces from contact with contaminating substances resulting from construction operations. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written instructions.

END OF SECTION 085200
SECTION 087100 – DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes commercial door hardware for the following:
   1. Swinging doors.
   2. Sliding doors.
   3. Other doors to the extent indicated.

B. Door hardware includes, but is not necessarily limited to, the following:
   1. Mechanical door hardware.
   2. Electromechanical door hardware.
   3. Automatic operators.
   4. Cylinders specified for doors in other sections.

C. Related Sections:
   1. Division 08 Section “Hollow Metal Doors and Frames”.
   2. Division 08 Section “Flush AMP Doors”.
   3. Division 08 Section “Stile and Rail Wood Doors”.

D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.
   6. NFPA 105 - Installation of Smoke Door Assemblies.
   7. UL/ULC and CSA C22.2 – Standards for Automatic Door Operators Used on Fire and Smoke Barrier Doors and Systems of Doors.
   8. State Building Codes, Local Amendments.

E. Standards: All hardware specified herein shall comply with the following industry standards:
   1. ANSI/BHMA Certified Product Standards - A156 Series
   2. UL10C – Positive Pressure Fire Tests of Door Assemblies
1.3 SUBMITTALS

A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.

B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."

2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.

3. Content: Include the following information:
   a. Type, style, function, size, label, hand, and finish of each door hardware item.
   b. Manufacturer of each item.
   c. Fastenings and other pertinent information.
   d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
   e. Explanation of abbreviations, symbols, and codes contained in schedule.
   f. Mounting locations for door hardware.
   g. Door and frame sizes and materials.
   h. Warranty information for each product.

4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.

C. Shop Drawings: Details of electrified access control hardware indicating the following:

1. Wiring Diagrams: Upon receipt of approved schedules, submit detailed system wiring diagrams for power, signaling, monitoring, communication, and control of the access control system electrified hardware. Differentiate between manufacturer-installed and field-installed wiring. Include the following:
   a. Elevation diagram of each unique access controlled opening showing location and interconnection of major system components with respect to their placement in the respective door openings.
   b. Complete (risers, point-to-point) access control system block wiring diagrams.
   c. Wiring instructions for each electronic component scheduled herein.

2. Electrical Coordination: Coordinate with related sections the voltages and wiring details required at electrically controlled and operated hardware openings.
D. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.

E. Informational Submittals:

1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.

F. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Procedures.

1.4 QUALITY ASSURANCE

A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.

B. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

C. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.

D. Door Hardware Standards and Guidelines: Prepare Door Hardware specification documents in accordance with the Owner's approved ASSA ABLOY Virtual Design Guide (VDG) standard for door opening products and applications.

E. Building Information Modeling (BIM) Qualifications: BIM software tools and processes are used to produce and support data integration of product and technical information used in specifications, submittals, project reviews, decision support, and quality assurance during all phases of Project design, construction, and facility management. Door and hardware schedules and the associated product data parameters are to be derived, updated, and fully integrated with the coordinated BIM.

1. Door Hardware BIM Software Tool: Openings Studio™ is the designated BIM software suite to be used in a coordinated effort with architects, contractors and trades to integrate Project product data and information into the coordinated Record BIMs and associated applications.

F. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.

1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.
2. Provide electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated.

G. Each unit to bear third party permanent label demonstrating compliance with the referenced standards.

H. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:

1. Function of building, purpose of each area and degree of security required.
2. Plans for existing and future key system expansion.
3. Requirements for key control storage and software.
4. Installation of permanent keys, cylinder cores and software.
5. Address and requirements for delivery of keys.

I. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.

1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
3. Review sequence of operation narratives for each unique access controlled opening.
4. Review and finalize construction schedule and verify availability of materials.
5. Review the required inspecting, testing, commissioning, and demonstration procedures.

J. At completion of installation, provide written documentation that components were applied to manufacturer's instructions and recommendations and according to approved schedule.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.

B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.

C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.6 COORDINATION

A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of
other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.

B. Door Hardware and Electrical Connections: Coordinate the layout and installation of scheduled electrified door hardware and related access control equipment with required connections to source power junction boxes, low voltage power supplies, detection and monitoring hardware, and fire and detection alarm systems.

C. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.7 WARRANTY

A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:

1. Structural failures including excessive deflection, cracking, or breakage.
2. Faulty operation of the hardware.
3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
4. Electrical component defects and failures within the systems operation.

C. Standard Warranty Period: One year from date of Substantial Completion, unless otherwise indicated.

D. Special Warranty Periods:
1. Five years for standard duty cylindrical (bored) locks and latches.
2. Ten years for manual surface door closer bodies.
3. Two years for electromechanical door hardware.

1.8 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.
B. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:

1. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.

C. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

2.2 HANGING DEVICES

A. Hinges: ANSI/BHMA A156.1 certified butt hinges with number of hinge knuckles and other options as specified in the Door Hardware Sets.

1. Quantity: Provide the following hinge quantity:

   a. Two Hinges: For doors with heights up to 60 inches.
   b. Three Hinges: For doors with heights 61 to 90 inches.
   c. Four Hinges: For doors with heights 91 to 120 inches.
   d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.

2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:

   a. Widths up to 3’0”: 4-1/2” standard or heavy weight as specified.
   b. Sizes from 3’1” to 4’0”: 5” heavy weight.

3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:

   a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
   b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.

4. Hinge Options: Comply with the following:

   a. Non-removable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the all out-swinging lockable doors.

5. Cam Lift Hinges: Where specified provide hinges that move the door up and then lower it to create a tight seal when the door is closed.

6. Manufacturers:

   a. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK) - TA Series.
B. Concealed Hinges: Hinges mortised into door and frame so that they are concealed when the door is closed. Hinges shall be adjustable three ways; vertically, horizontally and compression (in/out) capable of a 180 degree swing. Hinges are to be non-handed. Provide fastener type, size, and quantity as recommended by hinge manufacturer for properly installing concealed hinges in the door and frame type application. Provide steel receiver for metal door and frame cutouts for receiving concealed hinges.

1. Manufacturers:
   a. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK).

2.3 DOOR OPERATING TRIM

A. Flush Bolts and Surface Bolts: ANSI/BHMA A156.3 and A156.16, Grade 1, certified.

1. Flush bolts to be furnished with top rod of sufficient length to allow bolt retraction device location approximately six feet from the floor.
2. Furnish dust proof strikes for bottom bolts.
3. Surface bolts to be minimum 8” in length and U.L. listed for labeled fire doors and U.L. listed for windstorm components where applicable.
4. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.

5. Manufacturers:
   a. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).

B. Door Push Plates and Pulls: ANSI/BHMA A156.6 certified door pushes and pulls of type and design specified in the Hardware Sets. Coordinate and provide proper width and height as required where conflicting hardware dictates.

1. Push/Pull Plates: Minimum .050 inch thick, size as indicated in hardware sets, with beveled edges, secured with exposed screws unless otherwise indicated.
2. Door Pull and Push Bar Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door unless otherwise indicated.
3. Offset Pull Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door and offset of 90 degrees unless otherwise indicated.
4. Leather: Where specified English bridle and Italian Upholstery shall be 10 ounce with hand sewn saddle stiches and hand sewn end line stiches.
5. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets.
6. Manufacturers:
   a. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).

2.4 CYLINDERS AND KEYING

A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.

B. Source Limitations: Obtain each type of keyed cylinder and keys from the same source manufacturer as locksets and exit devices, unless otherwise indicated.
C. Cylinders: Original manufacturer cylinders complying with the following:

1. Mortise Type: Threaded cylinders with rings and cams to suit hardware application.
2. Rim Type: Cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
3. Bored-Lock Type: Cylinders with tailpieces to suit locks.
4. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
5. Keyway: Manufacturer’s Standard.

D. Permanent Cores: Match standard. Reference Division 01 "Cash Allowances" "Product Allowances" for material required under project. Installation to be included under Division 08 "Door Hardware" base bid package.

1. Interchangeable Cores: Core insert, removable by use of a special key; usable with other manufacturers' cylinders.
2. Removable Cores: Core insert, removable by use of a special key, and for use with only the core manufacturer's cylinder and door hardware. Provide removable core (small or large format) as specified in Hardware Sets.

E. Keying System: Each type of lock and cylinders to be factory keyed.

1. Conduct specified "Keying Conference" to define and document keying system instructions and requirements.
2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
3. New System: Key locks to a new key system as directed by the Owner.

F. Key Quantity: Provide the following minimum number of keys:

1. Change Keys per Cylinder: Two (2)
2. Master Keys (per Master Key Level/Group): Five (5).

G. Construction Keying: Provide construction master keyed cylinders.

H. Key Registration List (Bitting List):

1. Provide keying transcript list to Owner's representative in the proper format for importing into key control software.
2. Provide transcript list in writing or electronic file as directed by the Owner.

I. Key Control Cabinet: Provide a key control system including envelopes, labels, and tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet. Key control cabinet shall have expansion capacity of 150% of the number of locks required for the project.

1. Manufacturers:

   a. Lund Equipment (LU).
   b. MMF Industries (MM).
   c. Telkee (TK).
J. Key Control Software: Provide one network version of "Key Wizard" branded key management software package that includes one year of technical support and upgrades to software at no charge. Provide factory key system formatted for importing into “Key Wizard” software.

2.5 MECHANICAL LOCKS AND LATCHING DEVICES

A. Cylindrical Locksets, Grade 2 (Standard Duty): ANSI/BHMA A156.2, Series 4000, Grade 2 certified.
   1. Locks are to be non-handed and fully field reversible.
   2. Manufacturers:
      a. Yale Locks and Hardware (YA) - 4600LN Series.

2.6 LOCK AND LATCH STRIKES

A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:
   1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
   2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
   3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
   4. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.

B. Standards: Comply with the following:
   2. Strikes for Bored Locks and Latches: BHMA A156.2.
   3. Strikes for Auxiliary Deadlocks: BHMA A156.36.
   4. Dustproof Strikes: BHMA A156.16.

2.7 CONVENTIONAL EXIT DEVICES

A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:
   1. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.
   2. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the proper fasteners for installation as tested and listed by UL. Consult manufacturer’s catalog and template book for specific requirements.
   3. Except on fire rated doors, provide exit devices with key cylinder dogging device to hold the pushbar and latch in a retracted position.
   4. Devices must fit flat against the door face with no gap that permits unauthorized dogging of the push bar. The addition of filler strips is required in any case where the door light extends behind the device as in a full glass configuration.
5. **Flush End Caps:** Provide flush end caps made of architectural metal in the same finish as the devices as in the Hardware Sets. Plastic end caps will not be acceptable.

6. **Energy Efficient Design:** Provide lock bodies which have a holding current draw of 15mA maximum, and can operate on either 12 or 24 volts. Locks are to be field configurable for fail safe or fail secure operation.

7. **Lever Operating Trim:** Where exit devices require lever trim, furnish manufacturer's heavy duty escutcheon trim with threaded studs for thru-bolts.
   a. **Lock Trim Design:** As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets.
   b. Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.

8. **Vertical Rod Exit Devices:** Where surface or concealed vertical rod exit devices are used at interior openings, provide as less bottom rod (LBR) unless otherwise indicated. Provide dust proof strikes where thermal pins are required to project into the floor.

9. **Rim Exit Devices:** Exit device rails shall release with less than 5 pounds of pressure.

10. **Narrow Stile Applications:** At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2” wide stiles.

11. **Dummy Push Bar:** Nonfunctioning push bar matching functional push bar.

12. **Rail Sizing:** Provide exit device rails factory sized for proper door width application.

13. **Through Bolt Installation:** For exit devices and trim as indicated in Door Hardware Sets.

B. **Conventional Push Rail Exit Devices (Commercial Duty):** ANSI/BHMA A156.3, Grade 1 certified panic and fire exit hardware devices furnished in the functions specified in the Hardware Sets. Fabricate latchbolts from cast stainless steel, Pullman type, incorporating a deadlocking feature.

1. **Manufacturers:**
   a. Yale Locks and Hardware (YA) - 6000 Series.

C. **Tube Steel Removable Mullions:** ANSI/BHMA A156.3 removable steel mullions with malleable-iron top and bottom retainers and a primed paint finish.

1. Provide keyed removable feature where specified in the Hardware Sets.
2. Provide stabilizers and mounting brackets as required.
3. Provide electrical quick connection wiring options as specified in the hardware sets.
4. **Manufacturers:**
   a. Yale Locks and Hardware (YA) - M200 Series.

### 2.8 DOOR CLOSERS

A. All door closers specified herein shall meet or exceed the following criteria:

1. **General:** Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers including installation and adjusting information on inside of cover.
2. **Standards:** Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.
3. **Cycle Testing:** Provide closers which have surpassed 15 million cycles in a test witnessed and verified by UL.
4. **Size of Units:** Comply with manufacturer's written recommendations for sizing of door closer depending on size of door, exposure to weather, and anticipated frequency of use. Where closers
are indicated for doors required to be accessible to the physically handicapped, provide units complying with ANSI ICC/A117.1.

5. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.

6. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.

7. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.

B. Door Closers, Surface Mounted (Heavy Duty): ANSI/BHMA A156.4, Grade 1 surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control. Provide non-handed units standard.

1. Manufacturers:
   a. Norton Door Controls (NO) - 7500 Series.
   b. Yale Locks and Hardware (YA) - 4400 Series.

C. Door Closers, Surface Mounted (Unitrol): Unitrol arms to have door stop mechanism to absorb dead stop shock on arm and top hinge. Hold-open arms to have a spring loaded mechanism in addition to shock absorber assembly. Arms to be provided with rigid steel main arm and secondary arm lengths proportional to the door width.

1. Manufacturers:
   a. Norton Door Controls (NO) - Unitrol Series.
   b. Yale Locks and Hardware (YA) - Unitrol Series.

D. Door Closers, Surface Mounted (Commercial Duty): ANSI/BHMA 156.4, Grade 1 certified surface mounted, institutional grade door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck, closing sweep, and latch speed control valves. Provide non-handed units standard.

1. Manufacturers:
   a. Norton Door Controls (NO) - 8500 Series.
   b. Yale Locks and Hardware (YA) - 3500 Series.

2.9 ELECTROMECHANICAL DOOR OPERATORS

A. Standard: Certified ANSI/BHMA A156.19.

B. Performance Requirements: Capable of operating doors up to 48” wide and weighing up to 250 pounds.

C. Cycle Testing: Successfully tested to a minimum one million automatic cycles.

D. Configuration: Surface mounted. Door operators to control single swinging and pair of swinging doors.
1. Furnish complete with required signage.

E. Operation: Power opening and spring closing operation capable of meeting ANSI A117.1 accessibility guideline. Provide time delay for door to remain open before initiating closing cycle as required by ANSI/BHMA A156.19.

1. When operated manually a clutch mechanism disengages the motor gearbox upon opening, and then re-engages during the closing cycle to control spring force.

F. Features: Operator units to have full feature adjustments for door opening and closing force and speed, backcheck, motor assist acceleration from 0 to 30 seconds, time delay, vestibule interface delay, obstruction recycle, and hold open time from 0 up to 30 seconds.

1. Provide units which are self adjusting for door size and weight, and using on-board diagnostics, continually maintain control of doors in wind or abusive environments.
3. Provide units which have a regenerative drive system which charges the on-board battery pack when the door is operated manually, and which requires no external electrical power.

G. Provide outputs and relays on board the operator to allow for coordination of exit device latch retraction, electric strikes, magnetic locks, card readers, safety and motion sensors and specified auxiliary contact.

H. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Norton Door Controls (NO) - 5800 Series.

2.10 ARCHITECTURAL TRIM

A. Door Protective Trim

1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.

2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side of single doors and 1" LDW on stop side of pairs of doors, and not more than 1" less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.

3. Where plates are applied to fire rated doors with the top of the plate more than 16” above the bottom of the door, provide plates complying with NFPA 80. Consult manufacturer’s catalog and template book for specific requirements for size and applications.

4. Protection Plates: ANSI/BHMA A156.6 certified protection plates (kick, armor, or mop), fabricated from the following:

   a. Stainless Steel: 300 grade, 050-inch thick.

5. Options and fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets. Provide countersunk screw holes.

6. Manufacturers:

   a. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
2.11 DOOR STOPS AND HOLDERS

A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.

B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 certified door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.

1. Manufacturers:
   a. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).

C. Overhead Door Stops and Holders: ANSI/BHMA A156.6, Grade 1 certified overhead stops and holders to be surface or concealed types as indicated in Hardware Sets. Track, slide, arm and jamb bracket to be constructed of extruded bronze and shock absorber spring of heavy tempered steel. Provide non-handed design with mounting brackets as required for proper operation and function.

1. Manufacturers:
   a. Rixson Door Controls (RF).
   b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).

2.12 ARCHITECTURAL SEALS

A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.

B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.

1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.

C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.


D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.

E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

F. Manufacturers:

1. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE).
2.13 ELECTRONIC ACCESSORIES

A. Key Switches: Key switches furnished standard with stainless steel single gang face plate with a 12/24VDC bi-color LED indicator. Integral backing bracket permits integration with any 1 1/4" or 1 1/2" mortise type cylinder. Key switches available as momentary or maintained action and in narrow face plate options.

1. Manufacturers:
   a. Securitron (SU) - MK Series.

B. Switching Power Supplies: Provide switching power supplies that are dual voltage, UL listed, supervised units. Units shall be field selectable with a dedicated battery charging circuit that provide 4 Amp at 12VDC or 24VDC continuous, with up to 16 independently controlled power limited outputs. Units shall tolerate brownout or overvoltage input ± 15% of nominal voltage and have thermal shutdown protection with auto restart. Circuit breaker shall protect against overcurrent and reverse battery faults and units shall be available with a single relay fire trigger or individually triggered relayed outputs. Provide the least number of units, at the appropriate amperage level, sufficient to exceed the required total draw plus 50% for the specified electrified hardware and access control equipment.

1. Manufacturers:
   a. Securitron (SU) - AQ Series.

2.14 FABRICATION

A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.15 FINISHES

A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.

B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware

C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.2 PREPARATION

A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.


3.3 INSTALLATION

A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.

1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.

B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:

2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.

C. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

D. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."

E. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.
3.4 FIELD QUALITY CONTROL

A. Field Inspection (Punch-Out Report): Reference Division 01 Section "Closeout Procedures". Final inspect installed door hardware and state in report whether work complies with or deviates from specification requirements, including whether door hardware is properly installed, operating and adjusted.

3.5 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

3.6 CLEANING AND PROTECTION

A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.

B. Clean adjacent surfaces soiled by door hardware installation.

C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.7 DEMONSTRATION

A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.8 DOOR HARDWARE SETS

A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

B. The supplier is responsible for handing and sizing all products and providing the correct option for the appropriate door type and material where more than one is presented in the hardware sets. Quantities listed are for each pair of doors, or for each single door.

C. Manufacturer’s Abbreviations:

1. MK - McKinney
2. RO - Rockwood
3. YA - Yale
4. BE - Best
5. RF - Rixson
6. NO - Norton
### Hardware Sets

**Set: 1.0**  
Description: Exterior Pair - Auto

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Model</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 Hinge</td>
<td>T4A3386 (nrp @ out-swing w/ lock)</td>
<td>US10BE</td>
<td>MK</td>
</tr>
<tr>
<td>1 Key Removable Mullion</td>
<td>KRM200 SFIC</td>
<td>600</td>
<td>YA</td>
</tr>
<tr>
<td>2 Exit Device (rim, CD, classroom)</td>
<td>6105 PB626F SFIC</td>
<td>613E</td>
<td>YA</td>
</tr>
<tr>
<td>6 Cores (SFIC)</td>
<td>SFIC (keyed as directed)</td>
<td>13</td>
<td>BE</td>
</tr>
<tr>
<td>1 Cylinder</td>
<td>SFIC as required</td>
<td>613E</td>
<td>YA</td>
</tr>
<tr>
<td>1 Surf Overhead Stop</td>
<td>9-X36</td>
<td>613</td>
<td>RF</td>
</tr>
<tr>
<td>1 Door Closer x HD Stop</td>
<td>UNI7500</td>
<td>613E</td>
<td>NO</td>
</tr>
<tr>
<td>1 Door Operator (hard-wired)</td>
<td>5831xLPB 24VDC</td>
<td>Black</td>
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<tr>
<td>2 Kick Plate</td>
<td>K1050 10&quot; B4E CSK</td>
<td>US10BE</td>
<td>RO</td>
</tr>
<tr>
<td>1 Threshold</td>
<td>27_x292DFGPK FHSL14 (or per detail)</td>
<td>PE</td>
<td></td>
</tr>
<tr>
<td>1 Gasketing (head, jambs)</td>
<td>290DPK</td>
<td>PE</td>
<td></td>
</tr>
<tr>
<td>1 Gasketing (mullion)</td>
<td>510BL</td>
<td>PE</td>
<td></td>
</tr>
<tr>
<td>2 Sweep</td>
<td>18061DNB</td>
<td>PE</td>
<td></td>
</tr>
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<td>2 Astragal</td>
<td>18041DNB</td>
<td>PE</td>
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<tr>
<td>1 Keyswitch (alternate, SPDT)</td>
<td>MKA</td>
<td>SU</td>
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<tr>
<td>2 Door Switch</td>
<td>501 (sogl 2-gang elec box)</td>
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<tr>
<td>1 Hard-Wired Kit (24VDC output)</td>
<td>ADA1015P</td>
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<tr>
<td>1 Wireless Interface Module</td>
<td>ADA1028W</td>
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**Notes:** Exit device must be in dogged position for auto operator to function. Key switch turns operator on/off.

**Set: 2.0**  
Description: Exterior Proshop; Lounge; Corridor

<table>
<thead>
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<th>Item</th>
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<th>Notes</th>
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<tbody>
<tr>
<td>3 Hinge</td>
<td>T4A3386 (nrp @ out-swing w/ lock)</td>
<td>US10BE</td>
<td>MK</td>
</tr>
<tr>
<td>1 Exit Device (rim, CD, classroom)</td>
<td>6105 PB626F SFIC</td>
<td>613E</td>
<td>YA</td>
</tr>
<tr>
<td>2 Cores (SFIC)</td>
<td>SFIC (keyed as directed)</td>
<td>13</td>
<td>BE</td>
</tr>
<tr>
<td>1 Door Closer x HD Stop</td>
<td>UNI7500</td>
<td>613E</td>
<td>NO</td>
</tr>
<tr>
<td>1 Kick Plate</td>
<td>K1050 10&quot; B4E CSK</td>
<td>US10BE</td>
<td>RO</td>
</tr>
<tr>
<td>1 Threshold</td>
<td>27_x292DFGPK FHSL14 (or per detail)</td>
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<tr>
<td>1 Gasketing (head, jambs)</td>
<td>290DPK</td>
<td>PE</td>
<td></td>
</tr>
<tr>
<td>1 Sweep</td>
<td>18061DNB</td>
<td>PE</td>
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<tr>
<td>1 Door Position Switch</td>
<td>DPS by Security</td>
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</table>

**Set: 3.0**  
Description: Exterior Stair

<table>
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<tbody>
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<td>T4A3386 (nrp @ out-swing w/ lock)</td>
<td>US10BE</td>
<td>MK</td>
</tr>
<tr>
<td>1 Exit Device (rim, storeroom)</td>
<td>6100F PB627F SFIC</td>
<td>613E</td>
<td>YA</td>
</tr>
<tr>
<td>1 Cores (SFIC)</td>
<td>SFIC (keyed as directed)</td>
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<tr>
<td>1 Threshold</td>
<td>27_x292DFGPK FHSL14 (or per detail)</td>
<td>PE</td>
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</tr>
<tr>
<td>1 Gasketing (head, jambs)</td>
<td>290DPK</td>
<td>PE</td>
<td></td>
</tr>
<tr>
<td>1 Sweep</td>
<td>18061DNB</td>
<td>PE</td>
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</table>
### Set: 4.0
**Description:** Exterior Kitchen

<table>
<thead>
<tr>
<th>Item</th>
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<th>Description</th>
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</thead>
<tbody>
<tr>
<td>Hinge</td>
<td>3</td>
<td>T4A3386 (nrp @ out-swing w/ lock)</td>
</tr>
<tr>
<td>Cylindrical Lock (storeroom)</td>
<td>1</td>
<td>B PB 4605 LN</td>
</tr>
<tr>
<td>Cores (SFIC)</td>
<td>1</td>
<td>SFIC (keyed as directed)</td>
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<tr>
<td>Door Closer x HD stop/Holder</td>
<td>1</td>
<td>UNI7500 H</td>
</tr>
<tr>
<td>Kick Plate</td>
<td>1</td>
<td>K1050 10&quot; B4E CSK</td>
</tr>
<tr>
<td>Threshold</td>
<td>1</td>
<td>27 x 292 DFGPK FHSL14 (or per detail)</td>
</tr>
<tr>
<td>Gasketing (head, jambs)</td>
<td>1</td>
<td>290DPK</td>
</tr>
<tr>
<td>Sweep</td>
<td>1</td>
<td>18061 DNB</td>
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<tr>
<td>Door Position Switch</td>
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<td>DPS by Security</td>
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### Set: 5.0
**Description:** Lobby/Vest Pair

<table>
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<tr>
<th>Item</th>
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<tbody>
<tr>
<td>Hinge</td>
<td>6</td>
<td>T4A3386 (nrp @ out-swing w/ lock)</td>
</tr>
<tr>
<td>Exit Device (SVR, LBR, classroom)</td>
<td>2</td>
<td>6170F LBR PB626F SFIC</td>
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<tr>
<td>Cores (SFIC)</td>
<td>2</td>
<td>SFIC (keyed as directed)</td>
</tr>
<tr>
<td>Door Closer x HD Stop</td>
<td>2</td>
<td>UNI7500</td>
</tr>
<tr>
<td>Kick Plate</td>
<td>2</td>
<td>K1050 10&quot; B4E CSK</td>
</tr>
<tr>
<td>Threshold</td>
<td>1</td>
<td>271D FHSL14 (or per detail)</td>
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<td>Gasketing (head, jambs)</td>
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<td>S88BL</td>
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<tr>
<td>Astragal (adhesive, edge)</td>
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<td>S771C</td>
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<tr>
<td>Door Position Switch</td>
<td>1</td>
<td>DPS by Security (at door 112B)</td>
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### Set: 6.0
**Description:** Multi-purpose Pair

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<th>Item</th>
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</thead>
<tbody>
<tr>
<td>Hinge</td>
<td>6</td>
<td>T4A3386 (nrp @ out-swing w/ lock)</td>
</tr>
<tr>
<td>Exit Device (SVR, LBR, classroom)</td>
<td>2</td>
<td>6170F LBR PB626F SFIC</td>
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<tr>
<td>Cores (SFIC)</td>
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<td>SFIC (keyed as directed)</td>
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<tr>
<td>Door Closer</td>
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<td>7500 Series</td>
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<tr>
<td>Kick Plate</td>
<td>2</td>
<td>K1050 10&quot; B4E CSK</td>
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<tr>
<td>Door Stop</td>
<td>2</td>
<td>404 wall; 441CU floor</td>
</tr>
<tr>
<td>Threshold</td>
<td>1</td>
<td>271D FHSL14 (or per detail)</td>
</tr>
<tr>
<td>Gasketing (head, jambs)</td>
<td>1</td>
<td>S88BL</td>
</tr>
<tr>
<td>Astragal (adhesive, edge)</td>
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<td>S771C</td>
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</table>

### Set: 7.0
**Description:** Vest Sgl Proshop; Lounge

<table>
<thead>
<tr>
<th>Item</th>
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<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hinge</td>
<td>3</td>
<td>T4A3386 (nrp @ out-swing w/ lock)</td>
</tr>
<tr>
<td>Fixed Pushrail</td>
<td>1</td>
<td>620DB</td>
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<tr>
<td>Pull Plate</td>
<td>1</td>
<td>RM5510 x 73B</td>
</tr>
<tr>
<td>Door Closer x HD Stop</td>
<td>1</td>
<td>UNI7500</td>
</tr>
<tr>
<td>Kick Plate</td>
<td>1</td>
<td>K1050 10&quot; B4E CSK</td>
</tr>
<tr>
<td>Threshold</td>
<td>1</td>
<td>271D FHSL14 (or per detail)</td>
</tr>
<tr>
<td>Gasketing (head, jambs)</td>
<td>1</td>
<td>S88BL</td>
</tr>
</tbody>
</table>

### Set: 8.0
**Description:** Stair
3 Hinge T4A3786 (nrp @ out-swing w/ lock) US10BE MK
1 Exit Device (rim, passage) 6100F PB628F 613E YA
1 Surface Closer 8501 Series 613E NO
1 Kick Plate K1050 10" B4E CSK US10BE RO
1 Door Stop 404 wall; 441CU floor US10BE RO
1 Threshold 271D FHSL14 (or per detail) PE
1 Gasketing (head, jambs) S88BL PE

Set: 9.0
Description: Stair from Lounge; Proshop

3 Hinge T4A3786 (nrp @ out-swing w/ lock) US10BE MK
1 Exit Device (rim, classroom) 6100F PB626F SFIC 613E YA
1 Core (SFIC) SFIC (keyed as directed) 13 BE
1 Surface Closer 8501 Series 613E NO
1 Kick Plate K1050 10" B4E CSK US10BE RO
1 Door Stop 404 wall; 441CU floor US10BE RO
1 Threshold 271D FHSL14 (or per detail) PE
1 Gasketing (head, jambs) S88BL PE

Set: 10.0
Description: Stair to Kitchen

3 Hinge T4A3786 (nrp @ out-swing w/ lock) US10BE MK
1 Cylindrical Lock (classroom) B PB 4608LN 613E YA
1 Core (SFIC) SFIC (keyed as directed) 13 BE
1 Surface Closer 8501 Series 613E NO
1 Kick Plate K1050 10" B4E CSK US10BE RO
1 Door Stop 404 wall; 441CU floor US10BE RO
1 Threshold 271D FHSL14 (or per detail) PE
1 Gasketing (head, jambs) S88BL PE

Set: 10.1
Description:

3 Hinge T4A3786 (nrp @ out-swing w/ lock) US10BE MK
1 Cylindrical Lock (classroom) B PB 4608LN 613E YA
1 Core (SFIC) SFIC (keyed as directed) 13 BE
1 Surface Closer 8501 Series 613E NO
1 Kick Plate K1050 10" B4E CSK US10BE RO
1 Door Stop Stop as required US10BE RO
3 Silencers 608/609 PE

Set: 11.0
Description: Storage; Mech Pair

6 Hinge T4A3786 (nrp @ out-swing w/ lock) US10BE MK
2 Flush Bolt 555 US10BE RO
1 Dust Proof Strike 570 US10BE RO
1 Cylindrical Lock (storeroom) B PB 4605LN 613E YA
1 Core (SFIC) SFIC (keyed as directed) 13 BE
1 Surface Closer 8501 Series 613E NO
2 Door Stop 404 wall; 441CU floor US10BE RO
| Set  | Description                        | Hinge Model       | Hinge Material | Hinge Colors   | Cylindrical Lock Model | Cylindrical Lock Material | Cylindrical Lock Colors | Core Model        | Core Material    | Core Colors   | Door Stop Model  | Door Stop Material | Door Stop Colors   | Armor Plate Model  | Armor Plate Material | Armor Plate Colors | Surface Closer Model | Surface Closer Material | Surface Closer Colors | Door Stop Position Switch Model  | Door Stop Position Switch Material | Surface Closer Model  | Surface Closer Material | Surface Closer Colors |
|------|------------------------------------|-------------------|----------------|----------------|------------------------|--------------------------|--------------------------|----------------------|------------------|----------------|------------------|-------------------|----------------------|-------------------|----------------------|---------------------|----------------------|----------------------|---------------------|------------------|
| 12.0 | Bldg Services; Storage            | TA2714 (nrp @ out-swing w/ lock) | US10BE          | MK             | B PB 4605LN             | 613E                     | YA                       | SFIC (keyed as directed) | 13                | BE              | 8501 Series       | 613E               | NO                 |                  | DPS by Security (at Door 116) |                     |                      |                    |                      |                     |
| 13.0 | Kitchen                           | T4A3786 (nrp @ out-swing w/ lock) | US10BE          | MK             | B PB 4608LN             | 613E                     | YA                       | SFIC (keyed as directed) | 13                | BE              | 9-X26            | 613                | RF                 |                  |                  |                      |                     |                      |                    |                  |
| 14.0 | Office                            | TA2714 (nrp @ out-swing w/ lock) | US10BE          | MK             | B PB 4607LN             | 613E                     | YA                       | SFIC (keyed as directed) | 13                | BE              | 404 wall; 441CU floor | 610BE             | RO                 |                  |                  |                      |                     |                      |                    |                  |
| 15.0 | Closet                            | TA2714 (nrp @ out-swing w/ lock) | US10BE          | MK             | B PB 4608LN             | 613E                     | YA                       | SFIC (keyed as directed) | 13                | BE              | 404 wall; 441CU floor | 610BE             | RO                 |                  |                  |                      |                     |                      |                    |                  |
| 16.0 | Coat Closet                       | TA2714 (nrp @ out-swing w/ lock) | US10BE          | MK             | PB 4601LN               | 613E                     | YA                       | SFIC (keyed as directed) | 13                | BE              | 8501 Series       | 613E               | NO                 |                  |                  | K1050 10" B4E CSK | US10BE             | RO                 |
| 17.0 | Toilet                            | TA2714 (nrp @ out-swing w/ lock) | US10BE          | MK             | 404 wall; 441CU floor   | 610BE                    | RO                       |                     |                  |                |                  |                  |                      |                  |                      |                     |                    |                      |                    |                  |
August 2020 Reconstruction of the Hominy Hill Golf Center
Issue for Bid Colts Neck, New Jersey

3 Hinge TA2714 (nrp @ out-swing w/ lock) US10BE MK
1 Cylindrical Lock (privacy) PB 4602LN 613E YA
1 Surface Closer 8501 Series 613E NO
1 Kick Plate K1050 10" B4E CSK US10BE RO
1 Door Stop 404 wall; 441CU floor US10BE RO
3 Silencer 608; 609 RO

Set: 18.0
Description: Locker Room

3 Hinge T4A3386 (nrp @ out-swing w/ lock) US10BE MK
1 Push Plate 73C US10BE RO
1 Pull Plate RM5510 x 73B US10BE RO
1 Surface Closer 8501 Series 613E NO
1 Kick Plate K1050 10" B4E CSK US10BE RO
1 Door Stop 404 wall; 441CU floor US10BE RO
3 Silencer 608; 609 RO

Set: 19.0
Description: Restroom

3 Hinge T4A3386 (nrp @ out-swing w/ lock) US10BE MK
1 Push Plate 73C US10BE RO
1 Pull Plate RM5510 x 73B US10BE RO
1 Surf Overhead Stop 9-X36 613 RF
1 Surface Closer 8501 Series 613E NO
1 Kick Plate K1050 10" B4E CSK US10BE RO
3 Silencer 608; 609 RO

Set: 20.0
Description: Roll-up Door

1 Hardware Supplied w/ door assembly OT

END OF SECTION 087100
SECTION 088000 - GLAZING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes:
   1. Glass for windows and doors.
   2. Glazing sealants and accessories.

B. Related Requirements:
   1. Division 08 Section "Mirrors."

1.3 DEFINITIONS

A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.


D. Interspace: Space between lites of an insulating-glass unit.

1.4 COORDINATION

A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Glass Samples: For each type of glass product other than clear monolithic vision glass; 12 inches square.
   1. Frosted glass.
   2. Coated glass.
   3. Insulating glass.
1.6 INFORMATIONAL SUBMITTALS
   A. Preconstruction adhesion and compatibility test report.

1.7 DELIVERY, STORAGE, AND HANDLING
   A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.
   B. Comply with insulating-glass manufacturer's written instructions for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.8 FIELD CONDITIONS
   A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1.9 WARRANTY
   A. Manufacturer's Special Warranty for Insulating Glass: Manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.
      1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS
   A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
   B. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined according to the IBC and ASTM E 1300.
      1. Design Wind Pressures: Determine design wind pressures applicable to Project according to ASCE/SEI 7, based on heights above grade indicated on Drawings.
         a. Basic Wind Speed: 85 mph.
         b. Importance Factor: 1.0.
         c. Exposure Category: B.
      2. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1 inch, whichever is less.
C. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.

D. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:

1. For monolithic-glass lites, properties are based on units with lites 6 mm thick.
2. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
3. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F.
4. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
5. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

2.2 GLASS PRODUCTS, GENERAL

A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.


B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of, the SGCC or another certification agency acceptable to authorities having jurisdiction, or manufacturer. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.

1. Minimum Glass Thickness for Exterior Lites: 6 mm.

D. Strength: Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass. Where fully tempered float glass is indicated, provide fully tempered float glass.

2.3 GLASS PRODUCTS

A. Clear Annealed Float Glass: ASTM C 1036, Type I, Class 1 (clear), Quality-Q3.

B. Tinted Annealed Float Glass: ASTM C 1036, Type I, Class 2 (tinted), Quality-Q3.

C. Fully Tempered Float Glass: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
2.4 INSULATING GLASS

A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190.

1. Sealing System: Dual seal, with manufacturer's standard primary and secondary sealants.
2. Spacer: Manufacturer's standard spacer material and construction.
3. Desiccant: Molecular sieve or silica gel, or a blend of both.

2.5 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, with requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

2.6 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
   a. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.

C. Grind smooth and polish exposed glass edges and corners.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
2. Presence and functioning of weep systems.
3. Minimum required face and edge clearances.
4. Effective sealing between joints of glass-framing members.

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

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.
B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed Work.

3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.

C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

D. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

E. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

F. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

G. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.4 GASKET GLAZING (DRY)

A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

E. Install gaskets so they protrude past face of glazing stops.
3.5 CLEANING AND PROTECTION

A. Immediately after installation remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.

   1. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.

C. Remove and replace glass that is damaged during construction period.

D. Wash glass on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

3.6 MONOLITHIC GLASS SCHEDULE

A. Glass Type: Clear fully tempered float glass.

   1. Minimum Thickness: 6 mm.
   2. Safety glazing required.

END OF SECTION 088000
SECTION 088300 - MIRRORS

PART 1 - GENERAL

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

1.2 SUMMARY
   A. Section includes the following types of silvered flat glass mirrors:
      1. Annealed monolithic glass mirrors.
   B. Related Sections:
      1. Division 10 Section "Toilet, Bath, and Laundry Accessories" for metal-framed mirrors.

1.3 ACTION SUBMITTALS
   A. Product Data: For each type of product indicated.
      1. Mirrors. Include description of materials and process used to produce each type of silvered flat glass mirror specified that indicates sources of glass, glass coating components, edge sealer, and quality-control provisions.
   B. Samples: For each type of the following products:
      1. Mirrors: 12 inches square, including edge treatment on two adjoining edges.

1.4 INFORMATIONAL SUBMITTALS
   A. Qualification Data: For qualified Installer.
   B. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS
   A. Maintenance Data: For mirrors to include in maintenance manuals.

1.6 QUALITY ASSURANCE
   A. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.
B. Source Limitations for Mirrors: Obtain mirrors from single source from single manufacturer.

C. Source Limitations for Mirror Accessories: Obtain mirror glazing accessories from single source.

D. Glazing Publications: Comply with the following published recommendations:
   1. GANA's "Glazing Manual" unless more stringent requirements are indicated. Refer to this publication for definitions of glass and glazing terms not otherwise defined in this Section or in referenced standards.
   2. GANA Mirror Division's "Mirrors, Handle with Extreme Care: Tips for the Professional on the Care and Handling of Mirrors."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect mirrors according to mirror manufacturer's written instructions and as needed to prevent damage to mirrors from moisture, condensation, temperature changes, direct exposure to sun, or other causes.

B. Comply with mirror manufacturer's written instructions for shipping, storing, and handling mirrors as needed to prevent deterioration of silvering, damage to edges, and abrasion of glass surfaces and applied coatings. Store indoors.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not install mirrors until ambient temperature and humidity conditions are maintained at levels indicated for final occupancy.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which mirror manufacturer agrees to replace mirrors that deteriorate within specified warranty period. Deterioration of mirrors is defined as defects developed from normal use that are not attributed to mirror breakage or to maintaining and cleaning mirrors contrary to manufacturer's written instructions. Defects include discoloration, black spots, and clouding of the silver film.
   1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SILVERED FLAT GLASS MIRRORS

A. Glass Mirrors, General: ASTM C 1503; manufactured using copper-free, low-lead mirror coating process.

B. Clear Glass: Mirror Select Quality; ultraclear (low-iron) float glass with a minimum 91 percent visible light transmission.
   1. Nominal Thickness: 3.0 mm.

2.2 MISCELLANEOUS MATERIALS
A. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

B. Edge Sealer: Coating compatible with glass coating and approved by mirror manufacturer for use in protecting against silver deterioration at mirrored glass edges.

### 2.3 MIRROR HARDWARE

A. Top Channel/Cleat and Bottom Aluminum J-Channels: Aluminum extrusions with a return deep enough to produce a glazing channel to accommodate mirrors of thickness indicated and in lengths required to cover bottom and top edges of each mirror in a single piece.

1. Bottom Trim: J-channels formed with front leg and back leg not less than 5/16 and 3/4 inch in height, respectively.
   a. Product: Subject to compliance with requirements, provide D638 FHA Type "J" Channel by Laurence, C. R. Co., Inc.

2. Top Trim: Formed with front leg with a height of 5/16 inch and back leg designed to fit into the pocket created by wall-mounted aluminum cleat.
   a. Product: Subject to compliance with requirements, provide D 1638 Top Channel and D 1637M Mirror Mount System Cleat by Laurence, C. R. Co., Inc.


B. Fasteners: Fabricated of same basic metal and alloy as fastened metal and matching it in finished color and texture where fasteners are exposed.

C. Anchors and Inserts: Provide devices as required for mirror hardware installation. Provide toothed or lead-shield expansion-bolt devices for drilled-in-place anchors. Provide galvanized anchors and inserts for applications on inside face of exterior walls and where indicated.

### 2.4 FABRICATION

A. Mirror Edge Treatment: Flat polished.

1. Seal edges of mirrors with edge sealer after edge treatment to prevent chemical or atmospheric penetration of glass coating.
2. Require mirror manufacturer to perform edge treatment and sealing in factory immediately after cutting to final sizes.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

A. Examine substrates, over which mirrors are to be mounted, with Installer present, for compliance with installation tolerances, substrate preparation, and other conditions affecting performance of the Work.

B. Verify compatibility with and suitability of substrates, including compatibility of mirror mastic with existing finishes or primers.
C. Proceed with installation only after unsatisfactory conditions have been corrected and surfaces are dry.

3.2 INSTALLATION

A. General: Install mirrors to comply with mirror manufacturer's written instructions and with referenced GANA publications. Mount mirrors accurately in place in a manner that avoids distorting reflected images.

B. Provide a minimum air space of 1/8 inch between back of mirrors and mounting surface for air circulation between back of mirrors and face of mounting surface.

C. Wall-Mounted Mirrors: Install mirrors with mastic and mirror hardware. Attach mirror hardware securely to mounting surfaces with mechanical fasteners installed with anchors or inserts as applicable. Install fasteners so heads do not impose point loads on backs of mirrors.

1. Top Channel/Cleat and Bottom Aluminum J-Channels: Fasten J-channel directly to wall and attach top trim to continuous cleat fastened directly to wall.

3.3 CLEANING AND PROTECTION

A. Protect mirrors from breakage and contaminating substances resulting from construction operations.

B. Do not permit edges of mirrors to be exposed to standing water.

C. Maintain environmental conditions that will prevent mirrors from being exposed to moisture from condensation or other sources for continuous periods of time.

D. Wash exposed surface of mirrors not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash mirrors as recommended in writing by mirror manufacturer.

END OF SECTION 088300
SECTION 092500 - GYPSUM BOARD

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Interior gypsum board.

B. Related Sections:

1. Division 06 Section "Rough Carpentry" for wood framing and furring that supports gypsum board.
2. Division 07 Section "Thermal Insulation" for insulation and vapor retarders installed in assemblies that incorporate gypsum board.
3. Division 09 Section "Non-Structural Metal Framing" for non-structural framing and suspension systems that support gypsum board.
4. Division 09 Section "Gypsum Board Shaft Wall Assemblies" for metal shaft-wall framing, gypsum shaft liners, and other components of shaft-wall assemblies
5. Division 09 painting Sections for primers applied to gypsum board surfaces.

1.3 SUBMITTALS

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

B. Samples: For the following products:

1. Trim Accessories: Full-size Sample in 12-inch-long length for each trim accessory indicated.

1.4 QUALITY ASSURANCE

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

1.5 STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against damage from weather, condensation, direct sunlight, construction traffic, and other causes. Stack panels flat to prevent sagging.
1.6 PROJECT CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

B. Do not install interior products until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.
   1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
   2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PANELS, GENERAL

A. Size: Provide in maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.2 INTERIOR GYPSUM BOARD

A. General: Complying with ASTM C 36 or ASTM C 1396, as applicable to type of gypsum board indicated and whichever is more stringent.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. American Gypsum Co.
   b. BPB America Inc.
   c. G-P Gypsum.
   d. Lafarge North America Inc.
   e. National Gypsum Company.
   f. USG Corporation.

B. Regular Type:

1. Thickness: 3/8 inch or 1/2 inch, unless otherwise indicated.
2. Long Edges: Tapered.

C. Type X:

1. Thickness: 5/8 inch, unless otherwise indicated.
2. Long Edges: Tapered.

D. Type C:

1. Thickness: As required by fire-resistance-rated assembly indicated on Drawings.
2. Long Edges: Tapered.
E. Flexible Type: Manufactured to bend to fit radii and to be more flexible than standard regular-type gypsum board of same thickness.
   1. Thickness: 1/4 inch, unless otherwise indicated.
   2. Long Edges: Tapered.

F. Ceiling Type: Manufactured to have more sag resistance than regular-type gypsum board.
   1. Thickness: 1/2 inch, unless otherwise indicated.
   2. Long Edges: Tapered.

G. Abuse-Resistant Type: Manufactured to produce greater resistance to surface indentation, through-penetration (impact resistance), and abrasion than standard, regular-type and Type X gypsum board.
   1. Core: As indicated on Drawings.
   2. Long Edges: Tapered.

H. Moisture- and Mold-Resistant Type: With moisture- and mold-resistant core and surfaces.
   1. Core: 5/8 inch, unless otherwise indicated, Type X.
   2. Long Edges: Tapered.

2.3 EXTERIOR GYPSUM BOARD FOR CEILINGS AND SOFFITS

A. Exterior Gypsum Soffit Board: ASTM C 1396/C 1396M, with manufacturer's standard edges.
   2. Core: 1/2 inch, Type X.

2.4 TILE BACKING PANELS

A. Water-Resistant Gypsum Backing Board: ASTM C 630 or ASTM C 1396.
   1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. American Gypsum Co.
      b. BPB America Inc.
      c. G-P Gypsum.
      d. Lafarge North America Inc.
      e. National Gypsum Company.
      f. USG Corporation.
   2. Core: As indicated on Drawings.

B. Glass-Mat, Water-Resistant Backing Board:
   1. Complying with ASTM C 1178.
      a. Product: Subject to compliance with requirements, provide "DensShield Tile Guard" by G-P Gypsum, “GlasRoc” by CertainTeed or “e2XP” by National Gypsum, or equal.
   2. Core: As indicated on Drawings.
C. Cementitious Backer Units: Refer to Division 09 section "Tile".

2.5 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.

1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized steel sheet.
2. Shapes:
   a. Cornerbead.
   b. Bullnose bead.
   c. LC-Bead: J-shaped; exposed long flange receives joint compound.
   d. L-Bead: L-shaped; exposed long flange receives joint compound.
   e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
   f. Expansion (control) joint.
   g. Curved-Edge Cornerbead: With notched or flexible flanges.


1. Material: Hot-dip galvanized steel sheet, plastic, or rolled zinc.
2. Shapes:
   a. Cornerbead.
   b. LC-Bead: J-shaped; exposed long flange receives joint compound.
   c. Expansion (Control) Joint: One-piece, rolled zinc with V-shaped slot and removable strip covering slot opening.

C. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Fry Reglet Corp.
   b. Gordon, Inc.
   c. Pittcon Industries.

2. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221, Alloy 6063-T5.
3. Finish: Corrosion-resistant primer compatible with joint compound and finish materials specified.

2.6 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Joint Tape:

1. Interior Gypsum Wallboard: Paper.
4. Tile Backing Panels: As recommended by panel manufacturer.
C. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
   a. Use setting-type compound for installing paper-faced metal trim accessories.
3. Fill Coat: For second coat, use setting-type, sandable topping compound.
4. Finish Coat: For third coat, use setting-type, sandable topping compound.
5. Skim Coat: For final coat of Level 5 finish, use setting-type, sandable topping compound or high-build interior coating product designed for application by airless sprayer and to be used instead of skim coat to produce Level 5 finish.

D. Joint Compound for Exterior Applications:

1. Exterior Gypsum Soffit Board: Use setting-type taping compound and setting-type, sandable topping compound.
2. Glass-Mat Gypsum Sheathing Board: As recommended by sheathing board manufacturer.

E. Joint Compound for Tile Backing Panels:

1. Water-Resistant Gypsum Backing Board: Use setting-type taping compound and setting-type, sandable topping compound.
2. Glass-Mat, Water-Resistant Backing Panel: As recommended by backing panel manufacturer.
3. Cementitious Backer Units: As recommended by backer unit manufacturer.

2.7 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.

C. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.

1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

D. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.

E. Acoustical Sealant: As specified in Division 07 Section "Joint Sealants."

1. Provide sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
F. Thermal Insulation: As specified in Division 07 Section "Thermal Insulation."

G. Vapor Retarder: As specified in Division 07 Section "Thermal Insulation."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames and framing, for compliance with requirements and other conditions affecting performance.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

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

3.2 APPLYING AND FINISHING PANELS, GENERAL

A. Comply with ASTM C 840.

B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.

D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

E. Form control and expansion joints with space between edges of adjoining gypsum panels.

F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
   1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
   2. Fit gypsum panels around ducts, pipes, and conduits.
   3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch-wide joints to install sealant.

G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch-wide spaces at these locations, and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
I. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.

J. Install sound attenuation blankets before installing gypsum panels, unless blankets are readily installed after panels have been installed on one side.

3.3 APPLYING INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:
   1. Regular Type: As indicated on Drawings.
   2. Type X: As indicated on Drawings.
   3. Type C: As indicated on Drawings.
   4. Flexible Type: Apply in double layer at curved assemblies.
   5. Abuse-Resistant Type: As indicated on Drawings.
   6. High-Impact Type: As indicated on Drawings.
   7. Moisture- and Mold-Resistant Type: As indicated on Drawings.

B. Single-Layer Application:
   1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing, unless otherwise indicated.
   2. On partitions/walls, apply gypsum panels vertically (parallel to framing), unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
      a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
      b. At stairwells and other high walls, install panels horizontally, unless otherwise indicated or required by fire-resistance-rated assembly.
   3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
   4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

C. Multilayer Application:
   1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints 1 framing member, 16 inches minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
   2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
   3. On Z-furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
   4. Fastening Methods: Fasten base layers and face layers separately to supports with screws.

D. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board
manufacturer's written recommendations and temporarily brace or fasten gypsum panels until fastening adhesive has set.

E. Curved Surfaces:

1. Install panels horizontally (perpendicular to supports) and unbroken, to extent possible, across curved surface plus 12-inch-long straight sections at ends of curves and tangent to them.
2. For double-layer construction, fasten base layer to studs with screws 16 inches o.c. Center gypsum board face layer over joints in base layer, and fasten to studs with screws spaced 12 inches o.c.

3.4 APPLYING TILE BACKING PANELS

A. Water-Resistant Gypsum Backing Board: Install at showers, tubs, and where indicated. Install with 1/4-inch gap where panels abut other construction or penetrations.

B. Areas Not Subject to Wetting: Install regular-type gypsum wallboard panels to produce a flat surface except at showers, tubs, and other locations indicated to receive water-resistant panels.

C. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.5 INSTALLING TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints at locations indicated on Drawings and according to ASTM C 840 and in specific locations approved by Architect for visual effect.

C. Interior Trim: Install in the following locations:

1. Cornerbead: Use at outside corners, unless otherwise indicated.
2. Bullnose Bead: Use where indicated.
3. LC-Bead: Use at exposed panel edges.
4. L-Bead: Use where indicated.
5. Curved-Edge Cornerbead: Use at curved openings.

D. Aluminum Trim: Install in locations indicated on Drawings.

3.6 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints, rounded or beveled edges, and damaged surface areas.

C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:
1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
2. Level 2: Panels that are substrate for tile.
3. Level 4: At panel surfaces that will be exposed to view, unless otherwise indicated.
   a. Primer and its application to surfaces are specified in other Division 09 Sections.

3.7 PROTECTION

A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

B. Remove and replace panels that are wet, moisture damaged, and mold damaged.
   1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
   2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092500
SECTION 092650 - GYPSUM BOARD SHAFT WALL ASSEMBLIES

PART 1 - GENERAL

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

1.2 SUMMARY
A. Section Includes:
1. Shaft-wall enclosures.
2. Chase enclosures.
3. Horizontal enclosures.
B. Related Sections:
1. Division 07 Section "Fire-Resistive Joint Systems" for head-of-wall assemblies that incorporate gypsum board shaft-wall assemblies.

1.3 SUBMITTALS
A. Product Data: For each gypsum board shaft-wall assembly indicated.

1.4 QUALITY ASSURANCE
A. Fire-Resistance Ratings: Provide materials and construction identical to those of assemblies with fire-resistance ratings determined according to ASTM E 119 by a testing and inspecting agency.
B. STC-Rated Assemblies: Provide materials and construction identical to those of assemblies tested according to ASTM E 90 and classified according to ASTM E 413 by a testing and inspecting agency.

1.5 DELIVERY, STORAGE, AND HANDLING
A. Deliver materials in original packages, containers, and bundles bearing brand name and identification of manufacturer or supplier.
B. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes.
C. Stack panels flat on leveled supports off floor or slab to prevent sagging.
1.6 PROJECT CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or with gypsum board manufacturer's written recommendations, whichever are more stringent.

B. Do not install interior products until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, moisture damaged, or mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, and irregular shape.

2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 GYPSUM BOARD SHAFT-WALL ASSEMBLIES, GENERAL

A. Provide materials and components complying with requirements of fire-resistance-rated assemblies indicated.

1. Provide panels in maximum lengths available to eliminate or minimize end-to-end butt joints. 

2. Provide auxiliary materials complying with gypsum board shaft-wall assembly manufacturer's written recommendations.

2.2 PANEL PRODUCTS

A. Gypsum Liner Panels: Comply with ASTM C 442/C 442M.

1. Type X: Manufacturer's proprietary liner panels with moisture-resistant paper faces.
   a. Core: 1 inch thick.
   b. Long Edges: Double bevel.

2. Moisture- and Mold-Resistant Type X: Manufacturer's proprietary liner panels with moisture- and mold-resistant core and surfaces; comply with ASTM D 3273.

   a. Core: 1 inch thick.
   b. Long Edges: Double bevel.

B. Gypsum Board: As specified in Division 09 Section "Gypsum Board."

2.3 NON-LOAD-BEARING STEEL FRAMING

A. Framing Members: Comply with ASTM C 754 for conditions indicated.

B. Steel Sheet Components: Comply with ASTM C 645 requirements for metal, unless otherwise indicated.

2.4 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced product standards and manufacturer's written recommendations.

B. Trim Accessories: Cornerbead, edge trim, and control joints of material and shapes specified in Division 09 Section "Gypsum Board" that comply with gypsum board shaft-wall assembly manufacturer's written recommendations for application indicated.

C. Gypsum Base Joint-Reinforcing Materials: As specified in Division 09 Section "Gypsum Veneer Plastering."

D. Gypsum Board Joint-Treatment Materials: As specified in Division 09 Section "Gypsum Board."

E. Laminating Adhesive: Adhesive or joint compound recommended by manufacturer for directly adhering gypsum face-layer panels and gypsum-base face-layer panels to backing-layer panels in multilayer construction.

F. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.

1. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

G. Track Fasteners: Power-driven fasteners of size and material required to withstand loading conditions imposed on shaft-wall assemblies without exceeding allowable design stress of track, fasteners, or structural substrates in which anchors are embedded.

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

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

H. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing), produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.

I. Acoustical Sealant: As specified in Division 07 Section "Joint Sealants."

2.5 GYPSUM BOARD SHAFT-WALL ASSEMBLIES

A. Fire-Resistance Rating: As indicated.

B. STC Rating: As indicated.

C. Studs: Manufacturer's standard profile for repetitive members, corner and end members, and fire-resistance-rated assembly indicated.

1. Depth: As indicated.
D. Runner Tracks: Manufacturer's standard J-profile track with long-leg length as standard with manufacturer, but at least 2 inches long and in depth matching studs.

E. Firestop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.

F. Jamb Struts: Manufacturer's standard J-profile strut with long-leg length of 3 inches, in depth matching studs, and not less than 0.0329 inch thick.

G. Room-Side Finish: As indicated.

H. Shaft-Side Finish: As indicated by fire-resistance-rated assembly design designation.

I. Insulation: Sound attenuation blankets.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates to which gypsum board shaft wall assemblies attach or abut, with Installer present, and including hollow-metal frames, cast-in anchors, and structural framing. Examine for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, or mold damaged.

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

3.2 INSTALLATION

A. General: Install gypsum board shaft wall assemblies to comply with requirements of fire-resistance-rated assemblies indicated, manufacturers written installation instructions, and ASTM C 754 other than stud-spacing requirements.

B. Do not bridge building expansion joints with shaft wall assemblies; frame both sides of expansion joints with furring and other support.

C. Install supplementary framing in gypsum board shaft wall assemblies around openings and as required for blocking, bracing, and support of gravity and pullout loads of fixtures, equipment, services, heavy trim, furnishings, wall-mounted door stops, and similar items that cannot be supported directly by shaft wall assembly framing.

1. Reinforcing: Where handrails directly attach to gypsum board shaft wall assemblies, provide galvanized steel reinforcing strip with 0.033-inch minimum thickness of base metal (uncoated), accurately positioned and secured behind at least one layer of face panel.

D. Penetrations: At penetrations in shaft wall, maintain fire-resistance rating of shaft wall assembly by installing supplementary steel framing around perimeter of penetration and fire protection behind boxes containing wiring devices, elevator call buttons, elevator floor indicators, and similar items.

E. Isolate perimeter of gypsum panels from building structure to prevent cracking of panels, while maintaining continuity of fire-rated construction.
F. Firestop Tracks: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.

G. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect while maintaining fire-resistance rating of gypsum board shaft wall assemblies.

H. Cant Panels: At projections into shaft exceeding 4 inches or where indicated, install 1/2- or 5/8-inch-thick gypsum board cants covering tops of projections.
   1. Slope cant panels at least 75 degrees from horizontal. Set base edge of panels in adhesive and secure top edges to shaft walls at 24 inches o.c. with screws fastened to shaft wall framing.
   2. Where steel framing is required to support gypsum board cants, install framing at 24 inches o.c. and extend studs from the projection to shaft wall framing.

I. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

3.3 PROTECTION

A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

B. Remove and replace panels that are wet, moisture damaged, or mold damaged.
   1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, and irregular shape.
   2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092650
SECTION 093000 - TILING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Ceramic tile.
2. Porcelain tile.
3. Quarry tile.
5. Waterproof membrane.
6. Crack isolation membrane.
7. Tile backing panels.
8. Metal edge strips.

B. Related Sections:

1. Division 07 Section "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.
2. Division 09 Sections for “Gypsum Board” for cementitious backer units and “Glass Tiling” for glass mosaic tile.

1.3 DEFINITIONS

A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.

B. Module Size: Actual tile size plus joint width indicated.

C. Face Size: Actual tile size, excluding spacer lugs.

1.4 PERFORMANCE REQUIREMENTS

A. Static Coefficient of Friction: For tile installed on walkway surfaces, provide products with the following values as determined by testing identical products per ASTM C 1028:

1. Level Surfaces: Minimum 0.60.
2. Step Treads: Minimum 0.60.
3. Ramp Surfaces: Minimum 0.80.
1.5 SUBMITTALS

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

B. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.

C. Samples for Verification:
   1. Full-size units of each type and composition of tile and for each color and finish required.
   2. Assembled samples mounted on a rigid panel, with grouted joints, for each type and composition of tile and for each color and finish required. Make samples at least 12 inches square, but not fewer than 4 tiles. Use grout of type and in color or colors approved for completed Work.
   3. Full-size units of each type of trim and accessory.
   4. Stone thresholds in 6-inch lengths.
   5. Metal edge strips in 6-inch lengths.

D. Qualification Data: For qualified Installer.

E. Product Certificates: For each type of product, signed by product manufacturer.

F. Material Test Reports: For each tile-setting and -grouting product.

1.6 QUALITY ASSURANCE

A. Source Limitations for Tile: Obtain tile of each type and color or finish from one source or producer.
   1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.

B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from one manufacturer and each aggregate from one source or producer.

C. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer for each product:
   1. Stone thresholds.
   2. Waterproof membrane.
   3. Crack isolation membrane.
   4. Joint sealants.
   5. Cementitious backer units.
   6. Metal edge strips.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.

B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.

C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.
D. Store liquid materials in unopened containers and protected from freezing.

E. Handle tile that has temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

1.9 EXTRA MATERIALS

A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.

2. Grout: Furnish quantity of grout equal to 3 percent of amount installed for each type, composition, and color indicated.

PART 2 - PRODUCTS

2.1 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.

1. Provide tile complying with Standard grade requirements unless otherwise indicated.

B. ANSI Glass Tile Standard: Provide glass tile that complies with ANSI A137.2 for types and other characteristics indicated.

C. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCA installation methods specified in tile installation schedules, and other requirements specified.

D. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show the same range in colors as those taken from other packages and match approved Samples.

E. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.

F. Factory-Applied Temporary Protective Coating: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by pre-coating with continuous film of petroleum paraffin wax, applied hot. Do not coat unexposed tile surfaces.
2.2 TILE PRODUCTS

A. Tile Type (WT1, WT2, WT3, WT5, WT6): Glazed ceramic wall tile.
   1. Basis of Design Manufacturers and Products: Subject to compliance with requirements, provide product indicated on Finish Schedule on Drawings or approved comparable product.
   2. Module Size: As shown.
   3. Thickness: 1/4 inch, unless otherwise indicated.
   4. Face: Plain with modified square edges or cushion edges.
   5. Tile Color and Pattern: As selected by Architect from manufacturer's full range.
   6. Grout Color: As selected by Architect from manufacturer's full range.
   8. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile.

B. Tile Type (WT7): Glazed porcelain ceramic wall slab tile.
   1. Basis of Design Manufacturers and Products: Subject to compliance with requirements, provide product indicated on Finish Schedule on Drawings or approved comparable product.
   2. Face Size: Refer to Finish Schedule.
   3. Thickness: 6mm, unless otherwise indicated.
   4. Face: Plain with square or cushion edges.
   5. Finish: Refer to Finish Schedule.
   6. Tile Color and Pattern: As indicated by manufacturer's designations.
   7. Grout Color: Match Architect's sample or as selected by Architect from manufacturer's full range.

C. Tile Type (FT1, FT2, TB1): Unglazed porcelain ceramic floor tile.
   1. Basis of Design Manufacturers and Products: Subject to compliance with requirements, provide product indicated on Finish Schedule on Drawings or approved comparable product.
   2. Face Size: Refer to Finish Schedule.
   3. Thickness: 3/8 inch, unless otherwise indicated.
   4. Face: Plain with square or cushion edges.
   5. Finish: Refer to Finish Schedule.
   6. Tile Color and Pattern: As indicated by manufacturer's designations.
   7. Grout Color: Match Architect's sample or as selected by Architect from manufacturer's full range.

D. Tile Type (FT3): Unglazed square-edged quarry tile.
   1. Basis of Design Manufacturers and Products: Subject to compliance with requirements, provide product indicated on Finish Schedule on Drawings or approved comparable product.
   2. Face Size: Refer to Finish Schedule.
   3. Thickness: 1/2 inch, unless otherwise indicated.
   4. Face: Plain with cushion edges.
   5. Finish: Refer to Finish Schedule.
   6. Tile Color and Pattern: As indicated by manufacturer's designations.
   7. Grout Color: Match Architect's sample or as selected by Architect from manufacturer's full range.

2.3 THRESHOLDS

A. General: Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes.
1. Bevel edges at 1:2 slope, with lower edge of bevel aligned with or up to 1/16 inch above adjacent floor surface. Finish bevel to match top surface of threshold. Limit height of threshold to 1/2 inch or less above adjacent floor surface.

B. Marble Thresholds: ASTM C 503, with a minimum abrasion resistance of 10 per ASTM C 1353 or ASTM C 241 and with honed finish.

1. Description: Uniform, fine- to medium-grained white stone with gray veining.
2. Description: Match Architect's sample.

2.4 TILE BACKING PANELS

A. Cementitious Backer Units: ANSI A118.9 or ASTM C 1325, in maximum lengths available to minimize end-to-end butt joints; 1/2 inch thick, unless otherwise indicated.

B. Manufacturers / Products: Refer to Division 9 Section “Gypsum Board” for manufacturers and product requirements.

2.5 WATERPROOF MEMBRANE

A. General: Manufacturer's standard product that complies with ANSI A118.10 and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.

B. Basis of Design Manufacturer: Subject to compliance with requirements, provide products specified herein manufactured by MAPEI Corporation or approved comparable product.

C. Fabric-Reinforced, Fluid-Applied Membrane: System consisting of liquid-latex rubber or elastomeric polymer and continuous fabric reinforcement.

1. Basis of Design Product: Mapelastic L - PRP M19 (MAPEI Corp)

D. Latex-Portland Cement: Flexible mortar consisting of cement-based mix and latex additive.

1. Basis of Design Product: Mapelastic - PRP 315 (MAPEI Corp)

2.6 CRACK ISOLATION MEMBRANE

A. General: Manufacturer's standard product that complies with ANSI A118.12 for standard performance and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.

B. Polyethylene Sheet: Polyethylene faced on both sides with fleece webbing; 0.008-inch nominal thickness.

2.7 SETTING MATERIALS


1. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.4.
B. Basis of Design Manufacturer: Subject to compliance with requirements, provide products specified herein manufactured by MAPEI Corporation or approved comparable product.

2.8 GROUT MATERIALS

A. Sand-Portland Cement Grout: ANSI A108.10, composed of white or gray cement and white or colored aggregate as required to produce color indicated.


C. Polymer-Modified Tile Grout: ANSI A118.7.

A. Basis of Design Manufacturer: Subject to compliance with requirements, provide products specified herein manufactured by MAPEI Corporation or approved comparable product.

2.9 ELASTOMERIC SEALANTS

A. General: Provide sealants, primers, backer rods, and other sealant accessories that comply with the following requirements and with the applicable requirements in Division 07 Section "Joint Sealants."

2.10 MISCELLANEOUS MATERIALS

A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

B. Temporary Protective Coating: Product indicated below that is formulated to protect exposed surfaces of tile against adherence of mortar and grout; compatible with tile, mortar, and grout products; and easily removable after grouting is completed without damaging grout or tile.

1. Grout release in form of manufacturer's standard proprietary liquid coating that is specially formulated and recommended for use as temporary protective coating for tile.

C. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

D. Grout Sealer: Manufacturer's standard product for sealing grout joints and that does not change color or appearance of grout.

2.11 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.

B. Add materials, water, and additives in accurate proportions.

C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.
PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.

1. Verify that substrates for setting tile are firm, dry, clean, free of coatings that are incompatible with tile-setting materials including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.

2. Verify that concrete substrates for tile floors installed with bonded mortar bed or thin-set mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.
   a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
   b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.

3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.

4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.

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

3.2 PREPARATION

A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thin-set mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.

B. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot toward drains.

C. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.3 TILE INSTALLATION

A. Comply with TCA's "Handbook for Ceramic Tile Installation" for TCA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 Series "Specifications for Installation of Ceramic Tile" that are referenced in TCA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.

B. Extend tile work under base cabinetry, into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned
joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or
covers overlap tile.

D. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile
fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of
pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.

1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets
so joints between sheets are not apparent in finished work.
2. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align
joints.
3. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor,
base, walls, or trim, align joints unless otherwise indicated.

E. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:

1. Paver Tile: 1/4 inch.
2. Glazed Wall Tile: 1/16 inch.

F. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.

G. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction,
and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds,
and tile. Do not saw-cut joints after installing tiles.

1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
2. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint
Sealants."

H. Stone Thresholds: Install stone thresholds in same type of setting bed as adjacent floor unless otherwise
indicated.

1. At locations where mortar bed (thickset) would otherwise be exposed above adjacent floor
finishes, set thresholds in latex-portland cement mortar (thin set).
2. Do not extend waterproofing or crack isolation membrane under thresholds set in latex-portland
cement mortar. Fill joints between such thresholds and adjoining tile set on waterproofing or
crack isolation membrane with elastomeric sealant.

I. Metal Edge Strips: Install at locations indicated or where exposed edge of tile flooring meets carpet,
wood, or other flooring that finishes flush with or below top of tile and no threshold is indicated.

3.4 TILE BACKING PANEL INSTALLATION

A. Install cementitious backer units and treat joints according to ANSI A108.11 and manufacturer's written
instructions for type of application indicated. Use latex-portland cement mortar for bonding material
unless otherwise directed in manufacturer's written instructions.

3.5 WATERPROOFING INSTALLATION

A. Install waterproofing to comply with ANSI A108.13 and manufacturer's written instructions to produce
waterproof membrane of uniform thickness and bonded securely to substrate.
B. Do not install tile or setting materials over waterproofing until waterproofing has cured and been tested to determine that it is watertight.

3.6 CRACK ISOLATION MEMBRANE INSTALLATION

A. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness and bonded securely to substrate.

B. Do not install tile or setting materials over crack isolation membrane until membrane has cured.

3.7 CLEANING AND PROTECTING

A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
   1. Remove latex-portland cement grout residue from tile as soon as possible.
   2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.
   3. Remove temporary protective coating by method recommended by coating manufacturer and that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent drain clogging.

B. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.

C. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.

D. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

3.8 INTERIOR TILE INSTALLATION SCHEDULE

A. Interior Floor Installations, Concrete Subfloor:
   1. Tile Installation F113: Thin-set mortar; TCA F113.
      b. Grout: As recommended by manufacturer, sand-portland cement or standard sanded cement grout.
   2. Tile Installation F122 (wet tests): Thin-set mortar on waterproof membrane; TCA F122.
      b. Grout: As recommended by manufacturer, polymer-modified sanded or unsanded grout.

B. Interior Floor Installations, Wood Subfloor:
   1. Ceramic Tile Installation: TCNA F141 and ANSI A108.1C; cement mortar bed (thickset) with cleavage membrane.
August 2020 Reconstruction of the Hominy Hill Golf Center
Issue for Bid Colts Neck, New Jersey

a. Ceramic Tile Type: FT2, unless otherwise indicated.
c. Grout: As recommended by manufacturer.

2. Ceramic Tile Installation (Toilet / Shower / Kitchen): TCNA F144; thinset mortar on waterproof membrane over cementitious backer units or fiber-cement backer board.
   a. Ceramic Tile Types: FT1, FT3, unless otherwise indicated.
   b. Thinset Mortar: Standard dry-set mortar or Improved modified.
   c. Grout: As recommended by manufacturer (FT1), Water-cleanable epoxy grout (FT3).

C. Interior Wall Installations, Masonry or Concrete:

   b. Grout: As recommended by manufacturer.

   a. Grout: As recommended by manufacturer.

D. Interior Wall and Base Installations, Wood or Metal Studs or Furring:

   a. Grout: Polymer-modified grout as recommended by manufacturer.

2. Ceramic Tile Installation W243: TCNA W243; thinset mortar on gypsum board.
   a. Thinset Mortar: Standard dry-set or Improved modified dry-set mortar.
   b. Grout: As recommended by manufacturer.

3. Tile Installation W244: Thin-set mortar on cementitious backer units or fiber cement underlayment; TCNA W244.
   b. Grout: As recommended by manufacturer.

4. Tile Installation W245: Thin-set mortar on coated glass-mat, water-resistant gypsum backer board; TCNA W245.
   b. Grout: As recommended by manufacturer.

END OF SECTION 093000
SECTION 093023 - GLASS TILING

PART 1 - GENERAL

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

1.2 SUMMARY
A. Section Includes:
   1. Glass tile.
B. Related Sections:
   1. Division 07 Section "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.
   2. Division 09 Sections for “Gypsum Board” for cementitious backer units and “Tiling” for ceramic tile.

1.3 ACTION SUBMITTALS
A. Product Data: For each type of product.
B. Samples:
   1. Each type and composition of tile and for each color and finish required. For glass mosaic tile in color blend patterns, provide samples of each color blend.
   2. Assembled samples mounted on a rigid panel, with grouted joints, for each type and composition of tile and for each color and finish required.

1.4 MAINTENANCE MATERIAL SUBMITTALS
A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Tile Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.

PART 2 - PRODUCTS

2.1 PRODUCTS, GENERAL
A. ANSI Glass Tile Standard: Provide Standard grade glass tile that complies with ANSI A137.2 for types and other characteristics indicated.
B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.

2.2 TILE PRODUCTS

A. Glass Tile Type (WT4): Factory-mounted mosaic glass tile.
   1. Basis of Design Manufacturers and Products: Subject to compliance with requirements, provide product indicated on Finish Schedule on Drawings or approved comparable product.
   2. Module Size: Refer to Finish Schedule.
   3. Tile Color and Pattern: Refer to Finish Schedule.
   4. Grout Color: As selected by Architect from manufacturer's full range.

2.3 SETTING MATERIALS

A. Improved Modified Dry-Set Mortar (Thinset): ANSI A118.15; white, unless otherwise indicated.
   1. Provide prepackaged, dry-mortar mix to which only water must be added at Project site.
   2. Provide prepackaged, dry-mortar mix combined with liquid-latex additive at Project site.
   3. For wall applications, provide nonsagging mortar.

B. Organic Adhesive: ANSI A136.1, Type I.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
   1. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.

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

3.2 PREPARATION

A. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot toward drains.

B. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.
3.3 GLASS TILE INSTALLATION

A. Comply with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.

B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

D. Where accent tile differs in thickness from field tile, vary setting bed thickness so that tiles are flush.

E. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.

F. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:
   1. Mosaic Glass Tile: 1/16 inch.

G. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.

H. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
   1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.

I. Install waterproofing to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness that is bonded securely to substrate.

3.4 INTERIOR GLASS TILE INSTALLATION SCHEDULE

A. Interior Wall Installations, Wood or Metal Studs or Furring:
      a. Glass Tile Type: Wall Tile as Scheduled or approved.
      b. Grout: As recommended by manufacturer.
   2. Glass Tile Installation: TCNA W243; thinset mortar on gypsum board.
      a. Glass Tile Type: Wall Tile as Scheduled or approved.
      b. Thinset Mortar: Modified dry-set mortar.
      c. Grout: As recommended by manufacturer.

END OF SECTION 093023
SECTION 095113 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Acoustical panels and exposed suspension systems for ceilings.

B. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.

1. Acoustical Panel: Set of full-size samples of each type, color, pattern, and texture.

2. Exposed Suspension-System Members, Moldings, and Trim: Set of 6-inch-long Samples of each type, finish, and color.

1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each acoustical panel ceiling, for tests performed by manufacturer and witnessed by a qualified testing agency.

B. Evaluation Reports: For each acoustical panel ceiling suspension system and anchor and fastener type, from ICC-ES.

1.5 QUALITY ASSURANCE

A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: Comply with ASTM E 1264 for Class A materials.

2. Smoke-Developed Index: 50 or less.

1.6 CLOSEOUT SUBMITTALS
A. Maintenance Data: For finishes to include in maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Acoustical Ceiling Panels: Full-size panels equal to 2 percent of quantity installed.
2. Suspension-System Components: Quantity of each exposed component equal to 2 percent of quantity installed.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension-system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

PART 2 - PRODUCTS

2.1 ACOUSTICAL PANELS, GENERAL

A. Source Limitations:

1. Acoustical Ceiling Panel: Obtain each type from single source from single manufacturer.
2. Suspension System: Obtain each type from single source from single manufacturer.

B. Source Limitations: Obtain each type of acoustical ceiling panel and supporting suspension system from single source from single manufacturer.

C. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances unless otherwise indicated.

1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches away from test surface according to ASTM E 795.

D. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.
1. Where appearance characteristics of acoustical panels are indicated by referencing pattern designations in ASTM E 1264 and not manufacturers' proprietary product designations, provide products selected by Architect from each manufacturer's full range that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.

2.2 ACOUSTICAL PANELS (ACT1)

A. Basis-of-Design Manufacturer / Product: Subject to compliance with requirements, provide product indicated on Finish Schedule on Drawings or approved comparable product.

B. Classification: Provide panels complying with ASTM E 1264 for type, form, and pattern as follows:

1. Type and Form: Type IV, mineral base with membrane-faced overlay; Form 2, water felted; with vinyl overlay on face.

C. Color: White.

D. Thickness: As indicated on Finish Schedule on Drawings.

2.3 METAL SUSPENSION SYSTEMS, GENERAL

A. Metal Suspension-System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635/C 635M.

1. High-Humidity Finish: Comply with ASTM C 635/C 635M requirements for "Coating Classification for Severe Environment Performance" where high-humidity finishes are indicated.

B. Attachment Devices: Size for five times the design load indicated in ASTM C 635/C 635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

1. Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing according to ASTM E 488 or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.

   a. Type: Postinstalled expansion anchors.
   b. Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (0.005 mm) for Class SC 1 service condition.

2. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing according to ASTM E 1190, conducted by a qualified testing and inspecting agency.

C. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:

2. Stainless-Steel Wire: ASTM A 580/A 580M, Type 304, nonmagnetic.

ACOUSTICAL PANEL CEILINGS 095113 - 3
4. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635/C 635M, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106-inch-diameter wire.

D. Hold-Down Clips: Where indicated, provide manufacturer's standard hold-down clips spaced 24 inches o.c. on all cross tees.

E. Impact Clips: Where indicated, provide manufacturer's standard impact-clip system designed to absorb impact forces against acoustical panels.

2.4 METAL SUSPENSION SYSTEM (SS1)

A. Basis-of-Design Manufacturer / Product: Subject to compliance with requirements, provide product indicated on Finish Schedule on Drawings or approved comparable product.

B. Wide-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, pre-painted, electrolytic zinc-coated or hot-dip galvanized according to ASTM A 653/653M, G30 coating designation, with prefinished, cold-rolled, 15/16-inch-wide sheet metal caps on flanges.

1. Structural Classification: Heavy-duty system.
2. End Condition of Cross Runners: Override (stepped) type.
3. Face Design: Flat, flush.

2.5 METAL EDGE MOLDINGS AND TRIM

A. Manufacturers: Subject to compliance with requirements provide edge moldings from same manufacturer as suspension system.

B. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.

1. Provide manufacturer's standard edge moldings that fit acoustical panel edge details and suspension systems indicated and that match width and configuration of exposed runners unless otherwise indicated.
2. For lay-in panels with reveal edge details, provide stepped edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.
3. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.

C. Extruded-Aluminum Edge Moldings and Trim: Where indicated, provide manufacturer's extruded-aluminum edge moldings and trim of profile indicated or referenced by manufacturer's designations, including splice plates, corner pieces, and attachment and other clips, complying with seismic design requirements and the following:

1. Aluminum Alloy: Alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than the strength and durability properties of aluminum extrusions complying with ASTM B 221 for Alloy and Temper 6063-T5.
2. Baked-Enamel or Powder-Coat Finish: Minimum dry film thickness of 1.5 mils. Comply with ASTM C 635/C 635M and coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

2.6 ACOUSTICAL SEALANT

A. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

1. Acoustical Sealant for Exposed and Concealed Joints: Provide the following or approved equal:
   a. Pecora Corporation; AC-20 FTR Acoustical and Insulation Sealant.
   b. USG Corporation; SHEETROCK Acoustical Sealant.

B. Acoustical Sealant: Manufacturer's standard sealant complying with ASTM C 834 and effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.


PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

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

3.2 PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

3.3 ACOUSTICAL PANEL INSTALLATION

A. General: Install acoustical panel ceilings to comply with ASTM C 636 and seismic design requirements indicated, per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

B. Suspend ceiling hangers from building's structural members and as follows:

   1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
   2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
   3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system
members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.

4. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.

5. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.

6. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.

7. Do not attach hangers to steel deck tabs.

8. Space hangers not more than 48 inches o.c. along each member supported directly from hangers, unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.

9. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.

C. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.

1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.

2. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.

3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

D. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

E. Install acoustical panels with undamaged edges and fit accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.

1. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension system runners and moldings.

2. For reveal-edged panels on suspension system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.

3. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.

4. Install hold-down clips in areas indicated, in areas required by authorities having jurisdiction, and for fire-resistance ratings; space as recommended by panel manufacturer's written instructions, unless otherwise indicated.

3.4 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.
SECTION 096400 - WOOD FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Factory-finished wood flooring.
   2. Field finishing of existing wood flooring.

B. Related Sections:
   1. Division 03 Section "Hydraulic Cement Underlayment" for patching and leveling concrete floors substrate.

1.3 ACTION SUBMITTALS

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

B. Samples for Verification: For each type of wood flooring and accessory, with stain color and finish required, approximately 12 inches long and of same thickness and material indicated for the Work and showing the full range of normal color and texture variations expected.

1.4 QUALITY ASSURANCE

A. Hardwood Flooring: Comply with NOFMA's "Official Flooring Grading Rules" for species, grade, and cut.
   1. Certification: Provide flooring that carries NOFMA grade stamp on each bundle or piece.

B. Softwood Flooring: Comply with WCLIB No. 17 grading rules for species, grade, and cut.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver wood flooring materials in unopened cartons or bundles.

B. Protect wood flooring from exposure to moisture. Do not deliver wood flooring until after concrete, masonry, plaster, ceramic tile, and similar wet work is complete and dry.

C. Store wood flooring materials in a dry, warm, ventilated, weathertight location.

1.6 PROJECT CONDITIONS

A. Conditioning period begins not less than seven days before wood flooring installation, is continuous through installation, and continues not less than seven days after wood flooring installation.
1. Environmental Conditioning: Maintain an ambient temperature between 65 and 75 deg F and relative humidity planned for building occupants in spaces to receive wood flooring during the conditioning period.

2. Wood Flooring Conditioning: Move wood flooring into spaces where it will be installed, no later than the beginning of the conditioning period.
   a. Do not install flooring until it adjusts to relative humidity of, and is at same temperature as, space where it is to be installed.
   b. Open sealed packages to allow wood flooring to acclimatize immediately on moving flooring into spaces in which it will be installed.

B. After conditioning period, maintain relative humidity and ambient temperature planned for building occupants.

C. Install factory-finished wood flooring after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Basis of Design Manufacturer: The Basis of Design for factory finished wood flooring includes products manufactured by Armstrong Flooring; refer to Finish Schedule. Subject to compliance with requirements, provide the Basis of Design manufacturer or approved equal.

2.2 FACTORY-FINISHED WOOD FLOORING (WD1)

A. Engineered-Wood Flooring: HPVA EF.
   1. Species: Walnut.
   2. Grade: Best.
   3. Thickness: 3/8 inch.
   5. Face Width: 5 inches.
   7. Edge Style: Micro Beveled (eased).
   8. Finish: UV urethane, REFER TO Finish Schedule for color

2.3 FIELD-FINISHED WOOD FLOORING

A. Urethane Finish System: Complete water-based system of compatible components that is recommended by finish manufacturer for application indicated.
   1. Stain: Penetrating and nonfading type.
      a. Color: As selected by Architect from manufacturer's full range.
   2. Floor Sealer: Pliable, penetrating type.
   3. Finish Coats: Formulated for multicoat application on wood flooring.
B. Wood Filler: Compatible with finish system components and recommended by filler and finish manufacturers for use indicated. If required to match approved Samples, provide pigmented filler.

2.4 ACCESSORY MATERIALS

A. Vapor Retarder: ASTM D 4397, polyethylene sheet not less than 6.0 mils thick.

B. Wood Flooring Adhesive: Mastic recommended by flooring and adhesive manufacturers for application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas and conditions, with Installer present, for compliance with requirements for maximum moisture content, installation tolerances, and other conditions affecting performance of wood flooring.

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

C. Concrete Slabs: Verify that concrete substrates are dry and moisture-vapor emissions are within acceptable levels according to manufacturer's written instructions.

1. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft., and perform no fewer than two tests in each installation area and with test areas evenly spaced in installation areas.

   a. Perform anhydrous calcium chloride test per ASTM F 1869, as follows:

      1) Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.

      b. Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.

3.2 PREPARATION

A. Concrete Slabs: Grind high spots and fill low spots to produce a maximum 1/8-inch deviation in any direction when checked with a 10-foot straight edge.

B. Remove coatings, including curing compounds, and other substances on substrates that are incompatible with installation adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.

C. Broom or vacuum clean substrates to be covered immediately before product installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION

A. Comply with flooring manufacturer's written installation instructions, but not less than applicable recommendations in NWFA's "Installation Guidelines: Wood Flooring."

B. Provide expansion space at walls and other obstructions and terminations of flooring of not less than 3/4 inch.
C. Vapor Retarder: Comply with NOFMA's "Installing Hardwood Flooring" for vapor retarder installation and the following:
   1. Wood Flooring Nailed to Wood Subfloor: Install flooring over a layer of asphalt-saturated felt.
   2. Wood Flooring Installed Directly on Concrete: Install a layer of polyethylene sheet according to flooring manufacturer's written instructions.

D. Engineered-Wood Flooring: Set in adhesive.

3.4 FIELD FINISHING OF EXISTING WOOD FLOORING

A. Machine-sand flooring to remove offsets, ridges, cups, and sanding-machine marks that are noticeable after finishing. Vacuum and tack with a clean cloth immediately before applying finish.
   1. Comply with applicable recommendations in NWFA's "Installation Guidelines."

B. Fill open-grained hardwood.

C. Fill and repair wood flooring defects.

D. Apply floor-finish materials in number of coats recommended by finish manufacturer for application indicated, but not less than one coat of floor sealer and three finish coats.
   1. Apply stains to achieve an even color distribution matching approved Samples.
   2. For water-based finishes, use finishing methods recommended by finish manufacturer to minimize grain raise.

E. Cover wood flooring before finishing.

F. Do not cover wood flooring after finishing until finish reaches full cure, and not before seven days after applying last finish coat.

3.5 PROTECTION

A. Protect installed wood flooring during remainder of construction period with covering of heavy kraft paper or other suitable material. Do not use plastic sheet or film that might cause condensation.
   1. Do not move heavy and sharp objects directly over kraft-paper-covered wood flooring. Protect flooring with plywood or hardboard panels to prevent damage from storing or moving objects over flooring.

END OF SECTION 096400
SECTION 096513 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Resilient base.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and texture specified, not less than 12 inches long.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.

1.5 QUALITY ASSURANCE

A. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Coordinate mockups in this Section with mockups specified in other Sections.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg. F.

1.7 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg. F, in spaces to receive resilient products during the following time periods:

1. 48 hours before installation.

2. During installation.
3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg. F or more than 95 deg. F.

C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 THERMOPLASTIC-RUBBER BASE (RB1)

A. Basis of Design Manufacturers and Products: Subject to compliance with requirements, provide product indicated on Finish Schedule on Drawings or approved comparable product.

B. Product Standard: ASTM F 1861, Type TP (rubber, thermoplastic).


C. Thickness: 0.125 inch.

D. Height: As indicated on Drawings.

E. Lengths: Cut lengths 48 inches long.

F. Outside Corners: Job formed or preformed.

G. Inside Corners: Job formed or preformed.

H. Colors: Refer to Finish Schedule on Drawings.

2.2 INSTALLATION MATERIALS

A. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

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

1. Installation of resilient products indicates acceptance of surfaces and conditions.
3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Do not install resilient products until they are the same temperature as the space where they are to be installed.
   1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.

C. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.3 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.

G. Preformed Corners: Install preformed corners before installing straight pieces.

H. Job-Formed Corners:
   1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
      a. Form without producing discoloration (whitening) at bends.
   2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
      a. Miter corners to minimize open joints.

3.4 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.

B. Perform the following operations immediately after completing resilient-product installation:
   1. Remove adhesive and other blemishes from exposed surfaces.
   2. Sweep and vacuum horizontal surfaces thoroughly.
   3. Damp-mop horizontal surfaces to remove marks and soil.
C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION 096513
SECTION 096519 - RESILIENT TILE FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Solid luxury plank vinyl floor tile.
   2. Vinyl composition floor tile.

B. Related Sections:
   1. Division 09 Section "Resilient Base and Accessories" for resilient wall and stair base.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: Full-size units of each color and pattern of floor tile required.
   1. For heat-welding bead, manufacturer's standard-size Samples, but not less than 9 inches long, of each color required.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of floor tile to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs workers for this Project who are competent in techniques required by manufacturer for floor tile installation and seaming method indicated.
   1. Engage an installer who employs workers for this Project who are trained or certified by floor tile manufacturer for installation techniques required.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F. Store floor tiles on flat surfaces.
1.7 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg. F or more than 95 deg. F, in spaces to receive floor tile during the following time periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg. F or more than 95 deg. F.

C. Close spaces to traffic during floor tile installation.

D. Close spaces to traffic for 48 hours after floor tile installation.

E. Install floor tile after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For resilient tile flooring, as determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

2.2 SOLID LUXURY PLANK VINYL FLOOR TILE (LVT1)

A. Basis of Design Manufacturers and Products: Subject to compliance with requirements, provide product indicated on Finish Schedule on Drawings or approved comparable product.

B. Tile Standard: ASTM F 1700.

1. Class: Class I, monolithic vinyl tile. Class III, printed film vinyl tile
2. Type: A, smooth surface or B, embossed per manufacturer’s standard offering

C. Size and Thickness: As indicated on Finish Schedule.

D. Colors and Patterns: As indicated by manufacturer's designations and as shown on Drawings.

2.3 VINYL COMPOSITION FLOOR TILE (VCT1)

A. Products: Subject to compliance with requirements, provide products as shown on Finish Schedule or approved equal.

B. Tile Standard: ASTM F 1066, Class 1, solid-color tile.

C. Wearing Surface: Smooth.

D. Thickness: 0.125 inch, unless otherwise indicated.
2.4 INSTALLATION MATERIALS

A. Adhesives: Water-resistant type recommended by floor tile and adhesive manufacturers to suit floor tile and substrate conditions indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.

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

3.2 PREPARATION

A. Prepare substrates according to floor tile manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates: Prepare according to ASTM F 710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.

2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by floor tile manufacturer. Do not use solvents.

3. Alkalinity and Adhesion Testing: Perform tests recommended by floor tile manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.

4. Moisture Testing: Proceed with installation only after substrates pass testing according to floor tile manufacturer's written recommendations, but not less stringent than the following:

   a. Perform anhydrous calcium chloride test according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.

   b. Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install floor tiles until they are the same temperature as the space where they are to be installed.

1. At least 48 hours in advance of installation, move resilient floor tile and installation materials into spaces where they will be installed.

E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.
3.3 FLOOR TILE INSTALLATION

A. Comply with manufacturer's written instructions for installing floor tile.

B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.

1. Lay tiles in pattern indicated.

C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.

D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.

E. Extend floor tiles under cabinetry, into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent marking device.

G. Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in finished floor areas. Maintain overall continuity of color and pattern between pieces of tile installed on covers and adjoining tiles. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.

H. Adhere floor tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.4 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting floor tile.

B. Perform the following operations immediately after completing floor tile installation:

1. Remove adhesive and other blemishes from exposed surfaces.
2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop surfaces to remove marks and soil.

C. Protect floor tile from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Sealers and Finish Coats: Remove soil, visible adhesive, and surface blemishes from resilient terrazzo floor tile surfaces before applying liquid cleaners, sealers, and finish products.

1. Sealer and Finish: Apply two base coats of liquid sealer and two coats of liquid floor finish.

E. Cover floor tile until Substantial Completion.

END OF SECTION 096519
SECTION 096813 - TILE CARPETING

PART 1 - GENERAL

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

1.2 SUMMARY
A. Section Includes:
   1. Modular, tufted carpet tile.
B. Related Sections:
   1. Division 09 Section "Resilient Base and Accessories" for resilient wall base and accessories installed with carpet tile.
   2. Division 09 Section "Sheet Carpeting."

1.3 ACTION SUBMITTALS
A. Product Data: For each type of product.
   1. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
   2. Include installation recommendations for each type of substrate.
B. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.
   2. Exposed Edge, Transition, and Other Accessory Stripping: 12-inch-long Samples.

1.4 INFORMATIONAL SUBMITTALS
A. Qualification Data: For Installer.
B. Product Test Reports: For carpet tile, for tests performed by a qualified testing agency.
C. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS
A. Maintenance Data: For carpet tiles to include in maintenance manuals. Include the following:
1. Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
2. Precautions for cleaning materials and methods that could be detrimental to carpet tile.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Carpet Tile: Full-size units equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd..

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is certified by the International Certified Floorcovering Installers Association at the Commercial II certification level.
B. Fire-Test-Response Ratings: Where indicated, provide carpet tile identical to those of assemblies tested for fire response according to NFPA 253 by a qualified testing agency.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Comply with CRI 104.

1.9 FIELD CONDITIONS

A. Comply with CRI 104 for temperature, humidity, and ventilation limitations.
B. Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at occupancy levels during the remainder of the construction period.
C. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet tile manufacturer.
D. Where demountable partitions or other items are indicated for installation on top of carpet tiles, install carpet tiles before installing these items.

1.10 WARRANTY

A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.
   1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
   2. Failures include, but are not limited to, more than 10 percent edge raveling, snags, runs, dimensional stability, loss of tuft bind strength, loss of face fiber, and delamination.
   3. Warranty Period: 10 years from date of Substantial Completion.
PART 2 - PRODUCTS

2.1 CARPET TILE (CT1)

A. Products: Subject to compliance with requirements, provide tile carpet as shown on Finish Schedule or approved equal.

B. Performance Characteristics: As follows:

1. CT 1

<table>
<thead>
<tr>
<th>Construction</th>
<th>Tufted, Loop Pile</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flammability (ASTM E648)</td>
<td>Class 1</td>
</tr>
<tr>
<td>Average Density</td>
<td>8,024</td>
</tr>
<tr>
<td>Tile Size</td>
<td>Refer to Finish Schedule</td>
</tr>
<tr>
<td>Tufted Face Weight</td>
<td>28 oz/yd²</td>
</tr>
<tr>
<td>Yarn Type</td>
<td>Nylon Type 6,6</td>
</tr>
<tr>
<td>Stain Repel / Stain Resist / Soil Release</td>
<td>Manufacturer’s Standard</td>
</tr>
<tr>
<td>Antimicrobial</td>
<td>Manufacturer’s Standard</td>
</tr>
<tr>
<td>Finished Pile Height</td>
<td>0.12”</td>
</tr>
<tr>
<td>Backing</td>
<td>Manufacturer’s Standard; PVC-Free</td>
</tr>
</tbody>
</table>

2.2 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.

B. Metal Edge/Transition Strips: Unless resilient accessory is shown, provide extruded aluminum with mill finish of profile and width shown, of height required to protect exposed edge of carpet, and of maximum lengths to minimize running joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance. Examine carpet tile for type, color, pattern, and potential defects.

B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:

1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by carpet tile manufacturer.
2. Subfloor finishes comply with requirements specified in Section 033000 "Cast-in-Place Concrete" for slabs receiving carpet tile.
3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.

C. For wood subfloors, verify the following:

1. Underlayment over subfloor complies with requirements specified in Section 061000 "Rough Carpentry."
2. Underlayment surface is free of irregularities and substances that may interfere with adhesive bond or show through surface.

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

3.2 PREPARATION

A. General: Comply with CRI 104, Section 6.2, "Site Conditions; Floor Preparation," and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile installation.

B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch wide or wider and protrusions more than 1/32 inch unless more stringent requirements are required by manufacturer's written instructions.

C. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by carpet tile manufacturer.

D. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.3 INSTALLATION

A. General: Comply with CRI 104, Section 14, "Carpet Modules," and with carpet tile manufacturer's written installation instructions.

B. Installation Method: As recommended in writing by carpet tile manufacturer.

C. Maintain dye lot integrity. Do not mix dye lots in same area.

D. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.

E. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, non-staining marking device.

G. Install pattern parallel to walls and borders.

3.4 CLEANING AND PROTECTION

A. Perform the following operations immediately after installing carpet tile:

1. Remove yarns that protrude from carpet tile surface.
2. Vacuum carpet tile using commercial machine with face-beater element.

B. Protect installed carpet tile to comply with CRI 104, Section 16, "Protecting Indoor Installations."
C. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION 096813
SECTION 096816 - SHEET CARPETING

PART 1 - GENERAL

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

1.2 SUMMARY
A. Section Includes:
   1. Tufted carpet.

B. Related Sections:
   1. Division 09 Section "Resilient Base and Accessories" for resilient wall base and accessories installed with carpet.
   2. Division 09 Section "Tile Carpeting."

1.3 ACTION SUBMITTALS
A. Product Data: For the following, including installation recommendations for each type of substrate:
   1. Carpet: For each type indicated. Include manufacturer's written data on physical characteristics, durability, and fade resistance.

B. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.
   1. Carpet: 12-inch square Sample.
   2. Exposed Edge, Transition, and Other Accessory Stripping: 12-inch long Samples.

1.4 INFORMATIONAL SUBMITTALS
A. Qualification Data: For qualified Installer.

B. Product Test Reports: For carpet, for tests performed by a qualified testing agency.

C. Sample Warranties: For special warranties.

1.5 CLOSEOUT SUBMITTALS
A. Maintenance Data: For carpet to include in maintenance manuals. Include the following:
1. Methods for maintaining carpet, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
2. Precautions for cleaning materials and methods that could be detrimental to carpet.

1.6 QUALITY ASSURANCE
   A. Installer Qualifications: An experienced Installer who is certified by the International Certified Floorcovering Installers Association at the Commercial II certification level.

1.7 DELIVERY, STORAGE, AND HANDLING
   A. Comply with CRI 104.

1.8 FIELD CONDITIONS
   A. Comply with CRI 104 for temperature, humidity, and ventilation limitations.
   B. Environmental Limitations: Do not deliver or install carpet until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at occupancy levels during the remainder of the construction period.
   C. Do not install carpet over concrete slabs until slabs have cured, are sufficiently dry to bond with adhesive, and have pH range recommended by carpet manufacturer.
   D. Where demountable partitions or other items are indicated for installation on top of carpet, install carpet before installing these items.

1.9 WARRANTY
   A. Special Warranty for Carpet: Manufacturer agrees to repair or replace components of carpet installation that fail in materials or workmanship within specified warranty period.
      1. Warranty does not include deterioration or failure of carpet due to unusual traffic, failure of substrate, vandalism, or abuse.
      2. Failures include, but are not limited to, more than 10 percent loss of face fiber, edge raveling, snags, runs, loss of tuft bind strength, and delamination.
      3. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 TUFTED CARPET (C1, C2)
   A. Products: Subject to compliance with requirements, provide sheet carpeting as shown on Finish Schedule or approved equal.
B. Performance Characteristics: As follows:

<table>
<thead>
<tr>
<th>Performance Characteristic</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Critical Radiant Flux Classification</td>
<td>Not less than 0.45 W/sq. cm.</td>
</tr>
<tr>
<td>Construction</td>
<td>Tufted, Cut &amp; Loop</td>
</tr>
<tr>
<td>Nominal Total Thickness</td>
<td>0.315&quot;</td>
</tr>
<tr>
<td>Broadloom Width</td>
<td>12'6&quot;</td>
</tr>
<tr>
<td>Nominal Total Weight</td>
<td>100 oz/yd²</td>
</tr>
<tr>
<td>Pattern Repeat</td>
<td>None</td>
</tr>
<tr>
<td>Yarn Type</td>
<td>Nylon Type 6,6</td>
</tr>
<tr>
<td>Stain Repel / Stain Resist / Soil Release</td>
<td>Manufacturer’s Standard</td>
</tr>
<tr>
<td>Antimicrobial</td>
<td>Manufacturer’s Standard</td>
</tr>
<tr>
<td>Dye Method</td>
<td>Continuous Dye</td>
</tr>
<tr>
<td>Yarn Weight</td>
<td>36 oz/yd²</td>
</tr>
<tr>
<td>Finished Pile Height</td>
<td>0.246&quot;</td>
</tr>
<tr>
<td>Backing</td>
<td>Manufacturer’s Standard with NextStep Cushion™ attached</td>
</tr>
</tbody>
</table>

2.2 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet manufacturer.

B. Adhesives: Water-resistant, mildew-resistant, non-staining type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet and is recommended or provided by carpet manufacturer.

C. Seam Adhesive: Hot-melt adhesive tape or similar product recommended by carpet manufacturer for sealing and taping seams and butting cut edges at backing to form secure seams and to prevent pile loss at seams.

D. Metal Edge/Transition Strips: Unless resilient accessory is shown, provide extruded aluminum with mill finish of profile and width shown, of height required to protect exposed edge of carpet, and of maximum lengths to minimize running joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet performance. Examine carpet for type, color, pattern, and potential defects.

B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:

1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by carpet manufacturer.
2. Subfloor finishes comply with requirements specified in Division 03 Section "Cast-in-Place Concrete" for slabs receiving carpet.
3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.
C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Comply with CRI 104, Section 7.3, "Site Conditions; Floor Preparation," and with carpet manufacturer's written installation instructions for preparing substrates.

B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch wide or wider, and protrusions more than 1/32 inch, unless more stringent requirements are required by manufacturer's written instructions.

C. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by carpet manufacturer.

D. Broom and vacuum clean substrates to be covered immediately before installing carpet.

3.3 INSTALLATION

A. Comply with CRI 104 and carpet manufacturer's written installation instructions for the following:

1. Direct-Glue-Down Installation: Comply with CRI 104, Section 9, "Direct Glue-Down Installation."

B. Comply with carpet manufacturer's written recommendations and Shop Drawings for seam locations and direction of carpet; maintain uniformity of carpet direction and lay of pile. At doorways, center seams under the door in closed position.

C. Do not bridge building expansion joints with carpet.

D. Cut and fit carpet to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet manufacturer.

E. Extend carpet into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, non-staining marking device.

G. Install pattern parallel to walls and borders to comply with CRI 104, Section 15, "Patterned Carpet Installations" and with carpet manufacturer's written recommendations.

3.4 CLEANING AND PROTECTING

A. Perform the following operations immediately after installing carpet:

1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet manufacturer.
2. Remove yarns that protrude from carpet surface.
B. Protect installed carpet to comply with CRI 104, Section 16, "Protecting Indoor Installations."

C. Protect carpet against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet manufacturer and carpet adhesive manufacturer.

END OF SECTION 096816
SECTION 097200 - WALL COVERINGS

PART 1 - GENERAL

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

1.2 SUMMARY
A. Section Includes:
   1. Vinyl wall covering.
B. Related Sections:
   1. Section 099113 "Painting" Section for priming wall surfaces.

1.3 ACTION SUBMITTALS
A. Product Data: For each type of product indicated. Include data on physical characteristics, durability, fade resistance, and flame-resistance characteristics.
B. Samples for Verification: Full width by 36-inch-long section of wall covering.

1.4 INFORMATIONAL SUBMITTALS
A. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for wall covering.

1.5 CLOSEOUT SUBMITTALS
A. Maintenance Data: For wall coverings to include in maintenance manuals.

1.6 QUALITY ASSURANCE
A. Fire-Test-Response Characteristics: As determined by testing identical wall coverings applied with identical adhesives to substrates according to test method indicated below by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Surface-Burning Characteristics: As follows, per ASTM E 84:
      a. Flame-Spread Index: 25 or less.
      b. Smoke-Developed Index: 50 or less.
   2. Fire-Growth Contribution: Textile wall coverings tested according to NFPA 286 and complying with test protocol and criteria in the 2003 IBC.
1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install wall coverings until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

B. Lighting: Do not install wall covering until a permanent level of lighting is provided on the surfaces to receive wall covering.

C. Ventilation: Provide continuous ventilation during installation and for not less than the time recommended by wall-covering manufacturer for full drying or curing.

PART 2 - PRODUCTS

2.1 WALL COVERINGS

A. General: Provide rolls of each type of wall covering from same print run or dye lot.

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Finish Schedule on Drawings or approved comparable product.

2.2 VINYL WALL COVERING (WC1)

A. Vinyl Wall-Covering Standards: Provide products complying with the following:

1. FS CCC-W-408D and CFFA-W-101-D for Type II, Medium-Duty products.

B. Size: Refer to Finish Schedule on Drawing.

C. Pattern: Custom Image.

D. Colors and Textures: Refer to Finish Schedule on Drawings.

2.3 ACCESSORIES

A. Adhesive: Mildew-resistant, non-staining adhesive, for use with specific wall covering and substrate application; as recommended in writing by wall-covering manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for levelness, wall plumbness, maximum moisture content, and other conditions affecting performance of the Work.

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

3.2 PREPARATION

A. Comply with manufacturer's written instructions for surface preparation.
B. Clean substrates of substances that could impair bond of wall covering, including dirt, oil, grease, mold, mildew, and incompatible primers.

C. Prepare substrates to achieve a smooth, dry, clean, structurally sound surface free of flaking, unsound coatings, cracks, and defects.
   1. Moisture Content: Maximum of 5 percent on new plaster, concrete, and concrete masonry units when tested with an electronic moisture meter.
   2. Gypsum Board: Prime with primer as recommended in writing by primer/sealer manufacturer and wall-covering manufacturer.

D. Check painted surfaces for pigment bleeding. Sand gloss, semi-gloss, and eggshell finish with fine sandpaper.

E. Remove hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.

F. Acclimatize wall-covering materials by removing them from packaging in the installation areas not less than 24 hours before installation.

3.3 INSTALLATION

A. General: Comply with wall-covering manufacturers' written installation instructions applicable to products and applications indicated except where more stringent requirements apply.

B. Cut wall-covering strips in roll number sequence. Change roll numbers at partition breaks and corners. Install reversing every other strip.

C. Install wall covering with no gaps or overlaps, no lifted or curling edges, and no visible shrinkage. Match pattern 72 inches above the finish floor.

D. Install seams vertical and plumb at least 6 inches from outside corners and 3 inches from inside corners unless a change of pattern or color exists at corner. No horizontal seams are permitted.

E. Fully bond wall covering to substrate. Remove air bubbles, wrinkles, blisters, and other defects.

F. Trim edges and seams for color uniformity, pattern match, and tight closure. Butt seams without any overlay or spacing between strips.

3.4 CLEANING

A. Remove excess adhesive at finished seams, perimeter edges, and adjacent surfaces. Use cleaning methods recommended in writing by wall-covering manufacturer.

B. Replace strips that cannot be cleaned.

C. Reinstall hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.

END OF SECTION 097200
SECTION 099123 - PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes surface preparation and the application of paint systems on the following interior and exterior substrates:

1. Steel.
2. Galvanized metal.
3. Concrete.
4. Wood.
5. Gypsum board.

B. Related Requirements:

1. Division 05 Section "Structural Steel Framing" for shop priming of metal substrates with primers specified in this Section.

1.3 DEFINITIONS

A. Gloss Level 1 (Flat): Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.

B. Gloss Level 3 (Eggshell): 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.

C. Gloss Level 5 (Semi-Gloss): 35 to 70 units at 60 degrees, according to ASTM D 523.

D. Gloss Level 6 (Gloss): 70 to 85 units at 60 degrees, according to ASTM D 523.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

B. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.

1. Submit Samples on rigid backing, 8 inches square.
2. Step coats on Samples to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.
1.5 DELIVERY, STORAGE, AND HANDLING  
A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg. F.  
   1. Maintain containers in clean condition, free of foreign materials and residue.  
   2. Remove rags and waste from storage areas daily.  

1.6 FIELD CONDITIONS  
A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg. F.  
B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg. F above the dew point; or to damp or wet surfaces.  

PART 2 - PRODUCTS  

2.1 MANUFACTURERS  
A. Basis of Design Manufacturers and Products: Subject to compliance with requirements, provide product indicated on Finish Schedule on Drawings or approved comparable product.  

2.2 PAINT, GENERAL  
A. MPI Standards: Provide products that comply with MPI standards indicated and that are listed in its "MPI Approved Products List."  
B. Material Compatibility:  
   1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.  
   2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.  
C. Colors: As indicated on Finish Schedule on Drawings.  

2.3 PRIMERS/SEALERS  
A. Primer Sealer, Latex, Interior: MPI #50.  
B. Primer Sealer, Interior, Institutional Low Odor/VOC: MPI #149.  
C. Primer, Latex, for Interior Wood: MPI #39.  

2.4 METAL PRIMERS  
A. Primer, Rust-Inhibitive, Water Based: MPI #107.  
B. Primer, Galvanized, Water Based: MPI #134.
2.5 WATER-BASED PAINTS

A. Latex, Interior, Flat, (Gloss Level 1): MPI #53.
B. Latex, Interior, (Gloss Level 3): MPI #52.
C. Latex, Interior, Semi-Gloss, (Gloss Level 5): MPI #54.

2.6 SOURCE QUALITY CONTROL

A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:
   1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
   2. Testing agency will perform tests for compliance with product requirements.
   3. Owner may direct Contractor to stop applying coatings if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
   1. Concrete: 12 percent.
   3. Wood: 15 percent.
   4. Gypsum Board: 12 percent.

C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.

D. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

E. Proceed with coating application only after unsatisfactory conditions have been corrected.
   1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates indicated.
B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.

E. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer, but not less than the following:

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

F. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

G. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

H. Wood Substrates:

1. Sand surfaces that will be exposed to view, and dust off.
2. Prime edges, ends, faces, undersides, and backsides of wood.
3. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."

1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
   1. Paint the following work where exposed in equipment rooms:
      a. Equipment, including panelboards.
      b. Uninsulated metal piping.
      c. Pipe hangers and supports.
      d. Metal conduit.
   2. Paint the following work where exposed in occupied spaces:
      a. Uninsulated metal piping.
      b. Pipe hangers and supports.
      c. Metal conduit.
      d. Other items as directed by Architect.
   3. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

3.4 FIELD QUALITY CONTROL

A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
   1. Contractor shall touch up and restore painted surfaces damaged by testing.
   2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 INTERIOR PAINTING SCHEDULE

A. Steel Substrates:

1. Institutional Low-Odor/VOC Latex System (DP1, DP2)
   c. Topcoat: Latex, interior, institutional low odor/VOC, (Gloss Level 3), MPI #145.
   d. Topcoat: Latex, interior, institutional low odor/VOC, semi-gloss (Gloss Level 5), MPI #147.

B. Galvanized-Metal Substrates:

1. Latex over Waterborne Primer System:
   a. Prime Coat: Primer, galvanized, water based, MPI #134.
   c. Topcoat: Latex, interior, flat, (Gloss Level 1), MPI #53.
   d. Topcoat: Latex, interior, (Gloss Level 3), MPI #52.
   e. Topcoat: Latex, interior, semi-gloss, (Gloss Level 5), MPI #54.
   f. Topcoat: Latex, interior, gloss, (Gloss Level 6, except minimum gloss of 65 units at 60 degrees), MPI #114.

C. Wood Substrates: Including wood trim.

1. Latex System (PB1, PC1, PW1):
   a. Prime Coat: Primer, latex, for interior wood, MPI #39.
   c. Topcoat: Latex, interior, flat, (Gloss Level 1), MPI #53.
   d. Topcoat: Latex, interior, (Gloss Level 3), MPI #52.
   e. Topcoat: Latex, interior, semi-gloss, (Gloss Level 5), MPI #54.
   f. Topcoat: Latex, interior, gloss, (Gloss Level 6, except minimum gloss of 65 units at 60 degrees), MPI #114.

D. Gypsum Board Substrates:

1. Latex System (P1 – P4, CP1)
   a. Prime Coat: Primer sealer, latex, interior, MPI #50.
   b. Prime Coat: Latex, interior, matching topcoat.
   d. Topcoat: Latex, interior, flat, (Gloss Level 1), MPI #53.
   e. Topcoat: Latex, interior, (Gloss Level 3), MPI #52.
   f. Topcoat: Latex, interior, semi-gloss, (Gloss Level 5), MPI #54.

3.7 EXTERIOR PAINTING SCHEDULE

A. Wood Substrates: Wood trim, shutters, board siding, wood rails, etc..
1. Latex over Latex Primer System MPI EXT 6.3L:
   c. Topcoat: Latex, exterior, low sheen (MPI Gloss Level 3-4), MPI #15.
   d. Topcoat: Latex, exterior, semi-gloss (MPI Gloss Level 5), MPI #11.

B. Steel Substrates

1. Exterior Acrylic Latex
   a. Prime Coat: Shop primed, refer to Division 05 Section “Metal Fabrications.”
   b. Topcoat: Latex, exterior, institutional low odor/VOC, (Gloss Level 3), MPI #15.

END OF SECTION 099123
SECTION 099300 - STAINING AND TRANSPARENT FINISHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Primers
2. Wood stains at beams, flooring and elsewhere indicated.
3. Transparent finishes, protective topcoat finish at all locations.
4. Refinishing wood flooring.
5. Cleaning interior wood surfaces.

1.2 ACTION SUBMITTALS

A. Product Data:

1. For each type of product.
2. Include preparation requirements and application instructions.
3. Indicate VOC content.

B. Samples for Initial Selection: Manufacturer's standard color sheets, showing full range of available colors for each type of exposed finish.

C. Samples for Verification: Sample for each type of finish system and in each color and gloss of finish required on representative samples of actual wood substrates.

1. Size: 8 inches square or 8 inches long.
2. Apply coats on Samples in steps to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

1.3 MOCKUPS

A. Apply mockups of each finish system indicated and each color selected to verify preliminary selections made under Sample submittals and to set quality standards for materials and execution.

1. Architect will select one surface to represent surfaces and conditions for application of each type of finish system and substrate.
   a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft..
   b. Other Items: Architect will designate items or areas required.
2. Final approval of stain color selections will be based on mockups.
   a. If preliminary stain color selections are not approved, apply additional mockups of additional stain colors selected by Architect at no added cost to Owner.
1.4 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.5 FIELD CONDITIONS

A. Apply finishes only when temperature of surfaces to be finished and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply finishes when relative humidity exceeds 85 percent, at temperatures of less than 5 deg F above the dew point, or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Behr Paint Company; Behr Process Corporation.
2. Benjamin Moore & Co.
3. Cabot Stains
4. Minwax
5. PPG Paints.
7. Sherwin-Williams Company (The).

2.2 MATERIALS, GENERAL

A. Material Compatibility:

1. Provide materials for use within each coating system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.

B. VOC Content: For field applications, verify paints and coatings comply with VOC content limits of authorities having jurisdiction and the following VOC content limits:

1. **Primers, Sealers, and Undercoaters**: 100 g/L.
2. **Clear Wood Finishes, Varnishes**: 275 g/L.
3. **Clear Wood Finishes, Lacquers**: 275 g/L.
4. **Shellacs, Clear**: 730 g/L.
5. **Stains**: 100 g/L.

C. Stain Colors: As selected by Architect from manufacturer's full range.

D. Cleaning Materials
1. Cotton balls
2. Manufacturer’s standard dishwashing detergent
3. Mineral Spirits: by Klean Strip or equal
4. Wood Wax: “Paste Finishing Wax” by Minwax or equal
5. Denatured Alcohol: by Klean Strip or equal
6. Cheese Cloth and Sponges

E. Removal Materials

1. Paint Stripper, Scraper and Steel Brush: Removes top coat and stain
2. Lacquer Thinner and Steel Wool: Removes top coat only.

2.3 PRIMERS

A. Alkyd Sanding Sealer, Interior, Solvent Based, Clear: Solvent-based, quick-drying, clear, sandable alkyd sealer used on new interior wood surfaces that are to be top-coated with an alkyd varnish.

2.4 WOOD STAINS

A. Stain, Interior, Semitransparent, for Interior Wood: Solvent-based, oil or oil/alkyd, semitransparent, pigmented stain for new interior wood surfaces that are to be finished with a clear varnish.

2.5 TRANSPARENT FINISHES

A. Varnish, Interior, Polyurethane, Oil Modified, Satin: Solvent-based, one-component, oil-modified polyurethane clear satin varnish for new or previously varnished or stained interior wood surfaces.

1. Gloss and Sheen Level: Manufacturer's standard low-sheen finish.


1. Gloss and Sheen Level: Manufacturer's standard low-sheen finish.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Interior Wood Substrates: 15 percent, when measured with an electronic moisture meter.

C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

D. Proceed with finish application only after unsatisfactory conditions have been corrected.

1. Beginning finish application constitutes Contractor's acceptance of substrates and conditions.
3.2 PREPARATION

A. Remove hardware, covers, plates, and similar items already in place that are removable. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and finishing.

1. After completing finishing operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

3.3 CLEANING AND VERIFICATION

A. Existing Finished Wood Surfaces

1. Verification of Existing Finish: If possible, verify the existing wood finish below and use a cleaning method appropriate for that specific wood finish. Dab denatured alcohol on a cotton swab and test on the piece. If the finish remains consider it to be oil, lacquer, varnish, or polyurethane.
   a. Shellac
   b. Penetrating Oil
   c. Varnish: Applied as a topcoat over stains; non-penetrating natural (linseed, tung oil) and polyurethane (oil and water based)
   d. Paint

2. Cleaning: If unable to verify the existing finish, clean existing wood as follows. Prior to full cleaning test each application for damage:
   a. Detergent Cleaning: Mix water and dish soap and sponge down the entire piece. Do not soak the wood. Brush the sponge lightly over the surface and don’t let the liquid linger for long. Dry thoroughly.
   b. Mineral Spirits: Apply according to manufacturer recommendations. After testing there is some discoloration, clean with detergent and water and proceed to re-finish. If there is no discoloration, wipe the piece down with a clean cloth soaked in (but not dripping with) mineral spirits. Finish by wiping away any residual cleaner with a water-moistened cloth. Inspect the wood for blemishes.

B. Un-Finished Wood: Clean and prepare surfaces to be finished according to manufacturer's written instructions for each substrate condition and as specified.

1. Remove dust, dirt, oil, and grease by washing with a detergent solution; rinse thoroughly with clean water and allow to dry. Remove grade stamps and pencil marks by sanding lightly. Remove loose wood fibers by brushing.
2. Remove mildew by scrubbing with a commercial wash formulated for mildew removal and as recommended by stain manufacturer.

C. Interior Wood Substrates:

1. Removal of Existing Finish: Use thinner and steel wool to keep the underlying stain or paint stripper to remove top coat and stain. Follow manufacturer’s directions. Keep area well ventilated.
2. Scrape and clean knots, and apply coat of knot sealer before applying primer.
3. Apply wood filler paste to open-grain woods to produce smooth, glasslike finish.
4. Sand surfaces exposed to view and dust off.
5. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dry.

3.4 APPLICATION

A. Apply finishes according to manufacturer's written instructions.
   1. Use applicators and techniques suited for finish and substrate indicated.
   2. Finish surfaces behind movable equipment and furniture same as similar exposed surfaces.
   3. Do not apply finishes over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

B. Apply finishes to produce surface films without cloudiness, holidays, lap marks, brush marks, runs, ropiness, or other surface imperfections.

3.5 FINISHING WOOD FLOORING

A. Machine-sand flooring to remove offsets, ridges, cups, and sanding-machine marks that are noticeable after finishing. Vacuum and tack with a clean cloth immediately before applying finish.
   1. Comply with applicable recommendations in NWFA's "Installation Guidelines."

B. Fill and repair wood flooring defects.

C. Apply floor-finish materials in number of coats recommended by finish manufacturer for application indicated, but not less than one coat of floor sealer and three finish coats.
   1. Apply stains to achieve an even color distribution matching approved Samples.
   2. For water-based finishes, use finishing methods recommended by finish manufacturer to minimize grain raise.

D. Cover wood flooring before finishing.

E. Do not cover wood flooring after finishing until finish reaches full cure, and not before seven days after applying last finish coat.

F. Protection: Protect wood flooring during remainder of construction period with covering of heavy kraft paper or other suitable material. Do not use plastic sheet or film that might cause condensation.
   1. Do not move heavy and sharp objects directly over kraft-paper-covered wood flooring. Protect flooring with plywood or hardboard panels to prevent damage from storing or moving objects over flooring.

3.6 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing finish application, clean spattered surfaces. Remove spattered materials by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
C. Protect work of other trades against damage from finish application. Correct damage by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced finished wood surfaces.

3.7 INTERIOR WOOD-FINISH-SYSTEM SCHEDULE

A. Wood Substrates, Exposed Framing (SB1, SC1)

1. Polyurethane Varnish over Stain System:
   a. Stain Coat: Stain, semitransparent, for interior wood.
   d. Topcoat: Varnish, interior, polyurethane, oil modified, satin.

B. Wood Substrates, Casework:

1. Semitransparent Stain System:
   b. Topcoat: Stain, exterior, solvent based, semitransparent.

C. Wood Substrates, Traffic Surfaces, Including Floors and Stairs:

1. Polyurethane Varnish over Stain System:
   a. Stain Coat: Stain, semitransparent, for interior wood.
   d. Topcoat: Varnish, interior, polyurethane, oil modified, gloss.

END OF SECTION 099300
SECTION 102113.19 - PLASTIC TOILET COMPARTMENTS

PART 1 - GENERAL

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

1.2 SUMMARY
   A. Section includes solid-plastic toilet compartments configured as toilet enclosures urinal screens.

1.3 ACTION SUBMITTALS
   A. Product Data: For each type of product.
   B. Samples for each type of toilet compartment material indicated.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS
   A. Surface-Burning Characteristics: Comply with ASTM E 84; testing 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.

2.2 SOLID-PLASTIC TOILET COMPARTMENTS (TP1)
   A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by approved manufacturer.
   B. Toilet-Enclosure Style: Overhead braced Floor anchored.
   C. Urinal-Screen Style: Wall hung.
   D. Door, Panel, Screen, and Pilaster Construction: Solid, high-density polyethylene (HDPE) panel material, not less than 1 inch thick, seamless, with eased edges, and with homogenous color and pattern throughout thickness of material.
      1. Integral Hinges: Configure doors and pilasters to receive integral hinges.
      2. Heat-Sink Strip: Manufacturer's standard continuous, extruded-aluminum or stainless-steel strip fastened to exposed bottom edges of solid-plastic components to hinder malicious combustion.
      3. Color and Pattern: One color and pattern in each room as indicated by manufacturer's designations.
E. Urinal-Screen Post: Manufacturer's standard post design of material matching the thickness and construction of pilasters; with shoe matching that on the pilaster.

F. Brackets (Fittings):
   1. Stirrup Type: Ear or U-brackets, chrome-plated zamac.

2.3 HARDWARE AND ACCESSORIES

A. Hardware and Accessories: Manufacturer's standard operating hardware and accessories.
   1. Material: Chrome-plated zamac.
   2. Provide units that comply with regulatory requirements for accessibility at compartments designated as accessible.

B. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with antigrip profile and in manufacturer's standard finish.

2.4 FABRICATION

A. Fabrication, General: Fabricate toilet compartment components to sizes indicated. Coordinate requirements and provide cutouts for through-partition toilet accessories where required for attachment of toilet accessories.

B. Overhead-Braced Units: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, and anchors at pilasters to suit floor conditions. Provide shoes at pilasters to conceal supports and leveling mechanism.

C. Floor-Anchored Units: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment nuts at pilasters for structural connection to floor. Provide shoes at pilasters to conceal anchorage.

D. Urinal-Screen Posts: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment nuts at bottoms of posts. Provide shoes at posts to conceal anchorage.

E. Door Size and Swings: Unless otherwise indicated, provide 24-inch- wide, in-swinging doors for standard toilet compartments and 36-inch- wide, out-swinging doors with a minimum 32-inch- wide, clear opening for compartments designated as accessible.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.

   1. Maximum Clearances:
      a. Pilasters and Panels: 1/2 inch.
      b. Panels and Walls: 1 inch.
2. Stirrup Brackets: Secure panels to walls and to pilasters with no fewer than three brackets attached at midpoint and near top and bottom of panel.
   a. Locate wall brackets so holes for wall anchors occur in masonry or tile joints. Replace damaged tiles, refer to Division 09 Section “Tiling” for requirements.
   b. Align brackets at pilasters with brackets at walls.

3.2 ADJUSTING

A. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors to return doors to fully closed position.

END OF SECTION 102113.19
SECTION 105116 - WOOD LOCKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Double-tier wood lockers with solid wood doors.
   2. Locker benches.

B. Related Sections include the following:
   1. Division 6 Section "Rough Carpentry" for furring, blocking, shims, and hanging strips required for installing wood lockers and concealed within other construction before wood locker installation.

C. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for wood lockers.

D. Shop Drawings: Include plans, elevations, sections, details, and attachments to other Work.
   1. Show details full size.
   2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
   3. Show locations and sizes of cutouts and holes for items installed in wood lockers.
   4. Show wood locker fillers, trim, base, sloping tops, and accessories.
   5. Show wood locker numbering sequence.

E. Samples for Verification: For the following:
   1. Solid wood with transparent finish, not less than 50 sq. in., for each species and cut, finished on 1 side and 1 edge.

F. Maintenance Data: For adjusting, repairing, and replacing wood locker doors and latching mechanisms to include in maintenance manuals.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

B. Source Limitations: Obtain wood lockers through one source from a single manufacturer.

C. Product Options: Drawings indicate size, profiles, and dimensional requirements of wood lockers and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."
1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

D. Regulatory Requirements: Where wood lockers are indicated to comply with accessibility requirements, comply with ICC A117.1.

1. Provide not less than one shelf located within required reach ranges.
2. Provide hardware that does not require tight grasping, pinching, or twisting of the wrist, and that operates with a force of not more than 5 lbf.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver wood lockers until painting and similar operations that could damage wood lockers have been completed in installation areas. If wood lockers must be stored in other-than-installation areas, store only in areas where environmental conditions are same as that in final installation location and comply with requirements specified in "Project Conditions" Article.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install wood lockers until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Field Measurements: Verify concealed framing, blocking, and reinforcements that support wood lockers by field measurements before being enclosed and before wood locker fabrication, and indicate measurements on Shop Drawings.

1.6 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that wood lockers can be supported and installed as indicated.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of wood lockers that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to, the following:

1. Structural failures.
2. Faulty operation of locks or hardware.
3. Deterioration of wood, wood finishes, and other materials beyond normal use.

B. Warranty Period: Three years from date of Substantial Completion.
PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Classic Woodworking, Inc.
2. Dimension Millworks.
3. Famous Lockers.
4. Fiberesin Industries, Inc.
5. Hollman, Inc.
6. Ideal Products, Inc.
7. Multispace; Div. of Club Resource Group.
8. Treeforms.

2.2 MATERIALS

A. Solid Wood:

1. Exposed Locations: Clear hardwood lumber, selected for compatible grain and color.
2. Semixposed Locations: Sound hardwood lumber, selected to eliminate appearance defects of any species similar in color and grain to exposed solid wood.
3. Concealed Locations: Any hardwood or softwood species, with no defects affecting strength or utility.

B. Medium-Density Fiberboard: ANSI A208.2, Grade MD.

C. Softwood Plywood: DOC PS 1, Medium Density Overlay.

D. Hardwood Plywood: HPVA HP-1, Type I.

E. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.

F. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage.

1. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls[and elsewhere as required] for corrosion resistance.
2. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

2.3 WOOD LOCKER HARDWARE

A. General: Provide manufacturer's standard wood locker hardware and accessories.

B. Butt Hinges: 2-3/4-inch, 5-knuckle steel hinges; back mounted.

1. Provide 2 hinges for doors 36 inches tall and less.

C. Wire Pulls: Back mounted; 4 inches long, 5/16 inch in diameter.

D. Shelf Rests: BHMA A156.9, B04013.
E. Exposed Hardware Finishes: Polished chrome, unless otherwise indicated.

2.4 DOOR LOCKS

A. General: Fabricate wood lockers to receive locking devices. Provide one locking device for each wood locker door, unless otherwise indicated.

B. Cam Padlock Hasp: Surface mounted, steel; finished to match other wood locker hardware.

2.5 WOOD-FACED WOOD LOCKERS (L1)

A. Construction Style: Flush overlay, unless otherwise indicated.

B. Flush, Solid Wood Doors: 3/4-inch-thick solid wood, end and edge glued; wood species and cut as follows, unless otherwise indicated:

1. Cherry, plain sawn.

C. End Panels: Match style, material, construction, and finish of wood-faced wood doors.

D. Shelves: Fabricated from particleboard-core panels covered on both sides with thermoset decorative overlay; fixed.

1. Thickness: 3/4 inch.
2. Exposed Edges: 3-mm-thick PVC.

E. Corners and Filler Panels: Wood-veneer-faced, 3/4-inch-thick panel that matches door faces.

2.6 LOCKER ACCESSORIES

A. Hooks: Manufacturer's standard ball-pointed, aluminum or steel; chrome finished. Attach hooks with at least two fasteners.

B. Coat Rods: 1-inch-diameter steel; chrome finished.

C. Number Plates: 1-1/2-inch-diameter, etched, embossed, or stamped, aluminum plates with black numbers and letters at least 1/2 inch high. Identify wood lockers in sequence indicated on Drawings.

D. Continuous Finish Base: Wood-veneer-faced, 3/4-inch-thick panel that matches door faces; fabricated in lengths as long as practicable to enclose base and base ends of wood lockers.

E. Continuously Sloping Tops: Wood-veneer-faced, 3/4-inch-thick panel that matches door faces for installation over wood lockers with separate flat tops. Fabricate tops in lengths as long as practicable, without visible fasteners at splice locations. Provide fasteners, supports, and closures, as follows:

2.7 LOCKER BENCHES

A. Pedestal-Leg Locker Benches: Bench supported by pedestal legs, minimum of two pedestals for each bench; with overall bench height of 18 inches; as follows:
2. Metal Pedestal Legs: 1-1/2-inch-diameter, stainless-steel round tube or pipe.
3. Bench: 1-1/4 inches deep by 12 inches wide with rounded edges, and fabricated as follows:
   a. Laminated Solid Wood: Match material and finish of wood-faced wood locker doors.
4. Length: 36 inches.

2.8 WOOD LOCKER FABRICATION

A. Unit Principle: Fabricate each wood locker with an individual door and frame, individual top, bottom, back, and shelves, and common intermediate uprights separating compartments.
   1. Fabricate wood lockers to dimensions, profiles, and details indicated.
   2. Ease edges of corners of solid wood members to radius of 1/16 inch.

B. Fabricate components square, rigid, without warp, and with finished faces flat and free of scratches and chips. Accurately machine components for attachments in factory, with no chips. Make joints tight and true.
   1. Fabricate wood lockers using manufacturer's standard construction with joints made with dowels, dados, or rabbets. Dado side panels to receive shelving, except where indicated to be adjustable.

C. Number Plates: Inlay number plates flush in each wood locker door, near top, centered.

D. Complete fabrication, including assembly, finishing, and hardware application, to maximum extent possible, before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

E. Shop cut openings, to maximum extent possible, to receive hardware, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

F. Attach PVC edging to panels by thermally fusing edging to panels after panel fabrication.

2.9 FACTORY FINISHES FOR WOOD-FACED WOOD LOCKERS

A. General: Finish wood lockers at factory as specified in this Section. Defer only final touchup, cleaning, and polishing until after installation.

B. Preparations for Finishing: Sand, fill countersunk fasteners, seal concealed surfaces, and perform similar preparations for finishing wood lockers, as applicable to each unit of work.
   1. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of wood lockers. Apply two coats to back of paneling and to end-grain surfaces. Concealed surfaces of plastic-laminate-clad wood lockers do not require backpriming when surfaced with thermoset decorative overlay or plastic laminate.

C. Transparent Finish: Manufacturer's standard two-coat, clear, catalyzed lacquer finish with sanding between coats. Seal with moisture-resistant topcoat.
1. Stain: None required.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls, floors, and wood bases for suitable conditions where wood lockers will be installed.

B. Verify that furring is attached to concrete and masonry walls that are to receive wood lockers.

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

3.2 PREPARATION

A. Condition wood lockers to average prevailing humidity conditions in installation areas before installation.

B. Before installing wood lockers, examine factory-fabricated work for completeness and complete work as required, including removal of packing.

3.3 INSTALLATION

A. Install level, plumb, and true; shim as required, using concealed shims.

B. Connect groups of wood lockers together with manufacturer's standard fasteners, through predrilled holes, with no exposed fasteners on face frames. Fit wood lockers accurately together to form flush, tight, hairline joints.

C. Install wood lockers without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.

1. Installation Tolerance: No more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line. Shim as required with concealed shims.

2. Fasten wood lockers through back, near top and bottom, at ends with No. 8 pan- or bugle-head wood screws sized for 1-inch penetration into wood framing, blocking, or furring spaced not more than 16 inches o.c.

3. Fasten wood lockers through wood locker base, at ends and not more than 36 inches o.c. with No. 8 brass-finished, flush-head wood screws sized for 1-inch penetration into wood base.

D. Scribe and cut corner and filler panels to fit adjoining work using fasteners concealed where practical. Repair damaged finish at cuts.

E. Attach sloping top units to wood lockers, with end panels covering exposed ends.

F. Place freestanding locker benches in locations indicated on Drawings.

3.4 ADJUSTING AND CLEANING

A. Clean, lubricate, and adjust hardware. Adjust doors to operate easily without binding. Verify that integral locking devices operate properly.
B. Protect wood lockers from damage, abuse, dust, dirt, stain, or paint. Do not permit wood locker use during construction.

C. Touch up marred finishes, or replace wood lockers that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by wood locker manufacturer.

END OF SECTION 105116
SECTION 115213 - PROJECTION SCREENS AND PROJECTION EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Electrically operated, front-projection screens.
   2. Projectors

B. Related Requirements:
   1. Division 05 Section "Metal Fabrications" for metal support framing for front-projection screens.
   2. Division 06 Sections "Miscellaneous Rough Carpentry" for wood backing for screen installation and "Interior Architectural Woodwork" for wood trim for recessed screen installation.
   3. Division 26 Sections for electrical connections.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Environmental Limitations: Do not deliver front-projection screens until spaces are enclosed and weathertight, wet-work in installation spaces is complete and dry, and temporary or permanent HVAC system is operating and maintaining ambient temperature and humidity conditions planned for building occupants during the remainder of the construction period.

B. Store front-projection screens in manufacturer's protective packaging and according to manufacturer's written instructions.

1.5 COORDINATION

A. Coordinate layout and installation of front-projection screens with adjacent construction, including ceiling suspension systems, light fixtures, HVAC system components, and partitions.
PART 2 - PRODUCTS

2.1 ELECTRICALLY OPERATED, FRONT-PROJECTION SCREENS

A. General Requirements: Manufacturer's standard units, consisting of case, screen, motor, controls, mounting accessories, and other components necessary for a complete installation. Provide units that are listed and labeled as an assembly by Underwriters Laboratories Inc. (UL) or another testing and inspecting agency acceptable to authorities having jurisdiction.

1. 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.
2. Screen Mounting: Top edge securely anchored to rigid metal roller and bottom edge formed into a pocket holding a metal rod, with ends of rod protected by plastic caps.

B. Surface-Mounted, Metal-Encased, Electrically Operated Screen: Motor-in-roller unit with screen case fabricated from formed-steel sheet or from aluminum extrusions with manufacturer's standard finish and matching end caps.

1. Basis-of-Design Product: Subject to compliance with requirements, provide "Access E" by Draper Inc. or comparable product by one of the following:
   a. Legrand AV; Legrand North America, LLC.
   b. Stewart Filmscreen Corporation.
2. Motor in Roller: Instant-reversing motor of size and capacity recommended in writing by screen manufacturer; with permanently lubricated ball bearings, automatic thermal-overload protection, preset limit switches to automatically stop screen in up and down positions, and positive-stop action to prevent coasting. Mount motor inside roller with vibration isolators to reduce noise transmission.
3. Controls: Remote, key-operated, three-position control switch installed in recessed device box with flush cover plate.
   a. Provide with one control switch.
   b. Provide power supply for low-voltage systems if required.
   c. Provide locking cover plates for switches.
   d. Provide key-operated, power-supply switch.
   e. Provide radio-frequency remote control, consisting of battery-powered transmitter and receiver.
   f. Provide video interface control for connecting to projector. Projector provides signal to raise or lower screen.
4. Surface-Mounting Configuration: Recessed in ceiling trough indicated on Drawings, with concealed mounting.
5. Screen-Case Color: As selected by Architect from manufacturer's standard options.
6. Free-Hanging, Matte Viewing Surface: White, 1.0 minimum peak gain and 60-degree minimum half-gain angle.
7. Size of Viewing Surface: 100 by 160 inches; 189 inch diagonal.

2.2 LASER PROJECTOR

A. General: Provide laser projector with the following characteristics:

1. Technology: 3 LCD, 3 chip
2. Resolution: WUXGA 1920 x 1200
3. Brightness: 6,000 lumens (min.)
4. Aspect Ratio Native: 16:10, 4:3, 19:9, 14:9 and zoom compatible
5. Throw Ratio (distance : width): 1.4 – 2.4:1
6. Focus Distance: 31 – 619 inches
7. Display Size: 30 – 300 inches

B. Basis-of-Design Product: Subject to compliance with requirements, provide "MP-WU5603" LCD Laser Projector by Maxell Corp. or comparable product by one of the following:

1. Sony Electronics, Inc.
2. Epson America, Inc.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install front-projection screens at locations indicated on Drawings to comply with screen manufacturer's written instructions.

B. Install front-projection screens with screen cases in position and in relation to adjoining construction indicated. Securely anchor them to supporting substrate in a manner that produces a smoothly operating screen that, when lowered, has flat viewing surface and plumb vertical edges.

1. Install low-voltage controls in accordance with NFPA 70 and complying with manufacturer's written instructions.
   a. Wiring Method: Install wiring in raceway, except in accessible ceiling spaces and in gypsum board partitions, where unenclosed wiring method may be used. Use UL-listed plenum cable in environmental air spaces, including plenum ceilings. Conceal raceway and cables, except in unfinished spaces.

2. Test electrically operated units to verify that screen controls, limit switches, closures, and other operating components are in optimum functioning condition.

END OF SECTION 115213
SECTION 122200 - CURTAINS AND DRAPES

PART 1 - GENERAL

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

1.2 SUMMARY
A. Section Includes:
1. Drapes.
2. Drapery tracks.

1.3 ACTION SUBMITTALS
A. Product Data: For each type of product.
   1. Drapery Tracks: Include maximum weights of drapes that can be supported.
B. Samples: As follows:
   1. Drapery Fabrics: For each color and pattern indicated, full width by 36 inches long, from dye lot to be used for the Work and with specified textile treatments applied. Show complete pattern repeat if any. Mark top and face of fabric.

1.4 INFORMATIONAL SUBMITTALS
A. Coordination Drawings: For drapery track installation; reflected ceiling plans drawn to scale and coordinating track installation with openings and ceiling-mounted items.

1.5 CLOSEOUT SUBMITTALS
A. Maintenance data.

PART 2 - PRODUCTS

2.1 DRAPERY TRACKS
A. Manually Operated Track:
   1. Basis-of-Design Product: Subject to compliance with requirements, provide "CS Track" by Brimar or comparable approved product.
   2. Mounting Brackets and Accessories
a. Mounting Brackets: Aluminum, of type suitable for fastening track to surface indicated and designed to support weight of track assembly and drape plus force applied to operate track.

b. Track Accessories: Provide track accessories including but not limited to snap carriers, snap tape

3. Installation Fasteners: Sized to support track assembly and drape, and fabricated from metal compatible with track, brackets, and supporting construction. Provide two fasteners to fasten each bracket to supporting construction.

4. Operation: Baton operation with two way, center opening, unless otherwise indicated or directed.

2.2 DRAPES (W1, W2, W3)

A. Basis-of-Design Product: Subject to compliance with requirements, provide Drapery Fabric indicated on Finish Schedule on Drawings or comparable approved product.

B. Drapes Headings: Provide roll pleats with 100 percent fullness.

2.3 DRAPE FABRICATION

A. Fabricate drapes in heading styles and fullnesses indicated. Fabricate headings to stand erect. If less than a full width of fabric is required to produce panel of specified fullness, use equal widths of not less than one-half width of fabric located at ends of panel.

1. Center-Opening Drapes: Add 10 inches to overall width for overlap.

PART 3 - EXECUTION

3.1 DRAPERY TRACK INSTALLATION

A. Install track systems according to manufacturer's written instructions, level and plumb, and at height and location in relation to adjoining openings as indicated on Drawings.

B. Isolate metal parts of tracks and brackets from concrete, masonry, and mortar to prevent galvanic action. Use tape or another method recommended in writing by track manufacturer.

3.2 DRAPE INSTALLATION

A. Where drapes abut overhead construction, hang drapes so that clearance between headings and overhead construction is 1/4 inch.

B. Where drapes extend to floor, install so that bottom hems clear finished floor by not more than 1 inch and not less than 1/2 inch.

C. Where drapes extend to windowsill, install so that bottom hems hang above sill line and clear sill line by not more than 1/2 inch.

D. After hanging drapes, do the following:
1. Test and adjust each drapery track to produce unencumbered, smooth operation.
2. Steam and dress down drapes as required to produce crease- and wrinkle-free installation.
3. Remove and replace drapes that are stained or soiled.

END OF SECTION 122200
SECTION 122413 - ROLLER WINDOW SHADES

PART 1 - GENERAL

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

1.2 SUMMARY
   A. Section Includes:
      1. Manually operated roller shades with single rollers and blackout fabric.
   B. Related Requirements:
      1. Division 06 Section "Miscellaneous Rough Carpentry" for wood blocking and grounds for mounting roller shades and accessories.

1.3 ACTION SUBMITTALS
   A. Product Data: For each type of product.
      1. Include styles, material descriptions, construction details, dimensions of individual components and profiles, features, finishes, and operating instructions for roller shades.
   B. Samples for Initial Selection: For each type and color of shade band material with light filtering ranges available.
      1. Include Samples of accessories involving color selection.

1.4 QUALITY ASSURANCE
   A. Installer Qualifications: Fabricator of products.

1.5 DELIVERY, STORAGE, AND HANDLING
   A. Deliver roller shades in factory packages, marked with manufacturer, product name, and location of installation using same designations indicated on Drawings.

1.6 FIELD CONDITIONS
   A. Environmental Limitations: Do not install roller shades until construction and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
   B. Field Measurements: Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operating hardware of operable glazed units through entire operating
range. Notify Architect of installation conditions that vary from Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.1 MANUALLY OPERATED SHADES WITH SINGLE ROLLERS (W4)

A. Basis of Design Product: Subject to compliance with requirements, provide product indicated on Finish Schedule on Drawings or comparable approved product.

B. Chain-and-Clutch Operating Mechanisms: With continuous-loop bead chain and clutch that stops shade movement when bead chain is released; permanently adjusted and lubricated.

1. Bead Chains:
   a. Loop Length: Full length of roller shade.
   b. Limit Stops: Provide upper and lower ball stops.
   c. Chain-Retainer Type: Clip, jamb mount.

C. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.

1. Roller Drive-End Location: Right side of inside face of shade or as indicated on Drawings.
2. Direction of Shadeband Roll: Regular, from back of roller.

D. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.

E. Shadebands:

2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.
   a. Type: Enclosed in sealed pocket of shadeband material.
   b. Color and Finish: As selected by Architect from manufacturer's full range.

F. Installation Accessories:

1. Front Fascia: Aluminum extrusion that conceals front and underside of roller and operating mechanism and attaches to roller endcaps without exposed fasteners.
   a. Shape: L-shaped.
   b. Height: Manufacturer's standard height required to conceal roller and shadeband when shade is fully open, but not less than 4 inches.

2. Exposed Headbox: Rectangular, extruded-aluminum enclosure including front fascia, top and back covers, endcaps, and removable bottom closure.
   a. Height: Manufacturer's standard height required to enclose roller and shadeband when shade is fully open, but not less than 4 inches.

3. Endcap Covers: To cover exposed endcaps.
4. Installation Accessories Color and Finish: As selected from manufacturer's full range.

2.2 ROLLER-SHADE FABRICATION

A. Product Safety Standard: Fabricate roller shades to comply with WCMA A 100.1, including requirements for flexible, chain-loop devices; lead content of components; and warning labels.

B. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 74 deg F:

1. Between (Inside) Jamb Installation: Width equal to jamb-to-jamb dimension of opening in which shade is installed less 1/4 inch per side or 1/2-inch total, plus or minus 1/8 inch. Length equal to head-to-sill or -floor dimension of opening in which shade is installed less 1/4 inch, plus or minus 1/8 inch.

C. Shadeband Fabrication: Fabricate shadebands without battens or seams to extent possible except as follows:

   1. Vertical Shades: Where width-to-length ratio of shadeband is equal to or greater than 1:4, provide battens and seams at uniform spacings along shadeband length to ensure shadeband tracking and alignment through its full range of movement without distortion of the material.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, and other conditions affecting performance of the Work.

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

3.2 ROLLER-SHADE INSTALLATION

A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions.

   1. Opaque Shadebands: Located so shadeband is not closer than 2 inches to interior face of glass. Allow clearances for window operation hardware.

3.3 ADJUSTING

A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.4 CLEANING AND PROTECTION

A. Clean roller-shade surfaces after installation, according to manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer that ensure that roller shades are without damage or deterioration at time of Substantial Completion.
C. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

END OF SECTION 122413
SECTION 123661 - QUARTZ AGGLOMERATE COUNTERTOPS

PART 1 - GENERAL

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

1.2 SUMMARY
   A. Section Includes:
      1. Quartz agglomerate countertops, backsplashes and apron fronts.
   B. Related Requirements:
      1. Division 24 Section for plumbing fixtures for sinks and plumbing fittings.

1.3 ACTION SUBMITTALS
   A. Product Data: For countertop materials.
   B. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.
      1. Show locations and details of joints.
      2. Show direction of directional pattern, if any.
   C. Samples for Initial Selection: For each type of material exposed to view.
   D. Samples for Verification: For the following products:
      1. Countertop material, 6 inches square.

1.4 INFORMATIONAL SUBMITTALS
   A. Qualification Data: For fabricator.

1.5 CLOSEOUT SUBMITTALS
   A. Maintenance Data: For quartz agglomerate countertops to include in maintenance manuals. Include Product Data for care products used or recommended by Installer and names, addresses, and telephone numbers of local sources for products.
1.6 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate countertops similar to that required for this Project, and whose products have a record of successful in-service performance.

B. Installer Qualifications: Fabricator of countertops.

1.7 FIELD CONDITIONS

A. Field Measurements: Verify dimensions of countertops by field measurements before countertop fabrication is complete.

1.8 COORDINATION

A. Coordinate locations of utilities that will penetrate countertops or backsplashes.

PART 2 - PRODUCTS

2.1 QUARTZ AGGLOMERATE COUNTERTOP MATERIALS (S1, S2)

A. Quartz Agglomerate: Solid sheets consisting of quartz aggregates bound together with a matrix of filled plastic resin and complying with ICPA SS-1, except for composition.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Finish Schedule on Drawings or comparable product by one of the following:
   b. Wilsonart.
   c. Formica Corporation.

2. Colors and Patterns: As indicated by manufacturer's designations.

B. Particleboard: ANSI A208.1, Grade M-2.

C. Plywood: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded.

2.2 COUNTERTOP FABRICATION

A. Fabricate countertops according to quartz agglomerate manufacturer's written instructions and the AWI/AWMAC/WI's "Architectural Woodwork Standards."

1. Grade: Premium.

B. Configuration:

1. Front: Straight, slightly eased at top.
2. Backsplash: Straight, slightly eased at corner.

C. Countertops: One piece, 1-1/4-inch thick, quartz agglomerate.

D. Backsplashes: 1/2-inch- thick, quartz agglomerate.
E. Fabricate tops with shop-applied edges unless otherwise indicated. Comply with quartz agglomerate manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.

1. Fabricate with loose backsplashes for field assembly.

F. Joints: Fabricate countertops without joints.

G. Cutouts and Holes:

1. Undercounter Plumbing Fixtures: Make cutouts for fixtures using template or pattern furnished by fixture manufacturer. Form cutouts to smooth, even curves.
   a. Provide vertical edges, slightly eased at juncture of cutout edges with top and bottom surfaces of countertop and projecting 3/16 inch into fixture opening.
   b. Provide vertical edges, rounded to 3/8-inch radius at juncture of cutout edges with top surface of countertop, slightly eased at bottom, and projecting 3/16 inch into fixture opening.
   c. Provide 3/4-inch full bullnose edges projecting 3/8 inch into fixture opening.


3. Fittings: Drill countertops in shop for plumbing fittings, undercounter soap dispensers, and similar items.

2.3 INSTALLATION MATERIALS

A. Adhesive: Product recommended by quartz agglomerate manufacturer.

B. Sealant for Countertops: Comply with applicable requirements in Division 07 Section "Joint Sealants."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates to receive quartz agglomerate countertops and conditions under which countertops will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of countertops.

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

3.2 INSTALLATION

A. Install countertops level to a tolerance of 1/8 inch in 8 feet, 1/4 inch maximum. Do not exceed 1/64-inch difference between planes of adjacent units.

B. Fasten countertops by screwing through corner blocks of base units into underside of countertop. Predrill holes for screws as recommended by manufacturer. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with quartz agglomerate manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

C. Secure countertops to subtops with adhesive according to quartz agglomerate manufacturer's written instructions. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to
comply with quartz agglomerate manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

D. Bond joints with adhesive and draw tight as countertops are set. Mask areas of countertops adjacent to joints to prevent adhesive smears.
   1. Install metal splines in kerfs in countertop edges at joints. Fill kerfs with adhesive before inserting splines and remove excess immediately after adjoining units are drawn into position.
   2. Clamp units to temporary bracing, supports, or each other to ensure that countertops are properly aligned and joints are of specified width.

E. Install backsplashes by adhering to wall and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears.

F. Install aprons to backing and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears. Fasten by screwing through backing. Predrill holes for screws as recommended by manufacturer.

G. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.
   1. Seal edges of cutouts in particleboard subtops by saturating with varnish.

H. Apply sealant to gaps at walls; comply with Division 07 Section "Joint Sealants."

END OF SECTION 123661
SECTION 123662 - SOLID SURFACING FABRICATIONS

PART 1 - GENERAL

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

1.2 SUMMARY
A. Section Includes:
   1. Solid surface material window sills.
B. Related Requirements:
   1. Division 06 Section "Rough Carpentry" for solid surfacing substrate panel.

1.3 ACTION SUBMITTALS
A. Product Data: For window sill materials.
B. Samples for Verification: For the following products:
   1. Window sill material, 6 inches square.

1.4 FIELD CONDITIONS
A. Field Measurements: Verify dimensions of window sills by field measurements before window sill fabrication is complete.

PART 2 - PRODUCTS

2.1 SOLID SURFACE WINDOW SILL MATERIALS (S3)
A. Solid Surface Material: Homogeneous-filled plastic resin complying with ICPA SS-1.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Finish Schedule on Drawings or comparable product by one of the following:
      a. Avonite Surfaces.
      c. Formica Corporation.
   2. Type: Provide Standard type.
   3. Colors and Patterns: As indicated by manufacturer's designations.
2.2 WINDOW SILL FABRICATION

A. Fabricate window sills according to solid surface material manufacturer's written instructions and to the AWI/AWMAC/WI's "Architectural Woodwork Standards."
   1. Grade: Premium.

B. Window Sill: 3/4-inch-thick, solid surface material.

C. Fabricate sills with shop-applied edges unless otherwise indicated. Comply with solid surface material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.

D. Joints: Fabricate window sills without joints.

2.3 INSTALLATION MATERIALS

A. Adhesive: Product recommended by solid surface material manufacturer.

B. Sealant for Window Sills: Comply with applicable requirements in Division 07 Section "Joint Sealants."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates to receive solid surface material window sills and conditions under which window sills will be installed for compliance with requirements, installation tolerances and other conditions affecting performance of window sills.

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

3.2 INSTALLATION

A. Install window sill level to a tolerance of 1/8 inch in 8 feet, 1/4 inch maximum. Do not exceed 1/64-inch difference between planes of adjacent units.

B. Fasten subtops to top of wall below by screwing through subtops into framing of wall. Shim as needed to align subtops in a level plane.

C. Secure window sills to subtops with adhesive according to solid surface material manufacturer's written instructions. Align adjacent surfaces and, using adhesive in color to match window sill, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

D. Apply sealant to gaps at walls; comply with Division 07 Section "Joint Sealants."
SECTION 124813 - ENTRANCE FLOOR MATS

PART 1 - GENERAL

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

1.2 SUMMARY
   A. Section Includes:
      1. Resilient entrance mats.

1.3 COORDINATION
   A. Coordinate size and location of recesses in concrete to receive floor mats and frames.

1.4 ACTION SUBMITTALS
   A. Product Data: For each type of product.
      1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for floor mats and frames.
   B. Shop Drawings:
      1. Items penetrating floor mats and frames, including door control devices.
      2. Divisions between mat sections.
      3. Perimeter floor moldings.

1.5 CLOSEOUT SUBMITTALS
   A. Maintenance Data: For floor mats and frames to include in maintenance manuals.

PART 2 - PRODUCTS

2.1 ENTRANCE FLOOR MATS, GENERAL
   A. Regulatory Requirements: Comply with applicable provisions in, ICC A117.1.

2.2 RESILIENT ENTRANCE MATS (FM1)
   A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Finish Schedule on Drawings or approved comparable product.
B. Carpet-Type Mats: Solution Dyed Nylon carpet bonded to 1/8- to 1/4-inch-thick, flexible vinyl backing to form mats 3/8 or 7/16 inch thick with nonraveling edges.

1. Mat Tile Size: As indicated.
2. Construction: Tufted, Textured loop.
3. Face Weight:
4. 28 oz. per square yard
5. Pile Height: 0.256 inch
6. Density (Average): 5,678
7. ADA Compliant

2.3 FABRICATION

A. Floor Mats: Shop fabricate units to greatest extent possible in sizes indicated. Unless otherwise indicated, provide single unit for each mat installation; do not exceed manufacturer's recommended maximum sizes for units that are removed for maintenance and cleaning. Where joints in mats are necessary, space symmetrically and away from normal traffic lanes. Miter corner joints in framing elements with hairline joints or provide prefabricated corner units without joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and floor conditions for compliance with requirements for location, sizes, minimum recess depth, and other conditions affecting installation of floor mats.

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

END OF SECTION 124813
SECTION 142400 - HYDRAULIC ELEVATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes hydraulic passenger elevators.

B. Related Requirements:

1. Division 04 Section "Unit Masonry" for setting sleeves, inserts, and anchoring devices in masonry and for grouting elevator entrance frames installed in masonry walls.
2. Division 05 Section "Metal Fabrications" for the following:
   a. Attachment plates and angle brackets for supporting guide-rail brackets.
   b. Hoist beams.
   c. Structural-steel shapes for subsills.
   d. Pit ladders.
   e. Cants in hoistways made from steel sheet.
3. Division 09 Section "Resilient Tile Flooring" for rubber flooring in elevator cars.
4. Division 22 Section "Sump Pumps" for sump pumps, sumps, and sump covers in elevator pits.

1.3 ACTION SUBMITTALS

A. Product Data: Include capacities, sizes, performances, operations, safety features, finishes, and similar information. Include product data for car enclosures, hoistway entrances, and operation, control, and signal systems.

B. Shop Drawings:

1. Include plans, elevations, sections, and large-scale details indicating service at each landing, machine room layout, coordination with building structure, relationships with other construction, and locations of equipment.
2. Include large-scale layout of car-control station.
3. Indicate maximum dynamic and static loads imposed on building structure at points of support, and maximum and average power demands.

C. Samples for Initial Selection: For finishes involving color selection.

D. Samples for Verification: For exposed car, hoistway door and frame, and signal equipment finishes; 3-inch-square Samples of sheet materials; and 4-inch lengths of running trim members.
1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Manufacturer Certificates: Signed by elevator manufacturer certifying that hoistway and pit, as shown on Drawings, and electrical service, as shown and specified, are adequate for elevator system being provided.

C. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For elevators to include in emergency, operation, and maintenance manuals.

B. Inspection and Acceptance Certificates and Operating Permits: As required by authorities having jurisdiction for normal, unrestricted elevator use.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Elevator manufacturer or an authorized representative who is trained and approved by manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle materials, components and equipment in manufacturer's protective packaging. Store materials, components, and equipment off of ground, under cover, and in a dry location.

1.8 COORDINATION

A. Coordinate installation of sleeves, block outs, elevator equipment with integral anchors, and other items that are embedded in concrete or masonry for elevator equipment. Furnish templates, sleeves, elevator equipment with integral anchors, and installation instructions and deliver to Project site in time for installation.

B. Coordinate locations and dimensions of other work relating to hydraulic elevators including pit ladders; sumps and floor drains in pits; entrance subsills; electrical service; and electrical outlets, lights, and switches in hoistways and pits.

1.9 WARRANTY

A. Manufacturer's Special Warranty: Manufacturer agrees to repair, restore, or replace elevator work that fails in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, operation or control system failure, including excessive malfunctions; performances below specified ratings; excessive wear; unusual deterioration or aging of materials or finishes; unsafe conditions; need for excessive maintenance; abnormal noise or vibration; and similar unusual, unexpected, and unsatisfactory conditions.

2. Warranty Period: one year(s) from date of Substantial Completion.
PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: The elevator design is based on “HydroFit #3500” Machine-Roomless Holeless Hydraulic Elevator by Otis Elevator Company. Subject to compliance with requirements, provide the Basis-of-Design Product or approved comparable product.

B. Source Limitations: Obtain elevators from single manufacturer.

1. Major elevator components, including pump-and-tank units, plunger-cylinder assemblies, controllers, signal fixtures, door operators, car frames, cars, and entrances, shall be manufactured by single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with ASME A17.1/CSA B44.

B. Accessibility Requirements: Comply with Section 407 in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and with ICC A117.1.

2.3 ELEVATORS

A. Elevator System, General: Manufacturer's standard elevator systems. Unless otherwise indicated, manufacturers' standard components shall be used, as included in standard elevator systems and as required for complete system.

B. Elevator Description:

1. Elevator Number(s): 1.
2. Type: Holeless, beside-the-car, single-acting, dual cylinder.
4. Rated Speed: 100 fpm.
6. Auxiliary Operations:
   a. Battery-powered lowering.

7. Security Features: Keyswitch operation.
8. Hoistway Entrances:
   a. Width and Height: Refer to Drawings.
   b. Type: Single-speed center opening.
   c. Frames: Satin stainless steel, No. 4 finish.
   d. Doors and Transoms: Satin stainless steel, No. 4 finish.
   e. Sills: Aluminum, mill finish.

10. Additional Requirements:
   a. Provide inspection certificate in each car, mounted under acrylic cover with frame made from satin stainless steel, No. 4 finish.
   b. Provide hooks for protective pads in all cars and one complete set(s) of full-height protective pads.
2.4 SYSTEMS AND COMPONENTS

A. Pump Units: Positive-displacement type with a maximum of 10 percent variation between no load and full load and with minimum pulsations.

B. Piping: Size, type, and weight of piping as recommended by elevator manufacturer, with flexible connectors to minimize sound and vibration transmissions from power unit.

C. Buffers: Polyurethane

D. Hydraulic Fluid: Elevator manufacturer's standard fluid with additives as needed to prevent oxidation of fluid, corrosion of cylinder and other components, and other adverse effects.

E. Inserts: Furnish required concrete and masonry inserts and similar anchorage devices for installing guide rails, machinery, and other components of elevator work. Device installation is specified in another Section.

F. Car Frame and Platform: Welded steel units.

G. Guides: Roller guides; polymer-coated, nonlubricated sliding guides; or sliding guides with guide-rail lubricators. Provide guides at top and bottom of car and counterweight frames.

2.5 OPERATION SYSTEMS

A. General: Provide manufacturer's standard microprocessor operation system as required to provide type of operation indicated.

B. Auxiliary Operations: In addition to primary operation system features, provide the following operational features for elevators where indicated:

   1. Single-Car Battery-Powered Lowering: When power fails, car is lowered to the lowest floor, opens its doors, and shuts down. System includes rechargeable battery and automatic recharging system.

C. Security Features: Provide the following security features, where indicated. Security features shall not affect emergency firefighters' service.

   1. Keyswitch Operation: Push buttons are activated and deactivated by security keyswitches at car-control stations. Key is removable only in deactivated position.

2.6 DOOR REOPENING DEVICES

A. Infrared Array: Provide door reopening device with uniform array of 36 or more microprocessor-controlled, infrared light beams projecting across car entrance. Interruption of one or more light beams shall cause doors to stop and reopen.

B. Nudging Feature: After car doors are prevented from closing for predetermined adjustable time, through activating door reopening device, a loud buzzer shall sound and doors shall begin to close at reduced kinetic energy.

2.7 CAR ENCLOSURES

A. General: Provide enameled-steel car enclosures to receive removable wall panels, with removable car roof, access doors, power door operators, and ventilation.
1. Provide standard railings complying with ASME A17.1/CSA B44 on car tops where required by ASME A17.1/CSA B44.

B. Fabrication: Manufacturer's standards, but not less than the following:

1. Fabricate car with recesses and cutouts for signal equipment.
2. Fabricate car door frame integrally with front wall of car.
3. Inside Width: Not less than 70 inches from side wall to side wall.
4. Inside Depth: Not less than 66 inches from back wall to front wall (return panels).
5. Inside Height: Not less than 93 inches to underside of ceiling.

C. Materials and Finishes: Manufacturer's standards, but not less than the following:

1. Front Walls (Return Panels): Polished stainless steel, No. 8 finish with integral car door frames.
2. Car Fixtures: Polished stainless steel, No. 8 finish.
3. Ceiling: Manufacturer’s white ceiling panels with manufacturer’s standard four LED downlight cutouts. Align ceiling panel joints with wall panels joint.
4. Side and Rear Wall Panels (WP1): Plastic laminate; refer to Finish Schedule on Drawings.
5. Reveals: Black.
7. Door Sills: Aluminum.
9. Floor (LVT1): Vinyl tile; refer to Finish Schedule on Drawings and Division 09 Section "Resilient Flooring" for floor preparation.
10. Wall Base (SB1): Manufacturer’s standard stainless steel; satin finish; refer to Finish Schedule on Drawings.

2.8 HOISTWAY ENTRANCES

A. Hoistway Entrance Assemblies: Manufacturer's standard horizontal-sliding, door-and-frame hoistway entrances complete with track systems, hardware, sills, and accessories. Frame size and profile shall accommodate hoistway wall construction.

1. Where gypsum board wall construction is indicated, frames shall be self-supporting with reinforced head sections.

B. Fire-Rated Hoistway Entrance Assemblies: Door and frame assemblies shall comply with NFPA 80 and be listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction based on testing at as close-to-neutral pressure as possible according to NFPA 252.

1. Fire-Protection Rating: 1 hour, unless otherwise indicated.

C. Materials and Fabrication: Manufacturer's standards, but not less than the following:

1. Steel Subframes: Formed from cold- or hot-rolled steel sheet, with factory-applied enamel finish or rust-resistant primer. Fabricate to receive applied finish as indicated.
2. Stainless-Steel Frames: Formed from stainless-steel sheet.
5. Aluminum Extrusions: ASTM B 221, Alloy 6063.
6. Plastic Laminate: High-pressure type complying with NEMA LD 3, Type HGS for flat applications.
7. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M.
2.9 SIGNAL EQUIPMENT

A. General: Provide hall-call and car-call buttons that light when activated and remain lit until call has been fulfilled. Fabricate lighted elements with LEDs.

B. Car-Control Stations: Provide manufacturer's standard recessed or semi-recessed car-control stations. Mount in return panel adjacent to car door unless otherwise indicated.
   1. Mark buttons and switches for required use or function. Use both tactile symbols and Braille.
   2. Provide "No Smoking" sign matching car-control station, either integral with car-control station or mounted adjacent to it, with text and graphics as required by authorities having jurisdiction.

C. Emergency Communication System: Two-way voice communication system, with visible signal, which dials preprogrammed number of monitoring station and does not require handset use. System is contained in flush-mounted cabinet, with identification, instructions for use, and battery backup power supply.

D. Car Position Indicator: Provide illuminated, digital-type car position indicator, located above car door or above car-control station. Also, provide audible signal to indicate to passengers that car is either stopping at or passing each of the floors served. Include travel direction arrows if not provided in car-control station.

E. Hall Push-Button Stations: Provide one hall push-button station at each landing.
   1. Provide manufacturer's standard wall-mounted units.
   2. Equip units with buttons for calling elevator and for indicating applicable direction of travel.

F. Hall Lanterns: Units with illuminated arrows; but provide single arrow at terminal landings. Provide the following:
   1. Manufacturer's standard wall-mounted units, for mounting above entrance frames.

G. Hall Annunciator: With each hall lantern, provide audible signals indicating car arrival and direction of travel. Signals sound once for up and twice for down.
   1. At manufacturer's option, audible signals may be placed on cars.

H. Hall Position Indicators: Provide illuminated, digital-display-type position indicators, located above hoistway entrance at ground floor. Provide units with flat faceplate for mounting and with body of unit recessed in wall.
   1. Integrate ground-floor hall lanterns with hall position indicators.

I. Emergency Pictorial Signs: Fabricate from materials matching hall push-button stations, with text and graphics as required by authorities having jurisdiction, indicating that in case of fire elevators are out of service and exits should be used instead. Provide one sign at each hall push-button station unless otherwise indicated.

2.10 FINISH MATERIALS

A. General: Provide the following materials for exposed parts of elevator car enclosures, car doors, hoistway entrance doors and frames, and signal equipment as indicated.

B. Cold-Rolled Steel Sheet: ASTM A 1008, commercial steel, Type B, exposed, matte finish.

C. Hot-Rolled Steel Sheet: ASTM A 1011, commercial steel, Type B, pickled.
D. Stainless-Steel Sheet: ASTM A 240, Type 304.
E. Aluminum Extrusions: ASTM B 221, Alloy 6063.
G. High-Pressure Decorative Laminate: NEMA LD 3.

PART 3 - EXECUTION

3.1 EXAMINATION
A. Examine elevator areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work. Verify critical dimensions and examine supporting structure and other conditions under which elevator work is to be installed.
B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION
A. Install cylinder plumb and accurately centered for elevator car position and travel. Anchor securely in place, supported at pit floor and braced at intervals as needed to maintain alignment. Anchor cylinder guides at spacing needed to maintain alignment and avoid overstressing guides.
B. Welded Construction: Provide welded connections for installing elevator work where bolted connections are not required for subsequent removal or for normal operation, adjustment, inspection, maintenance, and replacement of worn parts. Comply with AWS workmanship and welding operator qualification standards.
C. Sound Isolation: Mount rotating and vibrating equipment on vibration-isolating mounts to minimize vibration transmission to structure and structure-borne noise due to elevator system.
D. Install piping per manufacturer’s instructions.
E. Lubricate operating parts of systems as recommended by manufacturers.
F. Alignment: Coordinate installation of hoistway entrances with installation of elevator guide rails for accurate alignment of entrances with car. Where possible, delay installation of sills and frames until car is operable in shaft. Reduce clearances to minimum, safe, workable dimension at each landing.
G. Leveling Tolerance: 1/4 inch, up or down, regardless of load and travel direction.
H. Set sills flush with finished floor surface at landing. Fill space under sill solidly with nonshrink, nonmetallic grout.
I. Locate hall signal equipment for elevators as follows, unless otherwise indicated:
   1. Place hall lanterns either above or beside each hoistway entrance.
   2. Mount hall lanterns at a minimum of 72 inches above finished floor.
3.3 FIELD QUALITY CONTROL

A. Acceptance Testing: On completion of elevator installation and before permitting elevator use (either temporary or permanent), perform acceptance tests as required and recommended by ASME A17.1/CSA B44 and by governing regulations and agencies.

B. Advise Owner, Architect, and authorities having jurisdiction in advance of dates and times that tests are to be performed on elevators.

3.4 PROTECTION

A. Temporary Use: Comply with the following requirements for elevator used for construction purposes:
   1. Provide car with temporary enclosure, either within finished car or in place of finished car, to protect finishes from damage.
   2. Provide strippable protective film on entrance and car doors and frames.
   3. Provide padded wood bumpers on entrance door frames covering jambs and frame faces.
   4. Provide other protective coverings, barriers, devices, signs, and procedures as needed to protect elevator and elevator equipment.
   5. Do not load elevators beyond their rated weight capacity.
   6. Engage elevator Installer to provide full maintenance service. Include preventive maintenance, repair or replacement of worn or defective components, lubrication, cleanup, and adjustment as necessary for proper elevator operation at rated speed and capacity. Provide parts and supplies same as those used in the manufacture and installation of original equipment.
   7. Engage elevator Installer to restore damaged work, if any, so no evidence remains of correction. Return items that cannot be refinished in the field to the shop, make required repairs and refinish entire unit, or provide new units as required.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to operate elevator(s).

B. Check operation of elevator with Owner's personnel present before date of Substantial Completion and again not more than one month before end of warranty period. Determine that operation systems and devices are functioning properly.

3.6 MAINTENANCE

A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of elevator Installer. Include monthly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper elevator operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
   1. Perform maintenance during normal working hours.
   2. Perform emergency callback service during normal working hours with response time of two hours or less.

END OF SECTION 142400
SECTION 15000 - HEATING, VENTILATING AND AIR CONDITIONING

HV-1 GENERAL

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

HV-2 SCOPE OF WORK

a. Include all labor, materials and equipment required for the furnishing, installing and testing, complete and ready for operation in a manner satisfactory to the Owner, all herein specified, including, in general, the following:

   1. Removals
   2. Installation of pre-purchased equipment
   3. HVAC equipment
   4. Piping
   5. Ductwork
   6. Firestopping
   7. Insulation
   8. Air Balancing
   9. Vibration Isolation
   10. Automatic Controls

HV-3 REQUIRED SUBMITTALS

a. Shop drawings, equipment specifications, test reports, etc., shall be submitted by the mechanical contractor in accordance with the requirements of the Supplementary Conditions and HVAC Specifications herein.

b. Submittals shall be pre-reviewed by the construction manager and certified for job conditions and conflicts. Departures from basis of design manufacturers shall include request for substitution and statement of differences. Submittal shall include but not be limited to:

   1. Sheetmetal shop standards, layouts, details
   2. Piping shop standards, layouts, details
   3. Record as-built drawings: Sheetmetal, piping, thermostat layouts
   4. As-built drawings in AutoCAD format on compact disc and 2 prints
   5. Operation and maintenance manuals for mechanical equipment
   6. Electric wiring diagrams for mechanical equipment
   7. Automatic temperature control diagrams, sequence of operation
   8. Manufacturer’s data for equipment (pumps, fans, AHU’s, vibration isolators, temperature and pressure gauges…all scheduled items)
   9. Valve chart draft
   10. Drawings of supports for loads above 100 lbs.
   11. Sketches for expansion loops, anchors and guides
   12. Seismic bracing
   13. Piping system pressure test reports
   14. Written reports of pipe cleaning activities
   15. MSD chemical sheets for water additives
   16. Weld inspector qualifications
   17. Weldment test reports
   18. Flexible ductwork sample
   19. Qualifications of water balancer
20. Water balance reports  
21. Duct system pressure test reports  
22. Air balancer qualifications  
23. Air balance reports  
24. Final air balance report after comfort balance exercise

HV-4 REMOVALS

a. Removals shall include but not be limited to portions of existing piping and ductwork which are not intended to be reused.

b. Refrigerant contained in existing equipment to be removed shall be reclaimed or disposed of in accordance with applicable environmental regulations.

c. Lithium bromine contained in existing absorption chillers to be removed shall be reclaimed or disposed of in accordance with applicable environmental regulations.

d. In addition to the above requirements, refer to General Conditions for DEMOLITION and REMOVALS.

e. Cap and seal any openings in existing piping and/or ductwork not intended for reuse.

HV-5 INSTALLATION OF PRE-PURCHASED EQUIPMENT

a. Accept, store, reassemble as necessary for components knocked down for shipping and handling, and install HVAC equipment as shown.

b. Pre-purchased equipment includes:

HV-6 HVAC FIRST YEAR MAINTENANCE

a. Submit a separate price to provide HVAC maintenance on all equipment installed by the HVAC contractor for one year following the date of Substantial Completion.

b. Service Times:

1. Regular maintenance Monday through Friday, 8:30 am - 4:30 pm, except holidays.

2. Emergency service 24 hours per day, 365 days per year within two hours of receipt of call on equipment utilized on a 24 hr per day basis.

c. Included Services:

1. Filter maintenance, strainer maintenance, lubrication and inspections

2. Repairs resulting from power failures or power surges.

3. Recovery of refrigerant and use of approved refrigerant storage devices under the Federal Clean Air Act (or similar laws and regulations) when servicing the equipment.

4. Air freight and expediting costs incurred in order to make emergency repairs of 24-hour equipment.

5. 24-hour central station monitoring of Computer/Telephone Room temperature and power outage and equipment failure of all 24-hour equipment.
d. Inspect each piece of equipment once per month for one year following the date of Substantial Completion.

1. During each inspection perform the following services:
   
a) Check the operation of all equipment and its conditions
   b) Furnish and install new filters
   c) Lubricate all fan and motor bearings and all moving parts as needed
   d) Lubricate all pump bearings requiring same and check alignment of mechanical seals, pumps and motors
   e) Check all belts and drives and make necessary adjustments
   f) Furnish and install fan belts as needed
   g) Check and clean condensate pumps and float assemblies
   h) Flush and clean drain lines with high pressure CO₂ gas
   i) Check and clean condensate pans
   j) Check operation of all heaters
   k) Check and clean humidifiers
   l) Check and clean water strainers at AC unit locations and pump stations
   m) Check and calibrate thermostats and automatic temperature controls
   n) Check all equipment electrically and mechanically
   o) Check all motor amperage for possible overloads
   p) Visual check for refrigerant leaks
   q) Lubricate automatic dampers and check operation

HV-7 PIPE AND PIPE FITTINGS

a. General: Provide piping work in accordance with the Contract Documents. Uninsulated piping in exposed areas shall be cleaned and painted with rust-proof primer. Finish coat shall be applied in ANSI Standard color or as selected by the Owner.

b. Except as modified by local governing codes and the Contract Documents, comply with the applicable provisions and recommendations of ANSI, ASTM, ASME and AWS.

c. In general, for welded piping, branch takeoffs from pipe mains shall be made with standard welding tees. Weldolet type reinforced branch connection fittings may be used at the Contractor’s option on branch sizes at least two standard pipe size smaller than the size of the main pipe.

d. Steel piping 2-1/2” and smaller shall have threaded connections, except as otherwise specified. Steel piping 3” and larger shall have welded connections.

e. Copper Piping: Silver braze joints for condenser/chilled water service. Soldered joints with 95-5 tin/antimony solder for coil condensate and drains.

f. Glycol Piping: Welded or brazed joints. Threaded joints shall not be used.

g. Galvanized Piping: Threaded connections.

h. Refrigerant Piping: Brazed joints.

i. Fuel Oil Piping: Welded steel pipe for oil, fill and vent pipe. Use seamless steel when oil storage is above the lowest floor.

j. Dielectric Pipe Union: As manufactured by Hart Dielectric Union Model D-3136-V-CS1B. Provide dielectric fittings at junction of dissimilar metals: Copper, steel, cast iron, brass, bronze and stainless steel.
k. Piping Materials:

<table>
<thead>
<tr>
<th>Service</th>
<th>Size</th>
<th>Material</th>
<th>Type</th>
<th>Weight</th>
<th>Rating (psig)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hot Water</td>
<td>To 4”</td>
<td>Copper, B88</td>
<td>Rigid</td>
<td>Type K</td>
<td>300</td>
</tr>
<tr>
<td></td>
<td>5” &amp; Up</td>
<td>Steel, A53</td>
<td>Black</td>
<td>Sch 40</td>
<td>300</td>
</tr>
<tr>
<td>Refrigerant</td>
<td>To 2-1/2”</td>
<td>Copper, B88</td>
<td>Rigid or Soft</td>
<td>Type K or L</td>
<td>250</td>
</tr>
<tr>
<td>City Water</td>
<td>To 2”</td>
<td>Copper, B88</td>
<td>Rigid</td>
<td>Type L</td>
<td>125</td>
</tr>
<tr>
<td>Coil Condensate</td>
<td>All</td>
<td>Copper, B88</td>
<td>Rigid</td>
<td>Type L</td>
<td>125</td>
</tr>
<tr>
<td>Fuel Oil</td>
<td>All</td>
<td>Steel</td>
<td>Black</td>
<td>Sch 40</td>
<td>250</td>
</tr>
<tr>
<td>Drains</td>
<td>All</td>
<td>Copper, B88</td>
<td>Rigid</td>
<td>Type L</td>
<td>125</td>
</tr>
</tbody>
</table>

l. Pipe Unions: Cast iron or bronze body, screwed, ground joint, brass seats; 300 psig for pipe 2” and smaller.

m. Pipe Flanges: ANSI B 16.5 and ASTM A-181 welding neck. Use on welded pipe for unions and at valves. Facing on flange shall match facing on equipment (flat or raised face). Studs shall be of carbon steel. Flanges shall be of the same pressure rating as the fittings and valves in each service category.

n. Piping Installation: Piping shall be installed in neat workmanlike manner with multiple pipes run in parallel banks which are properly pitched and routed parallel and perpendicular to building features. Valves, strainers and gauges and other appurtenances shall be readily accessible for service. Coordinate with other trades and relocate items as needed for final coordinated assembly.

o. Pipe Sleeves:

1. Provide for all pipes passing through floors, walls, partitions, concrete beams and girders and sleeves, types as scheduled below, of adequate diameter to allow a minimum of 3/4” clear all around between sleeve and pipe. When piping is required to be insulated, insulation shall pass continuously through the sleeve with 1/2” clearance between insulation and sleeve.

2. Non-Fire Rated Walls & Floor Penetrations: Sleeves shall be Pipe Shields, Inc. “Adjust-To Crete”, or approved equal, 24 gauge minimum galvanized sheet metal as scheduled below. “Adjust-To Crete” figure No. used for reference:

<table>
<thead>
<tr>
<th>Type</th>
<th>Figure No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drywall</td>
<td>#11</td>
</tr>
<tr>
<td>Concrete or masonry walls &amp; concrete beams</td>
<td>#100</td>
</tr>
<tr>
<td>Concrete floors</td>
<td>#10</td>
</tr>
<tr>
<td>Concrete floors with metal underdeck</td>
<td>#2</td>
</tr>
<tr>
<td>(tack weld to deck)</td>
<td></td>
</tr>
</tbody>
</table>
3. Fire Rated Wall & Floor Penetrations: All pipes penetrating fire walls and floors shall be encased in adjustable or fixed length metal cans, minimum 24 gauge, sized for maximum ½” spacing between insulation and can. Insulation shall consist of 360 waterproof calcium silicate insert sized to extend to a minimum of 1” beyond wall or floor penetration. Calcium silicate insert shall be same thickness as the adjoining pipe insulation. Spacing between insulation and can shall be packed on either end with double neoprene coated rope positively fastened or mineral wool with metal escutcheon. Work shall be in compliance with International Mechanical Code for penetration of rated wall construction. Refer to the architectural drawings for all fire rated wall locations.

p. Floor and Ceiling Escutcheons:

1. On all exposed pipes passing through floors, walls, partitions, plaster furring, etc., provide 1” split-type steel plates. In finished rooms, plates shall be nickel-plated; in unfinished rooms, plates shall be prime coated. Plates shall be similar to Grinnell No. 10.

q. Hangers, Anchors and Concrete Inserts:

1. Furnish and install suitable and substantial hangers, anchors, inserts and supports for all piping as specified herein, and as required. Submit locations for all supports and hangers. All figure numbers indicated herein are Grinnell Co. or as approved.

2. Horizontal copper piping shall be supported in accordance with the following schedule:

<table>
<thead>
<tr>
<th>Pipe Size</th>
<th>Rod Diameter</th>
<th>Maximum Hanger Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>1” &amp; smaller</td>
<td>3/8”</td>
<td>6’</td>
</tr>
<tr>
<td>1-1/4” to 2”</td>
<td>3/8”</td>
<td>9’</td>
</tr>
<tr>
<td>2-1/2” to 4”</td>
<td>1/2”</td>
<td>10’</td>
</tr>
<tr>
<td>6” and larger</td>
<td>1/2”</td>
<td>12’</td>
</tr>
</tbody>
</table>

3. Horizontal steel piping shall be supported in accordance with the following schedule.

<table>
<thead>
<tr>
<th>Pipe Size</th>
<th>Rod Diameter</th>
<th>Maximum Hanger Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>1” &amp; smaller</td>
<td>3/8”</td>
<td>6’</td>
</tr>
<tr>
<td>1-1/2” to 2”</td>
<td>1/2”</td>
<td>9’</td>
</tr>
<tr>
<td>2-1/2” to 3”</td>
<td>1/2”</td>
<td>11’</td>
</tr>
<tr>
<td>4”-5”</td>
<td>5/8”</td>
<td>14’</td>
</tr>
<tr>
<td>6”</td>
<td>3/4”</td>
<td>17’</td>
</tr>
<tr>
<td>8” and larger</td>
<td>1”</td>
<td>18’</td>
</tr>
</tbody>
</table>

4. No piping shall be hung from other piping, service, or ceiling hangers. In no case shall hangers be supported by means of vertical expansion bolts. Hangers for piping which supports in-line pumps shall be provided with vibration isolators to minimize vibration transmission to building structure.

5. Furnish and install approved roller supports, floor stands, wall brackets, etc. for all lines running near the floor or near walls, which can be properly supported or suspended by the floors or the walls. Pipe lines near walls may also be hung by hangers carried from approved wall brackets at a higher level than the pipe. Grinnell Co. pipe rolls Fig. 181, and wall brackets Fig. 195.
6. Hangers shall be heavy construction suitable for the size of pipe to be supported. Hangers for pipes up to and including 5” shall be adjustable wrought Clevis type. Hangers for any trapeze assembly shall consist of two rods and cross-bar with pipe roll complete with adjustable sockets and nuts. Where hanger rods extend below 7 feet A.F.F., they shall be protected from causing head injuries or replaced with Clevis hangers. Clevis hangers Fig. 260, ring hangers Fig. C1-97.

7. Piping secured to strut channels (Kindorf, Unistrut, etc.) shall be clamped with cushioned clamp assembly similar to Hydra-Zorb cushion clamps (Jarett Industries, Inc., NJ 201-539-4410). Clamp assemblies shall allow pipe and tube sizes to be intermixed on variable centers as needed to conserve space and to allow for addition or removal of tube or pipe without unclamping other elements.

Cushions shall be of resilient material; resistant to oils, hydraulic fluids, grease, fuels, common solvents, salt solutions, dilute bases and mineral acids; and not degrade at operating temperatures of 250°F. Cushions shall perform the additional function of providing a thermal break between the pipe and the metal clamp.

8. Provide all secondary structural steel members necessary to support pipes in shafts except where provided on structural drawings. The steel shall be adequately tied to the building structure. Detailed drawings of connections and calculations of supporting means shall be submitted.

9. Contractor shall be responsible for determining weight loads of all piping, forces on anchors, expansion joints/loops, etc., and coordination with structural engineer for adequacy of all supports.

r. Expansion Joints and Bends:

1. Piping shall be installed in such a manner as to allow for thermal expansion and contraction without excessive strain to connections at equipment or interconnecting piping.

2. Piping shall be properly anchored and guided in accordance with the Standards of The Expansion Joint Manufacturers Association. Submit drawings showing proposed expansion loops, anchor, and pipe guide locations, as well as details of construction of such piping system components not otherwise specified or shown. Drawings shall indicate stress loads for structural review.

3. Unless expansion joints are specifically shown, pipe expansion, in general, is to be absorbed in bends, swing joints, and offsets as required. Piping mains, branches, and run-outs shall be so installed as to allow for free expansion and contraction without developing leaks or undue stressing of pipe. Stresses shall be within allowable limits of ANSI Code B31.11 for Pressure Piping. Submit engineering data.

HV-8 PIPE SYSTEM PRESSURE TESTS

a. Test all piping except drainage connections, including valves, fittings and joints hydrostatically at a pressure equal to at least 1-1/2 times the working pressure, but no less than 200 psig for a minimum of four (4) hours. Blank off or remove elements or equipment which may be damaged by the pressure. Open but do not back seat valves. Inspect all joints and connections. Confirm no visible leakage and negligible drop in pressure.

b. Where new pipe is connected to existing pipe, contractors shall install flanged connection to enable pressure testing of new pipe sections. A “frying pan” shall be inserted into the flanged connection for isolation prior to pressure testing and shall be removed after the test is successfully completed.
c. Repair leaks in accordance with the following procedures. In each case, a retest shall be necessary after repairs are made.

1. Soldered/Brazed joints: Remove solder/brazing alloy and reapply with proper flux.

2. Flanged/Grooved end Joints: Check to determine that all bolts are uniformly tightened with the required torque. If leak persists, depressurize the line, remove gasket, examine flange/grooved end faces, and insert new gasket.

3. Threaded Joints: Tighten joint to a reasonable torque. If leak continues replace pipe and/or fittings. Do not use pipe dope or cement to stop pipe leaks.

4. Leaks in Material: Leaks located in pipe material shall require the replacement of that section of pipe.

HV-9 CLEANING OF PIPING

a. Plug open ends of piping, valves and equipment except when Work is being performed. Protect connections to equipment and control valves with temporary screens and flush piping with water. Remove dirt and debris collected.

b. Thoroughly clean new piping to remove organics, rust, and foreign matter.

c. Perform chemical cleaning after successfully completing pressure and leakage tests and thoroughly flushing the systems.

d. Use cleaning agents which will not interact with any of the materials in the systems in any way to produce corrosion, form deposits, weaken, reduce the life or in any way have a detrimental effect on any system components.

e. Fill the system with clean water and add sufficient cleaning preparation to provide a concentration adequate to perform complete cleaning. Add the cleaning preparation at a point which will assure good mixing.

f. Provide temporary containers to accommodate the foam that may form and temporary pumps to circulate the chemical solution. Provide capped outlet cleaning ports, as required, to connect temporary pumps to appropriate sections of pipe.

g. Circulate the mixture of cleanser and water for a sufficient length of time to complete the cleaning.

h. Drain the system, flush with clean water, clean permanent strainers and screens, remove temporary screens, and refill the system.

i. Cleaner for the new piping shall be 3DTRASAR (3DT701) as manufactured by the Nalco Chemical Co. or the approved equal. Contact current system chemical treatment vendor to confirm compatibility with existing system chemistry.

j. The entire cleaning operation shall be performed by a competent water treatment service organization in strict accordance with the manufacturer’s recommendations. Provide written certification after the cleaning operation is completed.

k. Obtain clean water approval from Building Management by submitting water sample and certificate. Begin circulation of building/tenant system within 5 days of treatment.

HV-10 VALVES
a. General: Provide valves of type and size as shown on the Drawings and as specified herein and as may be necessary for isolation, balancing and maintenance of piping distribution systems and equipment. Valves shall be of minimum working pressure and materials as pipe fittings specified for the service. Provide chain operator assemblies for valves mounted over 8 feet high in machine rooms.

b. Gate: Use for general isolation of pipe branches, pumps and equipment. Valve bodies shall be bronze for sizes 2” and below; IBBM for 2-1/2” and up. Manufacturers: Crane Stockham, Walworth, Jenkins, Kennedy, or as approved.

c. Ball: Use for shut off services for sizes 2” and below for non-corrosive service. Extended stems and handles shall be provided on insulated piping systems to coordinate with insulation thickness. Ball valves for 250 psig service and below shall be provided with bronze bodies, stainless steel ball, stem and seat ring, TFE bushing and ring gasket. Ball valves rated above 250 psig shall be carbon or 316 stainless steel body with 316 stainless ball. Full port ball valves shall be used.

d. Butterfly: Use for shut off only for sizes 2-1/2” and above for non corrosive service. Butterfly valves shall be of the bi-directional lug type, ANSI Class 150, 250 or 300 depending upon service. Mating pipe flange shall be weld neck type. Gear operators shall be provided on manual valves 4” size and larger. Iron body, 316 stainless steel disc, DeZurick or as approved.

e. Ballcentric: Use at return pipe of each water coil, heat exchanger, cooler, and condenser. Use at discharge pipe of each pump, and at each water system return riser and branch pipe off main pipe for isolation usage and minor balancing. Ballcentric valves shall be of the eccentric non-lubricating type as manufactured by DeZurick, Homestead, Nordstrom, or as approved. Water working pressure rating shall match installed piping service rating. Valves 8” size and smaller should be semi-steel construction and equipped with gear operator for size 6” and larger.

f. Silent Check: Use at pump discharge for chilled, condenser, glycol, and hot water systems. Water working pressure rating shall match installed piping service rating. Valves 2-1/2” size and larger shall be iron body, bronze trim; size 2” and smaller shall be semi-steel with bronze trim. Valves shall be manufactured by Mueller, Williams-Hagen, Smolensky, or as approved.

g. Wye Strainers: Strainers shall be the same size of pipe lines in which they are installed. Strainer bodies shall be bronze for copper piping systems and cast iron for steel piping systems with bottoms drilled and plugged. The bodies shall have arrows clearly cast on the sides to indicate the direction of flow. Each strainer shall be equipped with an easily removable cover and sediment basket. The basket shall be made of monel, not less than 0.025” thick (22 gauge), with approved size perforations of sufficient number to provide a net-free area through the basket of at least four times that of the entering pipe. The flow shall be into the basket and through the perforations. The basket shall seal against machined seat both in the body, and at the lap. The lap shall have a gasket seal between it and the strainer body. Strainers shall be as manufactured by Bailey, Illinois, Crane, Mueller, or Warren Webster. Provide valved blow-off with threaded hose connections at each strainer outlet, size to match strainer taps. Body pressure ratings shall be in accordance with working pressure for systems of this Section. Water systems: 3/16” perforations.

h. Constant Flow Valves: Bodies shall be constructed of brass, bronze, copper, or ductile iron with threaded, sweat, or flanged connections. Inner working cartridges shall be factory set to maintain specified constant flow rate with ±10% accuracy over a range of system pressure fluctuations. Effective operating ranges shall 2–80 PSID. Each valve shall have an identification label, or tag attached by chain, and shall be factory marked with manufacturer identification, valve series, and flow rate. Optional readout kit including differential pressure gauge, probes, and carrying case must be made available for purchase from the manufacturer.
1. Operating Pressure: Up to 1-1/2” – minimum 600 PSIG (except models 2511 and 2521 – 522 PSIG)/ Above 1-1/2” – minimum 400 PSIG.

2. Temperature Range: 32°–225°F.

3. Flow-Control Cartridge: Cartridge internal control mechanism shall be of a quiet, clog resistant design, and consist of one or more high temperature elastomeric diaphragm and polyphenylsulfone orifice plate. Manufacturer shall offer optional valve body style that allows for flow-control cartridge change-out.

4. Combination Valve Assemblies: Y-type body to include flow-control cartridge, ball valve, pressure/temperature ports, and union-end connection.

5. Warranty: Lifetime on elastomeric diaphragms and polyphenylsulfone orifice plates.


i. Manual Balancing Valves: Multi function globe-type balancing valves shall feature shut off, flow measurement, pressure measurement, temperature measurement and calibrated flow settings with four-turn digital reading handwheel. P/T test ports shall be self sealing type for temperature and pressure insertion probes. Valve body shall be Y-pattern globe style design with non-ferrous parts, suitable for water service between 20°F and 240°F temperature at 300 psig pressure rating. Provide reading kit with pressure gauge, hose and probe, pressure drop graph and flow balancing wheel to determine actual flow rates from differential pressure readings. Victaulic Series 78. Grooved, threaded or flanged ends as needed for the intended service

j. Refrigerant Valves:

   1. Manual shutoff valves shall be angle-stop type with back-seating construction to prevent leakage at valve stem packing. Valves shall be specifically designed for refrigerant use.

   2. Service valves shall include back-seating access port for pressure testing the system.

HV-11 COIL CONDENSATE PUMPS

a. Provide coil condensate pumps where 1/8” per 1’0” gravity pitch is unattainable due to field conditions.

b. Vertical type pumping unit with cast aluminum reservoir, ABS motor, tank cover, volute and impeller. Thermally protected motor with stainless steel shaft.

c. Pump assembly shall be UL-2043 listed (plenum rated) and equipped with snap action mercury float switch. Unit shall be hard-wired for 120V for use in ceiling plenum.

d. Capacity – 139/51 GPH at 12’/20’ lift. 22’ shutoff head.

e. Provide high level switch and contacts for external alarm controls.

f. Pump shall be Hartell Model KL-1DG or reviewed equivalent.

HV-12 PUMPS, IN LINE

a. Provide pumps with capacities as shown. Pumps shall be in-line, close-coupled, single-stage design for installation vertical or horizontal position, and capable of being serviced without disturbing piping connections.
b. Pump shall be of Class 30 cast iron. The impeller shall be cast bronze, enclosed type, dynamically balanced, keyed to the shaft and secured by a locking capscrew.

c. The liquid cavity shall be sealed off at the motor shaft by an internally-flushed mechanical seal with ceramic seal seat and carbon seal ring, suitable for continuous operation at 225 degrees Fahrenheit. A bronze shaft sleeve shall completely cover the wetted area under the mechanical shaft seal.

d. Casings shall be rated for a minimum of 250 psi working pressure unless otherwise shown on the plans. The pump case shall have gauge tappings at the suction and discharge nozzles and include vent and drain ports.

e. Motor shall meet NEMA specifications and shall be the size, voltage and enclosure called for on the plans. It shall have heavy-duty grease lubricated ball bearings, completely adequate for the maximum load for which the pump was designed.

f. Each pump shall be factory tested, cleaned and painted with at least one coat of high grade machinery enamel prior to shipment.

g. Pumps shall be as manufactured by Weinman Pump or reviewed equivalent.

HV-13 TEMPERATURE GAUGES

a. Temperature gauges shall be of the adjustable socket, fluid-in-glass type, with 9” Fahrenheit scale, of proper range for the service, enclosed in metal, glass covered case, with magnified mercury columns, separable wells, straight or angle-mounted as required, and installed in piping systems in such a manner as to be easily read. Provide extension necks where required to clear insulation.

b. Thermometers shall be manufactured by, Weiss, Trerice, Weksler, or as approved.

c. Provide as follows:

1. Chilled water supply and return at chiller
2. Condenser water supply and return at chiller
3. Suction of water pumps
4. Condenser water supply and return at cooling tower
5. Condenser water supply and return at AC units
6. Chilled water supply and return at air handler
7. Hot water supply and return at air handler
8. Steam supply at heating equipment
9. Hot water supply and return at boiler
10. Where indicated on the Drawings

HV-14 PRESSURE GAUGES

a. Polished brass case and ring, heavy glass dial face, dial range 150 - 200% of normal working pressure (psig), and 1/4” NPT bottom pipe connection fitted with 1/4” brass cocks and pulsation dampener. Steam pressure gauge assembly shall include pigtail stem.

b. Pressure gauge shall be as manufactured by Weiss, U. S. Gauge, Weksler, Trerice, or as approved.

c. Provide as follows:

1. Chilled water supply and return at chiller
2. Condenser water supply and return at chiller
3. Suction and discharge of water pumps
4. Condenser water supply at cooling tower
5. Condenser water supply and return at AC units
6. Chilled water supply and return at air handler
7. Hot water supply and return at air handler
8. Steam supply at heating equipment
9. Hot water supply and return at boiler
10. Piping connections to building risers
11. Where indicated on the Drawings

HV-15 WATER SYSTEM BALANCING

a. Provide necessary piping and connections for balancing all water systems. Operate water systems at full flow and perform necessary adjustments and balancing to deliver water quantities to system components as scheduled on the Drawings.

b. Water system balancing shall be performed by Contractor’s representative or accepted balancing firm. Submit evidence of qualifications. Water tests and balancing operations shall be conducted in the presence of the Owner’s representative.

c. Contractor shall submit water balancing data sheets and reports which tabulate test data of final adjusted system conditions including design quantities for all water system components. Tabulation shall include measured quantities and calculated quantities which are derived from the measured readings including flow rate in GPM, and inlet and outlet pressures.

d. Specified flow measuring devices shall be used for obtaining flow rates in main piping. For other sections of piping system, pressure gauge readings shall be obtained from balancing then tabulate flow rates from pressure readings.

e. Provide automatic air vents at all local high points of water systems and plug after systems have been initially purged and placed in operation.

HV-16 INSULATION, PIPING

a. Fire Resistance Rating:

1. All insulation, vapor barriers, adhesives, mastics and related material shall be of non combustible materials to meet Code, and with UL flame spread rating of 25 maximum and smoke developed rating of 50 maximum.

2. Adhesives and mastics ratings shall be based on test of bulk material to meet Code, and a maximum burning in accordance with RS14-11, ASTM-E84 Test Methods.

b. Manufacturers:

1. Insulation Manufacturers: Johns-Manville, Owens-Corning, Gustin Bacon, Armstrong, or as approved.

2. Adhesive Manufacturers: Benjamin Foster, Insul-Coustic, Minnesota Mining, Tuff-Bond, Zeston or as approved.

c. Thermal Resistance “R” Rating: Minimum insulation thickness specified herein is based on R rating of 4.0 per inch of thickness on a flat surface at a mean temperature of 75°F. The minimum insulation thickness shall be increased for materials having R rating less than 4.0, or may be reduced for materials having greater 4.0 in accordance with Energy Code determinations. Minimum density 4 lbs. per cubic foot.
d. Fibrous glass insulation shall be used for all piping work except where otherwise specified. Pipe covering shall be sectional molded fibrous glass, snap on installation, with all-service jacket meeting flame resistance ratings of the Code, UL, and NFPA. Blanket fibrous materials shall be used for fittings and valves.

e. Pipe Connections: Butted insulation sections shall be joined with 4” fire retardant vapor barrier strips and adhesive similar to Benjamin Foster 30-35, or as approved. Minimum 2” overlap.

f. Concealed Fittings and Valves: Blanket type insulation with Foil Scrim Kraft (FSK) facing. Seal ends with Benjamin Foster 30-35 and 30-36 for hot piping or as approved. Premolded fiberglass secured in place with 16 gauge copper plated steel wire. Cover with trowelled-on mastic.

g. Exposed Hot Fittings and Valves: Blanket type insulation with mastic covering or Johns-Manville Zeston PVC fittings. Seal ends with Benjamin Foster with 30-36 or as approved.

h. Exposed Cold Fittings and Valves: Blanket type insulation with mastic covering or Johns-Manville Zeston PVC fittings. Seal ends with Benjamin Foster with 30-35 or as approved.

i. Outdoor Piping Jacket: Designated outdoor pipe, fittings and valves with fiberglass insulation shall be covered with 0.016” minimum aluminum jacket, fittings and bands for weatherproofing.

j. Minimum Thickness (Based on R=4.0 per inch Rating)

<table>
<thead>
<tr>
<th>System</th>
<th>Pipe Size</th>
<th>Minimum Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chilled Water, glycol, Condenser Water</td>
<td>All</td>
<td>1”</td>
</tr>
<tr>
<td>Chilled Water, glycol, (Lower than 40ºF)</td>
<td>To 6”</td>
<td>1”</td>
</tr>
<tr>
<td></td>
<td>Above 6”</td>
<td>1-1/2”</td>
</tr>
<tr>
<td>City Water</td>
<td>All</td>
<td>1”</td>
</tr>
<tr>
<td>Coil Condensate</td>
<td>To 1-1/4”</td>
<td>1/2”</td>
</tr>
<tr>
<td></td>
<td>Above 1-1/4”</td>
<td>1”</td>
</tr>
<tr>
<td>Hot Water, LPR</td>
<td>To 1-1/4”</td>
<td>1-1/2”</td>
</tr>
<tr>
<td></td>
<td>Above 1-1/4”</td>
<td>2”</td>
</tr>
<tr>
<td>Steam</td>
<td>To 3”</td>
<td>2-1/2”</td>
</tr>
<tr>
<td></td>
<td>Above 3”</td>
<td>3”</td>
</tr>
<tr>
<td>Refrigerant (Indoors)</td>
<td>All</td>
<td>1”</td>
</tr>
<tr>
<td>Generator Exhaust (Indoors)</td>
<td>All</td>
<td>2”</td>
</tr>
</tbody>
</table>

k. Outdoor Refrigerant Pipe Insulation: Flexible elastomeric closed-cell Armstrong Armaflex insulation with flame spread rating of 25 or less or approved equal. Exposed Armaflex insulation shall be finished with two coats of Armstrong Armaflex Finish or approved equal.

<table>
<thead>
<tr>
<th>Pipe Insulation Thickness</th>
<th>Line Temperatures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pipe Size</td>
<td>Above 50ºF</td>
</tr>
<tr>
<td>3/8” to 1-1/8”</td>
<td>3/8”</td>
</tr>
</tbody>
</table>
HV-17 INSULATION, DUCTWORK

a. Scope:

1. Insulation shall be applied to:
   Supply ductwork
   Outdoor air ductwork
   Outdoor air plenums
   Condenser air intake and discharge
   Supply and return air ductwork located outdoors

2. Supply ductwork exposed in the conditioned space shall be provided with 1” acoustical lining unless external insulation is called for on drawings.

3. Supply ductwork insulation thickness may be reduced on lined ductwork by an amount equal to the lining thickness.

4. Insulate sections of existing ductwork which are disturbed by the work of this project.

5. Insulation shall be installed after pressure tests are completed and accepted.

b. Fire Resistance Rating:

1. All insulation, vapors barriers, adhesives, mastics and related material shall be of non combustible materials to meet Code, and with UL flame spread rating of 25 maximum and smoke developed rating of 50 maximum.

2. Adhesives and mastics ratings shall be based on test of bulk material to meet Code, and a maximum burning in accordance with RS14-11, ASTM-E84 Test Methods.

c. Manufacturers:

1. Insulation Manufacturers: Johns-Manville, Owens-Corning, Gustin Bacon, Armstrong, or as approved.

2. Adhesive Manufacturers: Benjamin Foster, Insul-Coustic, Minnesota Mining, Tuff-Bond, Zeston, or as approved.

d. Thermal Resistance “R” Rating: Minimum insulation thickness specified herein is based on R rating of 4 per inch of thickness on a flat surface at a mean temperature of 75ºF. The minimum insulation thickness shall be increased for materials having R rating less than 4.0, or may be reduced for materials having greater 4.0 in accordance with Energy Code determinations.

e. Concealed Ducts: Flexible fibrous glass insulation, one lb. density, 2” thickness as required to provide R-6 installed value with reinforced aluminum foil-faced flame resistant vapor barrier factory applied similar to Johns-Manville “Microlite” EQFSK. May be used for circular ducts in exposed areas. Rigid insulation as specified below may be used for concealed ducts. Wrap insulation tightly on duct but not excessively compressed at corners. Adhere to duct with 2/3 average of BF-85-20 adhesive in 4” wide bands, 8” on centers. Fasten all joints and seams with flare type staples on 4” centers. Seal all punctures of vapor barrier with pressure sensitive tape matching facing material. Support insulation on the bottom side of ducts over 24 inches with weld pins and speed washers approximately 18” on centers.
f. Exposed Ducts & Plenums: Rigid board fibrous glass insulation, 1-1/2 inch thickness (and 2 inch thickness for supply and return ductwork located outdoors), 6 lb. minimum density with aluminum foil-faced flame resistant vapor barrier factory applied, similar to Owens-Corning Type ED-75. Facing pinned and taped in place. Adhere to ducts with weld pins and speed washers at a maximum of 12 inch centers. Minimum of two rows of pins per side. Seal all joints with 4 inch wide ASJ buttstrips adhered with BF-85-20 adhesive. Ductwork located outdoors shall be provided with two coats of weatherproof paint with color approved by the Architect.

g. Kitchen Hood Exhaust: Two layers of 1½ inch thick fiberglass blanket insulation with foil scrim barrier secured to the duct with stainless steel banding. Assembly shall be listed for 2-hour rated grease duct enclosure 3-M Firemaster Duct Wrap (MEA 417-92-M). Refer to manufacturer recommended installation details for access door assembly.

HV-18 INSULATION, EQUIPMENT

a. Chilled water pumps: Provide custom fitted sheetmetal chamber around pump impeller section to enclose the cold elements of the pump up to the pump flanges. Insulate chamber with foil faced rigid insulation with complete vapor barrier seal. Provide removable/replaceable top section for inspection and service of pump.

b. Heat Exchangers:

c. Kitchen Exhaust Fans:

d. Chiller Water Boxes:

e. Boilers:

f. Condensate Coolers:

HV-19 VIBRATION ISOLATION

a. General: Provide vibration isolation for equipment as listed in the Isolation Selection Guide found at the end of this section. All equipment, piping, etc. shall be mounted on or suspended from approved foundations and supports.

b. The work in this section includes the following:

1. Vibration isolation elements for equipment
2. Equipment isolation bases
3. Piping flexible connectors
4. Rooftop equipment isolation

c. Concrete Pads: All floor mounted equipment shall be erected on 4" high concrete pads over the complete footprint of the equipment unless specified to the contrary. Wherever vibration eliminating devices and/or concrete inertia bases are specified hereinafter, those items shall, in all cases, be in turn mounted upon 4" high concrete pads.

d. Submittal Data Requirements:

1. Submittals

   a) Catalog cuts or data sheets on specific vibration isolators to be utilized detailing compliance with the specification including specification reference "TYPE" described in this specification.
b) An itemized list of all isolated equipment with detailed schedules showing isolators proposed for each piece of equipment, referencing material and isolation drawing numbers.

c) Drawing showing construction for equipment; include dimensions, structural member sizes and support point locations.

d) Indicate isolation devices selected with complete dimensional and deflection data before condition is accepted for installation.

e. Manufacturer of vibration control equipment shall have the following responsibilities:

1. Determine vibration isolation sizes and locations.
2. Provide equipment vibration isolation as specified.
4. Provide installation instructions, drawings and field supervision to insure proper installation and performance of systems.
5. Certify correctness of installation upon completion.

f. Devices: All vibration isolation equipment shall be the product of a single manufacturer. Products other than listed below are acceptable provided their systems strictly comply with intent, structural design, performance and deflections of the listed products.

g. Manufacturers: Vibration isolation manufacturer shall be one of the following or as approved:

Vibration Mountings & Controls, Inc., Bloomingdale, NJ (V.M.C.I.)
Mason Industries, Inc., Hollis, NY (M.I.I.)
Vibration Eliminator Co., Long Island City, NY (V.E.C.)
Kinetics Noise Control, Inc., Dublin, OH (K.N.C.)

h. Isolators: The theoretical vertical natural frequency for each support point, based upon load per isolator and isolator stiffness shall be out of resonance with equipment forcing frequencies or support structure natural frequency.

i. Corrosion protection for both indoor and outdoor applications shall be as follows:

1. Springs: Zinc electroplated or powder coat
2. Hardware: Zinc electroplated
3. All other metal parts: Zinc electroplated, powder coat, hot spray or hot dipped galvanized

j. Isolator Product Types:

1. Type A: Spring Isolator - Free Standing

   a) Spring shall have a minimum outer diameter to overall height ratio of 0.8 : 1 at rated deflection.

   b) Reserve deflection (from that at published rated load to solid height) equal to 50% of the rated deflection.

   c) Formed steel or ductile top cup with adjusting bolt and locking cap screw for securing to equipment.

   d) Minimum 1/4" thick neoprene acoustical base pad or cup on underside, unless designated otherwise.
e) Type "A" isolators shall be one of the following or an approved equal:

1) Type ASC  V.M.C.I.
2) Type SLF  M.I.I.
3) Type OST  V.E.C.
4) Type FDS  K.N.C.

2. TYPE B: Spring Isolator - Restrained

a) Shall be the same as TYPE A with the following additional features.

1) Leveling assembly which does not compromise the integrity of the restraint hardware.
2) Integral restraining bolts with elastomeric cushions preventing metal-to-metal contact.
3) Internal spring adjusting nut or bolt.
4) Capability of supporting equipment at fixed elevation during equipment installation.
5) Built-in all-directional limit stops with no less than 1/8" and no more than 1/4" clearance under normal operation.

b) Type "B" isolators shall be one of the following or an approved equal:

1) Type AWR or ASCM  V.M.C.I.
2) Type SLR  M.I.I.
3) Type BXL  V.E.C.
4) Type FLS  K.N.C.

3. TYPE C: Spring Hanger Isolator

a) Spring element (same as Type A) with steel upper spring retainer and a lower elastomer retainer cup with an integral bushing to insulate lower support rod from the hanger box.

b) Steel hanger box shall be hinged to allow for a minimum of 30 degree misalignment between the rod attachment to structure and the connection to the supported equipment. Hanger boxes shall withstand three times the rated load without failure.

c) When used on ductwork, provide eye bolts for attachment to duct straps.

d) Type "C" isolators shall be one of the following or an approved equal:

1) Type RSH or SANSH  V.M.C.I.
2) Type 30  M.I.I.
3) Type SNC4  V.E.C.
4) Type SH  K.N.C.

4. TYPE D: Double deflection neoprene isolator encased in ductile iron or steel casing.

a) Type "D" isolators shall be one of the following or an approved equal:
5. **TYPE E: Elastomer Hanger Isolator**
   
a) Molded neoprene element with an integral bushing to insulate lower support rod from the hanger box.

b) Steel hanger box shall be hinged to allow for a minimum of 30 degree misalignment between the rod attachment to structure and the connection to the supported equipment. Hanger boxes shall withstand three times the rated load without failure.

c) When used on ductwork, provide eye bolts for attachment to duct straps.

d) Type "E" isolators shall be one of the following or an approved equal:

   1) Type RHD V.M.C.I.
   2) Type HD M.I.I.
   3) Type 1C, 1CD, 3C, 3CT V.E.C.
   4) Type RH K.N.C.

6. **TYPE F: Combination Spring/Elastomer Hanger Isolator.**
   
a) Spring and neoprene elements in a hinged steel hanger box with the features as described for TYPE C and E isolators.

b) Type "F" isolators shall be one of the following or an approved equal:

   1) Type RSHN or SANSH V.M.C.I.
   2) Type 30N M.I.I.
   3) Type SNRC4 V.E.C.
   4) Type SRH K.N.C.

7. **TYPE G: Pad Type Elastomer Isolator**
   
a) Neoprene pad shall have 0.75" minimum thickness and shall have opposed cylindrical supports spaced on one inch centers to provide uniform deflection of 0.1 inch under rated load. Supports shall be connected in the center by a 1/8" tear strip to facilitate trimming to desired size in one inch increments. Supports will also have thru holes to accept up to 3/8" bolts without special drilling or coring.

b) 1/16" galvanized steel plate between multiple pad layers.

c) Load distribution plate where attachment to equipment bearing surface is less than 75% of the pad area.

d) When bolting is required for wind load compliance, neoprene and duct washers and bushings shall be provided to prevent short circuiting of bolt.

e) Type "G" isolators shall be one of the following or an approved equal:

   1) Type NP V.M.C.I.
8. TYPE H: Pad Type Elastomer Isolator
   a) Laminated canvas duck & neoprene, maximum loading 1,000 psi, minimum 1" thick.
   b) Load distribution plate where attachment to equipment bearing surface is less than 75% of the pad area.
   c) When bolting is required for wind load compliance, neoprene and duck washers and bushings shall be provided to prevent short circuiting of bolt.
   d) Type "H" isolators shall be one of the following or an approved equal:
      1) Type NIDP V.M.C.I.
      2) Type HL M.I.I.

9. TYPE I: Thrust Restraints
   a) A spring element same as TYPE A shall be combined with steel angles, backup plates, threaded rod, washers and nuts to produce a pair of devices capable of limiting thrust movement of air moving equipment to 1/4".
   b) Restraints shall be easily converted in the field from a compression type to tension type.
   c) Unit shall be factory pre-compressed.
   d) Type "I" isolators shall be one of the following or an approved equal:
      1) Type TR V.M.C.I.
      2) Type WB M.I.I.
      3) Type HSR K.N.C.

10. TYPE J: Telescoping Riser Guide – Non-isolated
    a) Telescoping arrangement of two sizes of steel tubing.
    b) Type "J" isolators shall be one of the following or an approved equal:
       1) Type TPG V.M.C.I.
       2) Type TADA M.I.I.
       3) Type VERA V.E.C.
       4) Type RAF K.N.C.

11. TYPE K: Resilient Pipe Anchors and Guides
    a) All directional acoustical pipe anchor, consisting of a telescopic arrangement of two sizes of steel tubing separated by a minimum 1/2" thickness of TYPE H pad.
    b) Vertical restraints shall be provided by a similar material arranged to prevent vertical travel in either direction.
c) Allowable loads on neoprene pad shall not exceed 500 PSI and the design shall be balanced for equal resistance in any direction.

d) Type "K" isolators shall be one of the following or an approved equal:

1) Type RPTG or RPA  V.M.C.I.
2) Type ADA  M.I.I.
3) Type VERG  V.E.C.
4) Type KPA  K.N.C.

12. TYPE L: Isolated Pipe Hanger System

a) Pre-compressed spring and elastomer isolation hanger combined with pipe support into one assembly. Replaces standard Clevis, single or double rod roller, or double rod fixed support.

b) Spring element (same as Type A) with steel lower spring retainer and an upper elastomer retainer cup with an integral bushing to insulate support rod from the isolation hanger.

c) The neoprene element under the lower steel spring retainer shall have an integral bushing to insulate the support rod from the steel spring retainer.

d) Hanger shall be hinged to allow for a minimum of 30 degree misalignment between the rod attachment to structure and the connection to the isolation hanger. Hangers shall be designed and constructed to support loads over three times the rated load without failure.

e) System shall be pre-compressed to allow for rod insertion and standard leveling.

f) Type "L" isolators shall be one of the following or an approved equal:

1) Type CIH, CIR, TIH, TIR & PIH  V.M.C.I.

13. TYPE M: Flashable restrained isolator

a) Shall have all features of TYPE B isolator.

b) Shall have waterproof spring covers for adjustment or removal of springs.

c) Unit shall have a structural top plate for welding or bolting of supplementary support steel.

d) Isolator shall accept 2" roofing insulation and be flashed directly into the waterproofing membrane.

e) To be complete with wood nailer and flashing.

f) Type "M" isolators shall be one of the following or an approved equal:

1) Type FRS  V.M.C.I.

14. TYPE P: Elastomer Isolator
Double deflection neoprene compression mountings shall have all metal surfaces neoprene coated.

Non-skid top and bottom surfaces.

Threaded bolting sleeves shall be embedded in the isolator.

Drilled tie-down bolt holes shall be provided in the base plate.

Type "P" isolators shall be one of the following or an approved equal:

1) Type RD V.M.C.I.
2) Type ND M.I.I.
3) Type T44 V.E.C.
4) Type RD K.N.C.

Equipment Bases: All Curbs and roof rails are to be bolted or welded to the building steel or anchored to the concrete deck for resisting a minimum 110 MPH wind loads.

1. TYPE B-1: Integral Structural Steel Base
   a) Constructed of structural members as required to prevent base flexure at equipment startup and misalignment of driver and driven units. Centrifugal fan bases shall be complete with motor slide rails and drilled for drive and driven units.
   b) Height saving brackets shall be used to reduce operating height and maintain 2" operating clearance under base, where required.
   c) Member depth shall be such that the maximum deflection of the longest side to be 1/360 of span, not to exceed 4".
   d) Type "B-1" shall be one of the following or an approved equal:
      1) Type SB V.M.C.I.
      2) Type WFSL M.I.I.
      3) Type S-OSKA V.E.C.
      4) Type KFB or SFB K.N.C.

2. TYPE B-2: Concrete Base
   a) Steel or removable concrete forms for floating foundations. Bases for pumps shall be large enough to support elbows and/or suction diffusers. The base depth shall be a minimum of 1/12 the longest unsupported span, but not less than 6" or greater than 12". Forms shall include concrete reinforcement consisting of steel bars or angles welded in place on 6" centers both ways. A layer 1-1/2" above the bottom.
   b) Isolators may be set into pocket housings which are an integral part of the base construction or utilize height saving brackets set at the proper height to maintain 2" clearance below the base. Base shall be furnished with templates for equipment attachment and anchor bolt sleeves.
   c) Type "B-2" shall be one of the following or an approved equal:
      1) Type MPF V.M.C.I.
3. TYPE B-7: Computer Room Unit Base
   a) Computer room air conditioning units shall be welded or bolted to welded structural steel stands.
   b) Stand shall have +1-1/2" of leveling adjustment.
   c) Type "B-1" shall be one of the following or an approved equal:
      1) Type CRFS (non-isolated) or ASCM (isolated) V.M.C.I.

m. Equipment Installation
   1. Equipment shall be isolated as indicated in the Isolation Selection Guide at the end of this section.
   2. Additional Requirements
      a) The minimum operating clearance under all isolated bases shall be 2".
      b) All bases shall be placed in position and supported temporarily by blocks or shims prior to the installation of the equipment, isolators.
      c) Spring isolators shall be installed after all equipment is installed without changing equipment elevations.
      d) After the entire installation is complete and under full operational load, the spring isolators shall be adjusted so that the load is transferred from the blocks to the isolators.
      e) Remove all debris from beneath the equipment and verify that there are no short circuits of the isolators or the isolation system. The equipment shall be free to move in all directions.
      f) Install equipment with flexibility in wiring.
      g) Thrust restraints shall be installed on all cabinet fan heads, axial or centrifugal fans whose thrust exceeds 10% of unit weight.

n. Piping and Ductwork Isolation
   1. Installation; General:
a) Hanger isolators shall be installed with the hanger box hung as close as possible to the structure. (without touching)

b) Hanger rods shall not short circuit the hanger box.

c) TYPE L hangers may be substituted for all other hangers tabulated below.

d) Pre-compressed hangers shall only be used if installed along with piping.

2. Ceiling supported piping outside shafts connected to rotating or reciprocating equipment and pressure reducing stations, whether the equipment is isolated or not, shall be isolated as follows:

a) Water and steam piping within 50 feet or 100 pipe diameters (whichever is greater) from equipment connection.

1) Horizontal suspended water piping 1¼” to 2” and all steam piping larger than 1” shall be hung with TYPE E isolators with 0.3” deflection.

2) Water pipe larger than 2” shall be hung with TYPE F isolators. The first three supports for piping connected to isolated equipment shall have deflection equal to the equipment isolators up to 2” deflection, all supports thereafter shall have 0.75” deflection isolators.

3) Floor supported piping outside shafts connected to isolated rotating or reciprocating equipment and pressure reducing stations shall be isolated as follows:

   (a) Horizontal floor or roof mounted water piping 1-1/4” to 2” and all steam piping larger than 1” shall be supported by TYPE P isolators with a minimum 0.3” deflection.

   (b) Water pipe larger than 2” shall be supported by TYPE B isolators with a minimum of 0.75” deflection.

4) Control air piping and vacuum piping from compressor discharge to receiver shall be suspended by TYPE E isolators with a minimum 0.3” deflection or supported by TYPE P isolators with a minimum 0.3” deflection.

o. Inspection: Upon completion of installation of all vibration isolation devices, a certification report prepared by the manufacturer shall be submitted in writing to the contractor indicating that all systems are installed properly and in compliance with the specifications. The report must identify those areas that require corrective measures or certify that none exists.

p. Vibration Isolation Selection Guide for Equipment:

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<th>Equipment</th>
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<th>Static Deflection</th>
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<tr>
<td>Pumps (Suspended)</td>
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<td>Suspended AC Units</td>
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<td>1-3/8&quot;</td>
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<tr>
<td>Suspended Fans</td>
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<tr>
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<tr>
<td>Floor Mounted Fan Coil Units</td>
<td>B</td>
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### Equipment

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<th>Equipment</th>
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<tr>
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<tr>
<td>Cooling Tower</td>
<td>B</td>
<td>1½”</td>
</tr>
</tbody>
</table>

### HV-20 MULTIPLE BOILER SYSTEM, HOT WATER, GAS FIRED

a. General: Furnish and install in accordance with manufacturer's instructions multiple boiler system comprised of two or more cast iron sectional boilers. Boilers shall be factory assembled and tested packages complete with jacket, burner, controls and trim mounted and wired. Burners shall be designed for use with liquefied propane or natural gas as shown. Assembled boilers shall be suitably crated for shipment.

b. Ratings: Boilers shall have nameplates showing output tested and approved by the American Gas Association (A.G.A.). Each boiler shall be constructed and stamped for 50 PSIG water working pressure in accordance with ASME Section IV Boiler and Pressure Vessel Code.

c. Safeties: Individual boilers shall be furnished with high-limit temperature control and side outlet relieve valve set for 50 PSIG. UL-listed low-water fuel cut-off, suitable for 50 PSIG working pressure shall be installed in the supply piping close to the boilers.

d. Control System:

1. Multiple boiler control system shall be UL-listed microprocessor type energy management controller with digital display capable of manually stepping through all set-points and system data. LED shall display lead stage and boiler operating status.

2. Boilers shall fire at full load (either ON or OFF) for maximum fuel efficiency. 15 minute time delay shall prevent unnecessary cycling of the boilers.

3. Manual or automatic sequencing of the lead boiler shall be provided at the panel face for daily lead stage rotation along with an ON/AUTO/OFF switch for each stage to allow removal of boiler from sequence without rewiring.

4. Controls shall provide adjustable ratio indoor/outdoor reset control for the number of boilers indicated. Outdoor air temperature starter and system temperature fine-tune offset control shall stage the boiler operation to maintain hot water system supply temperatures of 200°F at 0°F outdoors and 180°F at 60°F outdoors (adjustable).

e. Manufacturer: Multiple Boiler System shall be Weil-McLain type M-GV or reviewed equivalent.

### HV-21 AC UNIT, SPLIT SYSTEM EVAPORATOR UNIT
Factory assembled single piece indoor air handler shall include insulated casing, centrifugal fan with motor, coils and filter section with capacities as noted on the plans. Unit shall be assembled for draw-through application and shall be arranged to discharge air horizontally or vertically as shown. Unit shall be certified in accordance with ARI Standard 430 for Central Station Air Handling Units.

Cabinet: Casing panels shall be constructed of milled galvanized steel. Panels shall be removable for access to the unit. Insulation shall be 1-inch minimum thickness dual density fiberglass not less than 1.5 lb. per cubic foot. Insulation shall be secured to casing with waterproof adhesive. Access doors shall be hinged, double wall, galvanized steel panels with 1.5 lb. dual density fiberglass sandwiched between the panels. Condensate pans shall be sloped double wall pans with threaded drain connection.

Fan: Fan section shall be constructed of galvanized steel with formed channel base for integral mounting of fan, motor and casing panels. Fan scroll, wheel, shaft and bearings shall be rigidly secured to the unit base. Fan shall be double width, double inlet type with forward curved blades. Wheel shall be bonderized steel painted with baked enamel, or galvanized steel. Fans shall be statically and dynamically balanced on solid steel shaft assemblies with self-aligning pillow block bearings. Fan motor shall be NEMA Design B with 1.3 service factor, belt drive with variable pitch pulley.

Coil: Direct expansion coils shall have aluminum fins bonded to 1/2 inch OD copper tubes. Coils shall be provided with pressure type brass distributor with solder-type connections and shall have a minimum of two distributors. Coils for full face active or face split operation shall have intertwined circuits for equal loading of each circuit. Suction and discharge connections shall be on the same end. Coil shall be tested at 400 psig submerged in water then dehydrated and charged with dry air.

Filter: Flat filter section shall accept filters of standard sizes. Section shall include side access slide rails and hinged access door. Provide two sets of flat filters with unit.

Acceptable Manufacturers: Carrier Model 39L and Coolair or reviewed equivalent.

Requirements of evacuating refrigerant line:

1. Valve off each side of refrigerant line.
2. A vacuum of 28” high or 50mm shall be drawn at a minimum.
3. Line shall be tested after 8-hours to ensure integrity.
4. Line shall be filled with refrigerant then evacuated again to remove all moisture.
5. Line shall be connected to equipment and filled with refrigerant.

HV-22 AC UNIT, SPLIT SYSTEM CONDENSING UNIT (OUTDOOR 1½ TO 5 TONS)

Outdoor mounted air-cooled condensing unit shall consist of hermetic compressor, air cooled coil, propeller type condenser fan, accumulator, full refrigerant R22 charge and control box. Unit shall be matched with indoor evaporator and system shall be rated and certified in accordance with ARI Standards 210/240 and 270. Units shall be constructed in accordance with UL standards and shall carry the UL label.

Cabinet: Cabinet shall be constructed of 18 gauge galvanized steel bonderized and coated with a baked-enamel finish. Unit access panels shall be removable and provide full access to the compressor, fan and control components. Compressor compartment shall be isolated and have an acoustic lining for quiet operation.
c. Fans: Condenser fan shall be direct-drive propeller type arranged to pass air across the condenser coil. Fan blades shall be fabricated of corrosion resistant materials and shall be statically and dynamically balanced assembled on corrosion resistant shaft. Motors shall be protected by internal thermal overload protection. Motor shall have permanently lubricated ball bearings. Fan openings shall be equipped with PVC coated protection grille over fan and coil.

d. Compressor: Compressor shall be fully hermetic reciprocating or scroll type equipped with oil system, operating oil charge and motor. Motor shall be NEMA rated Class F, suitable for operation in a refrigerant atmosphere. Internal overloads shall protect the compressor from over-current and over-pressure. Scroll compressors shall have high discharge gas temperature protection. Reciprocating compressors shall be equipped with crankcase heaters to minimize liquid refrigerant accumulation during shutdown and to prevent refrigeration dilution of oil. Compressor assembly shall be installed on rubber vibration isolators and shall have internal spring isolation.

e. Compressor (units 10 tons and larger): Provide cylinder unloading or staged multiple compressor operator for low cooling demand.

f. Condenser Coil: Coil shall be constructed of aluminum fins mechanically bonded to internally enhanced, seamless copper tubes which are factory cleaned dehydrated and sealed. Coil shall provide at least 15º of liquid sub-cooling at design conditions.

g. Refrigeration Components: Refrigerant circuit components shall include brass external liquid line service valve with service gage port connections, suction line service valve with service gage connection port, service gage port connections on compressor suction and discharge lines with Schraeder-type fittings with brass caps, accumulator, filter drier, pressure relief and a full charge of refrigerant.

h. Controls and Safeties: Operating controls and safeties shall be factory selected, assembled and tested. Functions shall include:

1. Time delay compressor restart
2. Automatic restart on power failure
3. Three-pole contactors on 3-phase units
4. High and low-pressure switches
5. High pressure safety relief
6. Condenser fan failure protection

i. Accessories (Field Installed)

1. Low ambient kit capable of maintaining a condensing temperature of 90°F - 110°F with outdoor temperatures to 0°F.
2. Winter start control to permit start-up for cooling operation under low load conditions and at low ambient temperatures by bypassing the low pressure switch for a 3-minute delay.
3. Wind baffle sheet metal wrapper to prevent wind gusts from effecting unit performance.
4. Liquid solenoid valve, electronically operated, to stop and start refrigerant flow in response to compressor operation.
5. Crankcase heater, clamp-on compressor oil sump heater.

j. Acceptable Manufacturers: Carrier Model 38HDC and Coolair or reviewed equivalent.
a. General: Furnish and install, where indicated or scheduled on plans Model S-A horizontal hot water unit heaters. Unit shall be equipped as specified herein. All units shall be installed in a neat and workmanlike manner in accordance with this specification and the manufacturer's installation instruction.

b. Casings are fabricated from 20 gauge die-formed steel. Casing substrates are prepared for finishing with a hot wash, iron phosphatizing clear rinse, chromic acid rinse and oven drying. Paint finish is lead-free, chromate free, alkyd melamine resin base and applied with an electrostatic two-pass system. Finish is baked at 350°F.

c. Coil is a serpentine design with seamless copper tubing. Aluminum fins have drawn collars to assure permanent bond with expanded tubes. Tubing connections are 3/8" copper tubing, type “M" (.500 O.D.). Coils are factory tested at 250 P.S.I.

d. Motors are totally enclosed, resilient mounted with class “B” windings. All motors are designed for horizontal mounting

e. Fans are aluminum blade type, designed and balanced to assure maximum air delivery, low motor horsepower requirements and quiet operation.

f. Fan guards are welded steel, zinc plated or painted. To meet CSA and OSHA requirements, units mounted below 8 feet from floor must be equipped with an OSHA fan guard. OSHA fan guards are optional.

g. Units are equipped with horizontal, individually adjustable louvers.

h. Unit heaters shall be as manufactured by Trane or reviewed equivalent.

HV-24 ROOF EXHAUST FANS

a. Furnish and install fans with capacities as shown on the Drawings.

b. Roof exhaust fans shall be upblast centrifugal direct or belt drive as scheduled.

c. The fan wheel shall be centrifugal backward inclined, constructed of aluminum and shall include a wheel cone carefully matched to the inlet cone for precise running tolerances. Wheels shall be statically and dynamically balanced.

d. The fan housing shall be constructed of heavy gauge aluminum with a rigid internal support structure. Windbands shall have a rolled bead for added strength and shall be joined to curbcaps with a leakproof, continuously welded seam. Motors shall be mounted out of the airstream on vibration isolators. Fresh air for motor cooling shall be drain into the motor compartment from an area free of discharge contaminants. Motors shall be readily accessible for maintenance.

e. A disconnect switch shall be factory installed and wired from the fan motor to a junction box within the motor compartment.

f. A conduit chase shall be provided through the curb cap to the motor compartment for ease of electrical wiring.

g. All fans shall bear the AMCA Certified Ratings Seal for sound and air performance.

h. Each fan shall bear a permanently affixed manufacturer's nameplate containing the model number and individual serial number for future identification.
i. **Accessories:**

1. **Roof Curb:** Prefabricated, all welded, insulated aluminum roof curb with internal aluminum liner. Curb configuration shall accommodate roof construction.

2. **Speed Control:** Provide speed controller mounted within the fan housing.

j. **Manufacturer:** Greenheck Fan Corporation or reviewed equivalent.

**HV-25 IN LINE CENTRIFUGAL FANS**

a. Furnish and install fans with capacities as shown on the Drawings. Fans shall be of the non-overloading centrifugal type with airfoil or backward inclined blades.

b. All fans shall be guaranteed to fulfill the specified requirements. Fans shall not produce excessive noise as compared to the scheduled unit manufacturer when used in conjunction with the specified vibration isolation. Fan manufacturers shall furnish for approval for each fan, certified sound power ratings with an octave band analysis and also the volume-pressure-horsepower characteristic curves from shutoff to free delivery. Sound power level data shall be based on tests conducted in accordance with AMCA Standards. Wheels shall have ample strength. They shall be statically and dynamically balanced to avoid vibration and shall have blades secured to ensure quiet efficient operation.

c. Fans, unless otherwise indicated, shall be belted to respective motors by V-belt drives. Sheaves shall be cast iron. Motor sheaves shall be adjustable type for 2-groove or less. Belts shall have a rated capacity of not less than 150% of brake horsepower.

d. All fans shall carry the AMCA performance and construction seal.

e. All fans shall be provided with galvanized steel inlet guard screens, built in accordance with OSHA requirements. Inlet guard screens shall be of such design that they will not reduce the fan inlet area beyond the maximum reduction permitted by the fan manufacturer to guarantee the fan performance.

**HV-26 CEILING TRANSFER FANS**

a. Install ceiling fans indicated on the plans and as listed in the schedule. Fans shall be centrifugal, direct drive. Fans shall bear the AMCA Certified Ratings Seal and the UL label.

b. Fans shall have acoustically insulated housings. Manufacturers shall submit vibration amplitudes and magnetic motor hum in decibels or sones. Integral backdraft damper shall be chatter-proof. Entire fan motor and wheel assembly shall be removable without disturbing the housing.

c. Permanently lubricated squirrel cage induction motors shall be suitably grounded and mounted on rubber-in-shear vibration isolators. Terminals shall be provided with cord, plug and receptacle inside the housing.

d. Fan manufacturer shall furnish variable speed switch and pilot light type-on off switch with thermal overload for general exhaust type room fans.

**HV-27 COOKING EXHAUST FANS**

a. Kitchen exhaust fans shall be of the belt driven utility fan type, AMCA arrangement 10 with single width, single inlet housing.
b. Housing shall be constructed of heavy gauge steel with lock formed seams for no air leakage and shall be field rotatable to any of the eight standard discharge positions. The housing and bearing supports shall be constructed of welded steel members to prevent vibration and rigidly support the shaft and bearings.

c. Wheel shall be of the non-overloading backward inclined centrifugal fan type, constructed of heavy gauge steel. Wheels shall be statically and dynamically balanced. The wheel cone and fan inlet cone shall be carefully matched for maximum performance and operating efficiency.

d. Motors shall be of the heavy duty ball bearing type. The fan shaft shall be ground and polished shafting mounted in heavy duty, permanently sealed pillow-block ball bearings. Bearings shall be selected for a minimum of 200,000 hours life at maximum cataloged operating speed. Drives shall be sized for a minimum of 165% of driven horsepower. Pulleys shall be of the fully machined cast iron type keyed and securely attached to the wheel and motor shafts. The motor pulley shall be adjustable for final system balancing.

e. Fan performance shall be based on tests conducted in accordance with AMCA Standard 210 test code for air moving devices and fans shall be licensed to bear the AMCA Certified Ratings Seal.

f. Acceptable manufacturer: Greenheck or reviewed equivalent.

HV-28 DUCTWORK

a. All ductwork, register boxes, dampers, and all auxiliary work and products of any kind necessary to make the various air conditioning and ventilating systems of the building complete and ready for satisfactory operation, shall be furnished and installed.

b. Construct ductwork and casings and supports of galvanized steel or aluminum in accordance with the appropriate standards of the Sheet Metal and Air Conditioning Contractors National Association.

c. All ductwork indicated on drawings is schematic. Therefore, submit changes in duct size and location if necessary to conform to field conditions.

d. Dimensions given on drawings of all acoustically lined ducts shall be clear inside dimension. For example: increase sheet metal duct size by 2" in each direction to accommodate 1" of acoustic lining.

e. Install volume damper at branches connected into the main without a neck.

f. Where hanger rods for ducts, piping, or equipment must pierce ducts, provide closure plates fitted around the rod and riveted or welded to the duct. Use duct compound to make an airtight seal.

g. All duct mains and branches upstream of variable air volume boxes shall be constructed as 4" static pressure class in accordance with the current standards established by SMACNA. All other ductwork shall be constructed as 2" static pressure class.

h. Construct volume dampers of 16 gauge galvanized steel with hemmed edges. In ducts over 15" in depth use multiple opposed blade type, gang operated. Operating levers to be indicating type with locking quadrants, Ventfabric #555 or #560. See MANUAL DAMPERS section for additional requirements.

i. Access doors shall be provided in all ductwork for access to fire dampers, air valves, automatic dampers and coils, filters, fans, and other products which require access.
j. Access Doors: Double insulated reinforced panel type. In ductwork: Minimum 16" x 12" with two brass butt hinges and Ventlok No. 140 latches. In casings: 60" x 18" with three brass hinges and two Ventlok No. 310 latches and pulls.

k. Turning Vanes: Galvanized steel double vanes in a galvanized steel frame.

l. All galvanized ductwork shall be hung with galvanized hangers in accordance with SMACNA, ASHRAE, and ICC Code requirements.

m. Provide supports and fastenings adequate to insure permanent stability and to effectively resist all applied loads. Fasten hangers and supports by clips fastened to structure by expansion anchors or through-bolted. Where required, provide supplementary steel angles or channels.

n. Do not hang or support one duct from another.

o. Extend strap hangers along bottom of the duct. Fasten to the duct bottom by bolts or rivets and to the side by bolts or rivets with one fastener per foot or less of duct height.

p. Use bolted or welded structural angle iron frames to support rectangular ductwork and associated equipment from floor or roofs.

q. A snap-lock seam shall not be permitted.

r. Use gasketed type joint when dissimilar metals are joined.

s. Sealant shall be applied to supply ducts, condenser air intake and discharge ducts, and exhaust ducts. All longitudinal seams shall be sealed with 3M red duct sealant in the sheet metal shop during fabrication. All transverse joints shall be sealed with 3M red duct sealant. Connections from branch duct to diffuser collars shall be sealed at duct and at diffuser.

t. Support vertical ducts at each story by angles bolted or welded to the two largest duct sides.

u. Flexible connections of vinyl coated woven nylon/polyester blend fabric to prevent the transmission of vibration through the ducts shall be installed on both the supply and return sides of all fans, air conditioning, and ventilation units, approximately where shown on the drawings. Cloth used for flexible connections shall be "Ventglas" as manufactured by Ventfabrics, Inc., Duro Dyne Excelon Fabric or as approved. Flexible connection shall be a minimum of 10" long and fitted to provide an airtight connection. Provide gaskets on Class II and Class III fan collar.

v. Outdoor air intake plenum and ductwork shall be fabricated of aluminum sheetmetal except where otherwise noted on the plans.

w. Dishwashing exhaust ductwork shall be fabricated of welded, watertight stainless steel with SMACNA seam locations "a", "c", or "d" only per Figure 1-5 of the SMACNA HVAC Duct Construction Standards. Pitch ductwork back to the dishwasher.

x. Screens on open end duct: Provide #16 U.S.S. 3/4" wire mesh screen over each air opening in hung ceiling except where provided with grille or register back.

HV-29 LOW PRESSURE STEEL DUCTWORK

a. Ductwork downstream of variable volume boxes in medium pressure systems and low pressure duct system with duct velocities less than 2,000 FPM and static pressure in duct 2" WG or less. Return and exhaust ductwork.
b. Sheet metal gauges, transverse joint type and spacing, reinforcing type and spacing, in accordance with the latest ASHRAE and SMACNA Schedules for low pressure ductwork, except no ductwork less than 24 gauge. Longitudinal seams Pittsburgh Lock. Seal transverse joints with non-hardening sealant (3M "Red"). Longitudinal seams shall be sealed in the shop during fabrication.

c. Ducts exposed in occupied areas, other than mechanical and fan rooms fabricated with hemmed "S" slips. Reinforce joints of ducts over 30" wide with flat bars or flat bars and 3/8" rods for ducts over 54" wide. Top joint with bar skip under 31" width and reinforced bar skip for 31" and larger in width.

d. Cross break or bead each duct section on four sides of ducts over 17" in largest dimension. Install 3/8" stay rods in ducts over 72" at each transverse joint. Spacing between rods or rods and side of duct shall not exceed 48".

e. Turning vanes as detailed on drawings and to conform to SMACNA Standards installed with first vane tight in outside corner and last vane no less than one vane space from throat or inside corner. Secure both sides of runners to top and bottom of duct at both ends, and 6" on center with sheet metal screws or rivets.

HV-30 KITCHEN EXHAUST DUCTWORK


b. Fabricate joints and seams with continuous welds for watertight construction. Install without dips or traps which may collect residues, except where traps have continuous or automatic residue removal.

c. Provide access openings at each change in direction and every 12 feet of straight length, located on the sides of the duct 1-1/2" minimum from the bottom and 1" from the top, and fitted with grease-tight covers of same material as duct with removable wing nut or other approved fasteners. Fasteners shall be carbon steel or stainless steel and shall not penetrate duct walls. Access doors shall include lift handles to grip when opening and closing for service and inspection. Access doors shall have a gasket or sealant that is rated for 1500 °F and shall be protected by dry chemical fire suppression system. Doors are field fabricated, insulation on access doors shall be installed following manufacturer’s instructions.

d. Exhaust system shall be protected by dry chemical fire suppression system.

e. Dishwasher exhaust and register exhaust branch duct connection to the cooking exhaust duct shall be made with an automatic fire/smoke damper (FSD) with a fusible link. Damper shall close automatically when fire suppression system is activated. In addition, all registers shall be equipped with a fusible link damper.

f. Exterior cooking exhaust ducts shall be fabricated of not less than 18 gauge SST.

g. Grease duct shall be tested using a smoke test in the presence of a special inspector prior to any insulation or concealment. The test shall be performed on the entire duct system including the hood-to-duct connection. Ductwork shall be permitted to be tested in sections provided that every joint is tested. Grease duct shall be filled with a thick penetrating smoke produced by one or more smoke machines, or smoke bombs. A static pressure equal to or less than 2" W.G. shall be maintained throughout the test. The test shall be applied for a length of time sufficient to permit the inspection of the grease duct, but not less than 2 hours. If the test shows any evidence of leakage or other defects, such defects shall be corrected by the installing contractor and the test shall be repeated until there is no visible smoke observed.
HV-31 PROTECTION PANS

a. Provide protection pans under pipes passing through switchgear rooms or over electric equipment. The pans shall be constructed of galvanized steel, suitable reinforcement to prevent sagging. Edges of the pans shall turn up 2" on all sides with corners sealed to make pan watertight. Pan shall be supported by pipe hangers and shall drain clear of electrical equipment. Provide a 3/4" drain pipe for each pan terminating above nearest convenient sink of floor drain.

HV-32 BOILER FLUE AND BREECHING SYSTEM

a. The boiler system is capable of operating under condensing conditions and therefore the flues shall be made of a material resistant to corrosive boiler flue condensate.

b. The factory-built modular connector, manifold and stack system shall be laboratory tested and listed by Underwriters Laboratories, for use with building heating equipment and appliances which produce exhausted flue gases at a temperature not exceeding 1000°F under continuous operating conditions and not liquid fuels as described in NFPA 211. The stack system shall be designed and installed to be gas tight and thus prevent leakage of combustion products into a building. The system shall be designed to compensate for all flue gas induced thermal expansions.

c. The double wall stack shall have an inner gas carrying pipe of type 304 stainless steel for gas. There shall be a nominal 1" air space between the walls. The outer jacket shall be aluminum coated steel. The materials and construction of the modular sections and accessories shall be as specified by the terms of the product's UL listing.

d. The flue system shall be installed according to the manufacturer's installation instructions and shall comply with the following additional codes or standards:

e. National Safety Standards and National Building Codes.

f. Inner pipe joints shall be sealed by use of factory supplied V Bands and sealant as specified in the manufacturer's installation instructions.

g. When installed according to the manufacturer's installation instructions the piping and its supporting system shall resist side loads (whether system is horizontal or vertical) at least 1.5 times the weight per foot of the piping. Wall supports shall support (as verified by manufacturer testing) 40 feet of pipe with a factor of safety of at least four. Plate supports shall support (as verified by manufacturer testing) 200 feet of pipe in 6" through 20" ID sizes and 100 feet of pipe in 24" ID and larger sizes with a factor of safety of at least four.

h. The entire flue and breeching system from each boiler or appliance to the termination; including accessories, except as noted; shall be from one manufacturer.

i. The flue and breeching shall be warranted against functional failure due to defects in material and manufacturer's workmanship for a period of ten years from date of delivery.

j. Drawings showing the actual layout and drawn to scale shall be provided by the manufacturer. The system shall be installed as designed by the manufacturer and in accordance with the terms of the manufacturer's 10-year warranty and in conjunction with sound engineering practice.
k. The inner diameter for breeching shall be verified by the manufacturer's computations. The computation shall be technically sound, shall follow ASHRAE calculation methods, and incorporate the specific low characteristics of the inner pipe. The contractor shall furnish the exact boiler model and operating characteristics to the factory representative. Operating characteristics shall include flue gas flow rate, BTU input, outlet temperature, local altitude, stack layout, and available external pressure at boiler outlet, etc., necessary to determine system operation at maximum and minimum levels of burner turndown range.

l. Aluminized steel surfaces exposed to the elements shall be protected by a minimum of one base coat of primer and one finished coat of corrosion resistant paint suitable for outer jacket skin temperatures of particular installation (such as series 4100 or 9400 as manufactured by Rust-Oleum). Paint to be supplied by the installing contractor. (Outer wall of type 304 or 316 stainless steel may be substituted for paint.)

m. Technical Services Support: The factory-built modular flue and breeching system shall be furnished by a vendor organization which assures design, installation and services coordination; and provides in-warranty and post-warranty unified responsibility for owner, architect, consulting engineer and contractor.

n. Specification requirements shall be met by using Selkirk Metalbestos Model PS or equivalent as approved by the responsible engineer.

HV-33 FLEXIBLE DUCTWORK

a. Insulated low pressure type: Genflex Type LPS-181, Wiremold, or approved equal, with positive interior air seal which shall prohibit insulation fiber erosion. Factory insulated with 1” thickness of 1 lb. density fiberglass insulation sheathed in Class 1 vapor barrier, UL labeled, and meet latest UL Class 1 Fire Hazard Classification of NFPA Bulletin 90-A. Use for connection between air supply duct to air outlets and other indicated locations. Install in accordance with manufacturer’s instructions.

b. Flexible duct to be installed in a fully extended condition free of sags and kinks, using minimum length required to make connections. Lengths shall in no case exceed 18 inches. Joints and/or connections made by thoroughly coating interior of duct to a depth of 2” with high pressure duct sealer and securing in place over sheet metal collar with Genflex Model QC, or approved equal.

HV-34 DUCT LINING – FIBROUS GLASS

a. General: Acoustical insulation adhesive, mastics and related material shall be of non-combustible materials to meet Code and with UL flame spread rating of 25 maximum and smoke developed rating of 50 maximum. Thermal resistance R rating of 4 per inch on a flat surface at a mean temperature of 75ºF.

b. Provide internal duct insulation for a minimum of 15 feet upstream and downstream of air handlers and fans, 10 feet downstream of VAV boxes and where indicated on the Drawings. Apply insulation on all interior surfaces.

c. Apply insulation with faced surface exposed to the air stream. Fasten insulation to interior of ducts and casings with welded pin or clip fasteners. Space fasteners a maximum of 18” on center in the longitudinal direction and 12” on center in the transverse direction, in accordance with SMACNA standards. Caulk butting edges to form a smooth surface with no raw edges exposed. Provide metal nosing on all leading edges.

d. Insulation Thickness: 1 inch unless otherwise noted.
e. For supply ductwork above a ceiling or inside a mechanical room (within unconditioned space), contractor shall provide either 1-1/2” lining or 1” lining with ½” external insulation to meet the R-6 insulation requirement per Energy Code.

f. For supply and return ductwork located outdoors where acoustic lining is called for, provide 2” lining to meet the R-8 insulation requirements per Energy Code.

g. Line ductwork with 1½ pound density flexible fibrous glass blanket with a non-eroding interior surface.

h. The duct lining coating shall not support the growth of fungus or bacteria in accordance with ASTM C1071 and ASTM G21 and G22.

i. Schuller Manville Permacote Linacoustic.

HV-35 MANUAL DAMPERS

a. Provide adjustable dampers necessary for proper control and balancing of air distribution. Furnish dampers in all branches, with operating levers readily accessible. No damper greater than 48” long. For greater lengths, provide dampers in equal sections as required.

b. Damper shall be constructed as same material as ductwork, except as otherwise specified. Rigid construction, free of all rattling and vibration, with edges crimped or creased for stiffness.

c. All dampers shall have through rods, not less than 3/8” diameter fastened to blade with 2 or more yokes with set screws, with steel washer at each end of damper rod.

d. Damper blades are to be two gauge numbers heavier than ductwork in which they are to be installed; 18 gauge and lighter shall have both edges double hemmed. Blades longer than 35” shall have “V” crease in middle to receive damper rod.

e. Dampers shall have through rod axles with 14 gauge bearing plate at one end, and quadrant and lever with lock screw at the other end.

f. On insulated ductwork, mount quadrant metal saddles finishing flush with insulating surface.

g. Dampers less than 16” high can be single blade; 16” and deeper shall be multi-blade. Splitter dampers are not acceptable for air balance, volume dampers shall be used.

h. Provide teleflex cables for remote damper operation as required.

i. Dampers utilized for tight shutoff shall not permit leakage in excess of 1% volume with a pressure differential of 6” w. g.

j. Multi-Blade Dampers: Opposed blade type, and shall comply with requirements for single blade dampers. All damper rods, linked together to operate as a unit.

HV-36 CABLE OPERATED DAMPERS

a. Provide cable operated remote controlled volume dampers in inaccessible branch ducts feeding linear diffuser plenums and rectangular air outlets located in gypsum board and spline ceilings. Dampers shall be adjustable through the diffuser face with standard tools, providing positive balancing of multiple airflows to maintain design air throw and noise criteria.
b. Extruded aluminum damper shall be gear actuated by a brass plated rotary cable meeting Mil-spec 1-45208 and supported at each end by self-lubricating bearings in extruded aluminum support brackets.

c. Rotary cable shall have a minimum torque service factor of 200% when installed in accordance with manufacturer furnished instructions. Cable assembly shall snap-fit into damper for ONE PIECE installation with no linkage adjustment requirement or small parts to get lost on site.

d. Adjustment end mounting bracket shall screw to plenum wall or install with factory furnished double face tape and push-in fastener, facilitating one hand installation in plenums as narrow as 2". Positive, direct, two-way damper control shall be provided with no sleeves, springs, or screw adjustments to come loose after ceiling closure.

e. Acceptable manufacturers: Metropolitan Air Technology Inc. Model #RT-100 or reviewed equivalent.

HV-37 FIRE DAMPERS

a. Provide fire dampers with access doors installed where shown, and as required by all local codes. Damper rating shall match that of the wall/partition it is meant to protect (see Architect’s drawings). In general, fire dampers are required where ducts pierce fire rated floors, walls and shafts, or where unducted transfer openings are located in fire rated barriers.

b. Fire dampers shall be similar to Air Balance, Inc. Model No. 119, Type B or Type C, or as approved for rectangular and round ducts. Dampers shall meet the requirements of NFPA Bulletin No. 90A, and shall be tested in accordance with UL 555 Test Criteria for Fire, Corrosion and Dust Loading, labeled and listed by Underwriters Laboratories.

c. Fire dampers shall be installed as detailed on the Drawings with retaining angle iron frames, sleeves and breakaway connections.

d. Dampers must be able to fully close with the operating maximum airflow and pressure present.

e. Dampers installed horizontally in vertical ductwork shall be spring loaded to close without the aid of gravity.

HV-38 SMOKE DAMPERS

a. Provide electric operated smoke dampers where shown on the plans.

b. Smoke dampers and their operators shall be qualified under UL555 S to an elevated temperature of 250 F, leakage Class I. Electric operator shall be installed by the damper manufacturer at the time of damper fabrication.

c. Damper shall be Ruskin Model SD50, Pottorff Model SD151 or reviewed equivalent.

HV-39 FIRE/SMOKE DAMPERS (FSD'S)

a. Provide combination fire/smoke damper where shown on the plans. Damper rating shall match that of the wall/partition it is meant to protect (see architectural drawings).

b. Fire/smoke dampers and their operators shall be qualified under UL555S to an elevated temperature of 250°F, leakage Class I. Electric operator shall be 120 volt, normally closed, installed by the damper manufacturer at the time of damper fabrication.
Each combination fire/smoke damper shall be equipped with two UL classified heat sensors. Primary heat sensor shall operate at 165ºF. Secondary heat sensor shall allow override to operate as may be required for smoke control functions after fire closure. For non-smoke purge application use only one heat sensor.

d. FSD's for use in smoke exhaust systems shall be furnished with end switches for remote indication of damper position.

e. For 1½-hour rating, damper shall be Ruskin Model FSD 60, Pottorff FSD151, for 3-hour rating damper shall be Ruskin FSD60-3 or reviewed equivalent.

HV-40 ACCESS DOORS IN SHEETMETAL WORK

a. Wherever necessary in ductwork, casings or sheetmetal partitions, provide suitable access doors and frames to permit inspections, operation and maintenance of controls, fire dampers, filters, bearings, traps, or other apparatus concealed behind the sheet metal work. All such doors shall be of double construction of not less than No. 20 gauge sheet metal, and shall have sponge rubber gaskets around the entire perimeter. Doors in insulated ducts or insulated casings shall have rigid fiberglass insulation between the metal panels.

b. Access doors in sheet metal ducts shall be hung on heavy flat hinges and shall be secured in the closed position by means of cast zinc clinching type latches. Where space conditions preclude hinges, use four (4) heavy duty window type latches. Doors in ductwork shall, in general, be no smaller than 18” by 18”, except for access doors to fire dampers which may be larger depending on size of fire damper and need to service the fusible links.

c. In no case shall access to any items or equipment requiring inspections, adjustments, or servicing require the removal of nuts, bolts, screws, wing nuts, wedges, or any other screwed or loosed device.

d. Access doors shall be provided where needed for existing components of systems as well as all new components added under this contract whether or not shown on the plans.

HV-41 CEILING DIFFUSERS, REGISTERS AND GRILLES

a. Factory finish new air outlets with semi-gloss baked enamel in a color approved by the Architect. Paint visible dampers and accessories flat black.

b. Provide equalizing deflectors and an opposed blade damper at each diffuser.

c. Louver Face Ceiling Diffusers: Square as shown on the plans, surface mounted, multiple flared discharge members square inlet neck. Titus TDC.

d. Plate Face Ceiling Diffusers: Round neck, lay-in, steel diffuser with single plate deflector. Titus OMNI.

e. Top Registers: Steel double deflection individually adjustable contoured blades with front blades parallel to short dimension. 1¼” steel border flange with countersunk screw holes and welded corners. Opposed blade dampers shall be constructed of steel and operable from the face of the register by screw driver. Titus Model 300.

f. Linear Diffusers: Aluminum frame, end caps and flanges in one-piece lengths up to 6 feet. Greater lengths shall be joined with alignment pins to form continuous appearance. Curved steel pattern controller shall be capable of 180º pattern adjustment in 3-foot lengths. Finish shall be black for pattern controller and white or optional color flanges per Architect preference. Titus Model ML or MLR (return).
g. Bar Grille: Sidewall linear bar grilled of extruded aluminum construction shall be single piece up to 6 feet. Longer lengths shall be joined with alignment pins to form continuous appearance. Core support bars 9 inches apart shall strengthen the grille assembly. Bars shall be spaced ½” on center with 15 degree deflection. Titus Model CT541.

h. Return and Exhaust Grilles: Steel, 1-1/4” flat margin with fixed 3/4” bar spacing at 45 degrees angle. Fixed face louvers shall be parallel to the long dimension of grille. Color as approved by Architect. Titus 23RL. Furnish opposed blade dampers for return grilles. Provide light shields at each CG exposed to ceiling plenum (non-ducted).

i. Provide ceiling mounting flanges as per architectural requirements.

HV-42 ACOUSTICAL SPECIFICATION FOR DIFFUSERS

a. Air Distribution System; Diffusers, Grilles and Register Noise: Maximum permissible sound-power levels in octave bands of airborne transmission through the combination of grille, registers, diffusers, or related pressure reducing devices, when operated at the maximum inlet pressure and cfm in installed condition per plans and specifications shall be as follows:

<table>
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<tr>
<th>Octave Band</th>
<th>Auditorium NC-25</th>
<th>Private Dining Rooms NC-30</th>
<th>Private Offices NC-35</th>
<th>Executive and &quot;A&quot; Offices NC-30</th>
<th>Small Conference Rooms NC-35</th>
<th>Large Conference Rooms NC-30</th>
<th>Open Plan Offices NC-40</th>
<th>Corridors NC-40</th>
<th>Bathrooms NC-40</th>
<th>Storage Rooms NC-45</th>
<th>Main Kitchen NC-50</th>
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AIR DISTRIBUTION SYSTEM EQUIPMENT/Terminal Device Noise

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HV-43 EXTERIOR LOUVERS

a. Louvers shall be 45° deflection or combination type as shown, weatherproof with no less than 50% free area.

b. Extruded aluminum, 12 B&S gauge, 6063-T5 alloy blades, and frame, stainless steel or aluminum fasteners.

c. Miter frames and trim at corners and reinforce with corner brackets.
d. Provide removable ¾” x ¾” aluminum birdscreen in an aluminum frame.

e. Remove existing window frame complete with glass without damage and deliver to Owner to be stored as directed.

f. Blank off remaining portion of window glass and seal weathertight.

g. Finish material and color shall match building features and shall be approved by the building’s representative.

h. Exterior louvers shall be as manufactured by Construction Specialties, Arrow Louver or Ruskin. Combination louvers with horizontal blades shall be similar to Ruskin Model ELF375.

HV-44 AIR BALANCING

a. Air balancing firm or representative must be qualified and submit evidence before engagement.

b. Take air readings prior to construction to determine existing conditions serving the demised space and effecting adjacent spaces. Traverse main ducts supply air and/or take air outlet readings to determine boundary conditions. Refer to building rules for additional requirements.

c. Upon completion of the air system installation, air balancer shall examine air movers, return system and supply system for open air ways and normal operating conditions. Perform air system balance in accordance with the Standards of American Air Balance Council and/or the Testing, Adjusting and Balancing Bureau under the witness of Owner’s representative.

d. Provide new fixed sheave and belts or make adjustments, as required, to achieve design balance points for each unit.

e. Submit Air Balance Reports, including design and actual quantities for each product, including fans, air outlets, etc. Static pressure readings at various points in and around AC equipment shall be shown on schematic diagram of system.

f. Air balance and adjustments shall be provided until acceptable to the Owner’s representative.

g. Contact building management to schedule balancing procedures.

h. Balance all supply, return and exhaust systems to the quantities indicated on the Drawings with the following tolerances:

1. Fans - Design volume plus 5%
2. Leakage - 5% maximum
3. Outlets - Design volume plus or minus 5%

i. Take pitot traverse readings of main ducts at shaft connections and air handler or AC unit discharge. Record static pressure at time of reading. Readings shall be taken after final balancing and shall include sketch indicating reading locations.

j. Add volume dampers as required for final balancing.

k. With regard to variable air volume system air balancing, the intent is to open the VAV terminals to their fullest extent. The Drawings indicate the maximum air quantities expected to be delivered by the boxes. After the boxes are fully opened, take readings at the diffusers. Should the air quantity actually being delivered be less than designed, each air outlet connected to a particular VAV box shall receive an equal percentage of the total air quantity being delivered to the box.
l. Refer to Fan Powered VAV Terminal Section for method of balancing fan-powered boxes.

m. Record outdoor air quantities for minimum OA and maximum OA conditions.

n. Record exhaust fan cfm, inlet static pressure, discharge static, volts and amps.

o. Record AC unit cfm, static pressures, volts, amps on evaporator section and condenser section as applicable.

p. Contractor to perform necessary comfort balancing after move-in.

q. Contractor shall field adjust air pattern deflectors at air outlets to obtain desirable air distribution and draft-free environment.

HV-45 ELECTRIC MOTORS

a. Provide electric motors for driving the mechanical equipment. Motors shall be of proper power, construction and speed to suit the specified makes of equipment; if other makes of equipment are accepted, the proper adjustments of motor speed and power must be included without additional cost. Submit drawings for approval before the equipment is purchased.

b. 1/2 horsepower and larger motors shall operate on 3 phase, 60 Hertz, alternating current, except as otherwise noted. 1/3 horsepower and smaller motors shall operate on 120 volt, single phase, 60 Hertz, alternating current, except as otherwise noted.

c. Motors shall be of constant speed, squirrel-cage type. Single phase motors to be capacitor start, induction run, or split phase type as approved for the service.

d. All 1/2 horsepower and larger motors shall have Class II insulation with maximum temperature rise of 40 C ambient when operated at 115% load.

e. All motors shall be quiet operating, guaranteed to fulfill the specified requirements without producing any sound audible outside of Machine Rooms.

f. All belt connected motors shall have adjustable bases and set screws to maintain proper belt tension. Provide proper belt guards.

g. All motors and accessories shall comply in all respects with NEMA standards.

h. Coordinate the NEMA type of each motor with the torque and inertia of the equipment served, and the inrush characteristics of the motor with the starter selection, so that all items furnished constitute a properly related package. No motor shall operate in the service factor range.

HV-46 ELECTRIC MOTORS FOR VARIABLE SPEED SERVICE

a. This specification contains the minimum requirements for the design, manufacture and performance of three phase, horizontal, NEMA frame induction motors for use on AC Adjustable Frequency controllers.

b. This specification addendum shall apply to all motors supplied directly to the purchaser, to motor/drive packages and to OEM equipment designated for use on AC Adjustable Frequency Drives.

c. The motor shall be designed and manufactured to meet all applicable sections of NEMA MG1, 1993.
d. Motors shall be capable of operating at 1.0 service factor on Inverter Power. Nameplate Sinewave service factor shall be 1.0 or greater.

e. Motor temperature rise shall not exceed Class "F" insulation limits, with $115^\circ C$ allowable winding hot spot temperature, when operated on Inverter Power across its nameplate speed and torque envelope. Sinewave temperature rise shall be Class "F" or better.

f. Motors shall be designed and evaluated for use on AC inverter power and adjustable speed applications.

g. Frame materials shall be cast iron, aluminum or rolled steel.

h. Stator core designs shall be of high rigidity with reinforced end turn construction to minimize mechanical fatigue of the winding, and to reduce resonant noise. Single dip and bake cycles are not acceptable.

i. Winding thermal protection, utilizing normally closed contacts, shall be sized to match the maximum safe operating temperature of the insulation system. Hazardous location motors shall have winding thermal protection sized as required to meet UL or as auxiliary devices where not required by UL.

j. Low loss electrical steel shall be utilized in the stator and rotor core assemblies.

k. Rotor cores and/or assemblies shall be of a low vibration design that meets $\frac{1}{2}$ of the NEMA MGI recommended levels for balance.

l. Variable torque motors shall meet NEMA design "B" performance levels. Design "A" motors are acceptable when higher than normal efficiencies as required.

m. Variable torque motors shall be nameplated for 6-60 hertz operation. Hazardous location motors may be nameplated 10-60 hertz.

n. Performance data for adjustable speed operation shall be stamped on a steel data plate and permanently attached to the motor frame.

o. The minimum amount of adjustable speed data shall include:

1. Application Type - Constant Torque, Variable Torque or Constant HP.
2. Maximum approved continuous torque.
3. Approved RPM and frequency operating range.
4. Typical motor full load amps on inverter power.

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U.S. Electrical Motors "Inverter Grade" or reviewed equivalent acceptable manufacturers.

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HV-47 MOTOR STARTERS

a. Provide all necessary contacts, relays and switches for motor operation in accordance with the control system sequences and safety device operation.

b. Starter, push buttons, signal devices and motor controller equipment shall be NEMA Standard.

c. Provide a nameplate at each control unit indicating the equipment it controls.

d. Starters for motors shall be fused disconnect and magnetic across-the-line starter in an enclosure. The cover shall be capable of being padlocked in the open position. Enclosure shall be NEMA 1 for dry locations, NEMA 3R for wet or outdoor locations. Allen Bradley 712-713.

e. Furnish contactors in starters with under voltage protection and one N. O. magnetic electric interlock for the holding circuit and provision for adding two additional auxiliary contacts within the same enclosure.

f. Provide all starters unless otherwise specified, with manual reset thermal type overload relays having inverse time delay characteristics and interchangeable heater elements. Single phase starters shall have one relay; three phase starters shall have one relay per phase.

g. Red running lights shall be of neon type, mounted on (or so to be visible through) the cover.

h. Selector switches shall be mounted on (or be accessible through) the cover; Hand-Off-Auto switch positions.

i. Provide three (3) overload heaters for each motor starter sized in accordance with actual motor nameplate full load amps, service factor, and NEC Article 430.

j. All starters shall be appropriately sized for the motor served, minimum NEMA Size 1. Motor horsepower shown on the Drawings are approximate. Coordinate with the Contractor supplying the motors and modify to suit.

k. Unless otherwise indicated, all starter controls shall be 120 VAC. Starters for 480 volt motors shall each be provided with a fused control power transformer tapped from the line side of the contactor. The unfused secondary leg shall be grounded. Starters for 208 volt motors shall each be provided with a control circuit fuse tapped from one leg of the line side of the contactor and a #14 AWG minimum neutral wire from the panelboard feeding the starter.

l. Control transformers shall each have minimum 50VA additional capacity for auxiliary devices. Refer to control diagrams for quantities and types of devices, and size transformers to suit.

m. Each motor starter shall be provided with minimum 3-normally open and 1-normally closed auxiliary contacts, a cover-mounted hand-off-automatic selector switch and RUN pilot light. Pilot lights shall utilize long-life, 20,000 hour minimum lamps. Refer to control diagrams for exact requirements and modify starters to suit.
n. Approved Manufacturers - Motors
   2. Cutler Hammer
   3. General Electric Company
   4. Westinghouse Electric Corp.

HV-48 VARIABLE SPEED DRIVES

a. Adjustable frequency motor drive package shall consist of pulse width modulated inverter, control features and safety devices, diode bridge rectifier (0.95 power factor) and indicator lights in NEMA 1 enclosure.

b. Inverter logic shall be microprocessor based and control shall incorporate a switching power supply operating off the DC link of the control to eliminate control transformers and line disturbance sensitivity.

c. Built-in display shall indicate output frequency, output voltage, or output current. It shall also provide an indication of the activation of protection features or status.

d. In addition to standard adjustable motor control features, package shall include the following:
   2. Door interlocked disconnect.
   3. Manual transfer to line power via contactors including motor thermal overload and short circuit protection while in the bypass mode.
   4. Service switch which will provide the ability to service the control while in bypass operation not having to remove power from the motor.
   5. External fault input to provide indication of Fire, Smoke, or Freeze detector activation.
   6. 115 VAC control transformer.
   7. Line reactor – 5% impedance.
   8. Sufficient auxiliary contacts and/or Network Interface Card (NIC) to interface with Building Automation System. All contacts shall be brought out to factory installed terminal strips.
   10. Copper internal wiring.
   11. Critical frequency avoidance circuit board to lockout certain frequencies which will create resonance of equipment. Test equipment to determine resonant frequencies after installation is complete.
   12. RFI filter meeting requirements of EMC product standard EN 61800-3 for first environment.
   13. Reverse motor operation circuitry programmable from control panel.

e. Service, Warranty and Agency Approval
   1. The manufacturer shall have existing sales, service and parts suppliers local to the installation site.
   2. Start-up service shall be provided by a factory authorized technician. Included with this service, for a period of one year after initial start-up, is a full parts and labor on-site warranty.
   3. The control shall have CSA and ETL approval.

Drives shall be furnished by Control Contractor and installed by Electrical Contractor.

HV-49 WATER DETECTOR ALARMS (RAYCHEM)

a. Point Alarm System: Remote wall mounted, Raychem Model TTC-1, to monitor a single run of Raychem Model TT3000 sensor cable from 1 to 300 feet in length as required. Module shall be connected to sensor cable via plenum rated jumper wire. Each module shall include Power LED (green), Leak LED (red) and Cable Break LED (yellow) indicators. Each module shall provide Form "C" relay outputs (N/O and/or N/C) for leak alarm, and one Form "C" relay output (N/O and/or N/C) for Cable Break alarm. Each module shall be configurable for manual relay reset (latching) or automatic relay reset. Each module shall provide variable leak sensitivity and variable time delay for alarm. See Contract Drawings for quantities.

b. Multiple Point Water Detection System: Furnish and install, where shown on the Drawings, a complete water detection location and alarm system as manufactured by Raychem Corporation. The system shall be able to quickly detect and digitally display water location zones up to 100 zones per panel, as well as sound an audible alarm. System shall detect a 4 inch leak anywhere on the system and provide the zone where water was detected. System shall include the following components:

1. One Model TTDM wall mounted alarm panel, powered by 24VAC or 120VAC, with separate Form "C" relay outputs for Leak, Service, and Fault conditions. System shall provide open protocol 4-20mA, RS232, and RS485 signal for integration to site monitoring or building management systems. The panel shall provide data-logging of 500 events in non-volatile memory. The panel shall monitor for additional events even after detecting a leak. The panel shall provide self-diagnostics on factors effecting electronics and cable performance.

2. Length of plenum rated water detection cable for each zone shall be 5 feet. Cable shall be provided in pre-connectorized sections. Cable connectors shall be low profile for ease of installation and replacement. Cable shall be field splicable as required.

3. All plenum rated interconnecting jumper wires from panel to first water detection sensor segment and from sensor segment to sensor segment after that.

4. Install sensing cable only after all other construction work is completed. The leak sensing area must be clean, dry, and free of oil or any conductive fluids. Provide hold down clips. Attach to cables and install approximately 3 feet apart.

5. Provide graphic reference map showing actual cable layout with leak sensor locations and premises (including AC unit numbers) landmarks. Map shall be made after actual testing for zone reading is completed. Map shall be framed or otherwise enclosed and placed alongside the TTDM panel. Submit copy for review prior to installation.

c. Precise Location Water Detection System: Furnish and install, where shown on the Drawings, a complete water detection location and alarm system as manufactured by Raychem Corporation. The system shall be able to quickly detect and digitally display water location (one foot increments) up to 5,000 feet, as well as sound an audible alarm. System shall detect a 4 inch leak anywhere on the system and provide the location +/- 1 foot. System shall include the following components:
1. One Model TTDM wall mounted alarm panel, powered by 24VAC or 120VAC, with separate Form "C" relay outputs for Leak, Service, and Fault conditions. System shall provide open protocol 4-20mA, RS232, and RS485 signal for integration to site monitoring or building management systems. The panel shall provide data-logging of 500 events in non-volatile memory. The panel shall monitor for additional events even after detecting a leak. The panel shall provide self-diagnostics on factors affecting electronics and cable performance.

2. Length of plenum rated water detection cable shall be determined from field conditions. Cable shall be provided in pre-connectorized sections not to exceed 50 feet in length. Cable connectors shall be low profile for ease of installation and replacement. Cable shall be field splicable as required.

3. All plenum interconnecting jumper wires from panel to first water detection sensor segment.

4. Install sensing cable only after all other construction work is completed. The floor must be clean, dry, and free of oil or any conductive fluids. Provide hold down clips. Attach to cables and install approximately 6 feet apart.

5. Provide graphic reference map showing actual cable layout with distance indications and room landmarks from beginning point of water detection cable run. Map shall be made after actual testing for distance reading is completed. Map shall be framed or otherwise enclosed and placed alongside the TTDM panel. Submit copy for review prior to installation.

d. System shall be serviced by installing contractor for a period of one year from date of recorded start-up.

HV-50 ELECTRIC UNIT HEATERS

a. Electric unit heater shall be UL listed, horizontal type (unless otherwise shown) with heating and air delivery capacities as scheduled.

b. Cabinet shall be fabricated of 18 gauge steel. All metal surfaces shall be corrosion resistant and provided with baked enamel finish and protective air inlet louvers.

c. Mounting bracket shall be provided for ceiling or wall hung application.

d. Heating elements shall have copper clad steel sheath and aluminum heat transfer fins. Automatic reset thermal over-heat protection shall instantly de-energize in case of thermal overload.

e. All heaters drawing in excess of 48 amperes shall be provided with factory installed sub-divided circuits of 48 amperes or less.

f. Motors shall be totally enclosed, continuous heavy-duty all-angle operation, equipped with thermal overload protection.

g. Fans shall be aluminum, directly connected to fan motor.

h. Field installable control kits, including low voltage transformers shall be provided. All heaters of 63 amperes or less shall be provided with power disconnect switches (field installed).

i. Manufacturer shall be Markel, Chromalox or reviewed equivalent.
HV-51 ELECTRIC HEAT TRACING

a. The self-regulating heater shall consist of two 16 AWG tinned-copper bus wires embedded in parallel in a self-regulating polymer core that varies its power output to respond to temperature all along its length, allowing the heater to be crossed over itself without overheating. The heater shall be covered by a radiation cross-linked modified polyolefin dielectric jacket, and have an outer braid of tinned-copper and an outer jacket of modified polyolefin.

b. In order to provide energy conservation and to prevent overheating, the heater shall have a self-regulating factor of at least 90 percent. The self-regulation factor is defined as the percentage reduction, without thermostatic control, of the heater output going from 40ºF pipe temperature operation to 150ºF pipe temperature operation.

c. The heater assembly shall operate on line voltages of 208 volts. Provide any necessary transformers.

d. The heater shall be sized according to the manufacturer's recommendation for particular pipe size and insulation thickness of 2" fiberglass at the minimum ambient temperature. The minimum ambient temperature shall be –10ºF. The heater output rating is to be given in watts per foot at 50ºF.

e. Each heater cable shall be individually controlled by an end of line temperature sensing device. The thermocouple or RTD shall be located on each pipe of the furthest end of the heating cable from the power connection point. Failure of a temperature sensor shall be indicated at the system monitor panel. Mechanical thermostat shall not be used.

f. Each heater cable including all tees shall be directly monitored for continuity of all heater cable bus wires by use of an end of line active end seal. Monitoring current and ground fault shall not replace direct end of line bus wire continuity monitoring. The addressable system shall be capable of identifying the continuity status of each leg individually.

g. All monitoring and temperature sensing shall be provided without additional wiring other than power supply to the heater cable.

h. The control system shall energize each heater when the pipe temperature drops to 40ºF. The system shall indicate an alarm condition when the pipe temperature drops to 35ºF. The control system shall be fail-safe.

i. A system monitor panel shall be provided of NEMA 1 construction and shall be located indoors as determined in the field. The panel shall operate off of the heater cable power supply, at that voltage. The panel shall have LED indication for power on and common alarm. The system shall provide common alarm dry contacts to the HVAC Alarm System (auto-dialer). The system shall be capable of being upgraded for RS-232 communication interface.

j. Each heater cable or branch shall have the following discrete LED indication at control panel:

1. Continuity fault;
2. Heater on;
3. Low temperature;
4. Temperature sensor failure.

k. The enclosure shall be provided with a laminated system map that shall define which monitor channel refers to each pipe location.
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Colts Neck, New Jersey

l. The control system shall be GAF-MCP-10 by G.A. Fleet Associates, Harrison, NY. Heater cables shall be Model XL-Trace-CR by Raychem Corporation.

m. Installation

1. Apply the heater linearly on the pipe after piping has been successfully pressure tested. Secure the heater to piping with cable ties or fiberglass tape.

2. Apply "electric traced" signs to the outside of the thermal insulation.

3. Active end seals shall not be installed until cable is tested. Protect exposed ends from moisture during construction.

4. After installation and before and after installing the thermal insulation, subject heater cable to testing using a 1000 VDC megger. CABLE MUST BE MEGGER TESTED BEFORE POWER AND END CONNECTIONS ARE MADE. Minimum insulation resistance should be 20 to 1000 megohms regardless of length.

5. Four hours of start-up and training by factory authorized personnel shall be provided.

HV-52 AUTOMATIC CONTROLS

a. General:

1. Standards: Except as modified by local governing codes and the Contract Documents, comply with the provisions and recommendations of UL, ASME, ASTM, ASHRAE, NBFU, NEC, ABM Systems and NFPA.

2. Controls Contractor: Work included under this section shall be provided by a qualified temperature controls installer with a minimum of five years experience.


b. Components:

1. The automatic control system shall be complete with all necessary sources of electricity, instrument air, sensors, controllers, relays, switches, transformers, gauges and interconnecting wiring and tubing to control the system in accordance with the sequences specified.

2. Include the design of all necessary motor control and interlock wiring to achieve the required sequence of operation. Control contractor shall furnish and install control wiring per sequence of operation herein specified. Control wiring shall be installed in EMT conduit in exposed areas, equipment rooms and stub-ups in partitions. In concealed spaces such as hung ceilings, control wiring (under 100 volts) can be plenum rated cable without EMT conduit.

3. Control contractor shall also be responsible for 110 volt power wiring for his own control panels required.
4. Room thermostats shall be of the concealed adjustment type with concealed indicators. Unless otherwise noted, install wall mounted thermostats 5'-0" above the floor measured to the centerline of the instrument. Obtain Architects approval of exact mounting location prior to installation.

c. Provide to Owner a copy of the as-installed control system for each mechanical system mounted on 1/2" masonite and covered with heat bonded clear plastic laminate or other acceptable permanent wall mounted form. Instruct Owner on how to operate systems.

d. Mount surface mounted control devices on brackets to clear the final finished surface of insulation as needed. Install control valves horizontally with the power unit up. Install controls so that adjustments and calibrations can be readily made. Calibrate controls as required after installation.

e. Conceal control conduit and tubing in all spaces except in the Mechanical Equipment Rooms and in unfinished spaces. Install in parallel banks with all changes in directions made at 90 degree angles.

f. Submit shop drawings as prepared by automatic temperature control manufacturer. Wiring diagrams shall be submitted expeditiously to allow reasonable installation time. Submittals shall include:

1. Sequence of operation and flow diagrams for all control systems
2. Equipment catalog and performance data for components
3. Wiring diagrams

HV-53 WEB BASED ALARM NOTIFICATION

a. Monitoring alarm system shall automatically message up to eight contacts, via email or SMS text messages.

b. Web access for the device shall be via Ethernet connection, to a data drop provided by others. Any required signal routing and network security must be coordinated with client IT and security teams.

c. Built-in features shall include LED indicators for Alarm status, Power status and Ethernet link status, battery backup, web based remote access and data logging capabilities.

d. Unit shall be capable of accepting signals from up to six low voltage digital or analog devices or dry contacts. If more than six inputs are required, provide additional expansion devices as needed.

e. Unit shall be suitable for wall mounting or horizontal shelf or desktop mounting.

f. Acceptable Manufacturers: Sensaphone Web600 or reviewed equivalent.

HV-54 CONTROL PANELS

a. All relays, switches, transducers and other field interface devices, for equipment located within the mechanical equipment rooms, shall be mounted in a local control panel. Each local controls panel shall have door mounted devices as required. All electrical devices within the panels shall be wired to a numbered terminal strip. All wiring within the panel shall be run in wiring tray in accordance with NEMA and UL standards, and shall meet all local codes. Panels shall be NEMA type suitable for applications as required. Provide a final as-built control drawing, reduced, laminated and mounted inside of the panel door.

b. Panels located in kitchens shall be constructed of stainless steel.

c. Panel shall be provided with 120 VAC and shall include the required transformer for control devices.
d. All electric control devices shall be of a type to meet current, voltage, and switching requirement of their particular application. Relays shall be provided with 24 VAC coils and contacts shall be rated at 10 amps minimum.

HV-55 AC UNIT AUTO CHANGEOVER CONTROLLER

a. Remote, wall-mounted unit auto changeover controller shall automatically start standby AC unit upon trouble signal received from one or two active AC units.

b. Controller shall include selector for which AC unit shall be standby and which AC unit(s) shall be active. An adjustable auto-cycle function shall allow automatic changeover (up to 99 days) of standby unit.

c. Controller shall include alarm output signal indicating emergency switchover has occurred.

d. Panel shall be powered by 24-VAC from field mounted 120V to 24V transformer supplied with controller. Internal battery shall allow operation for a minimum of 8 days without external power supply.

e. Acceptable Manufacturers: Liebert Model AC3.

HV-56 CONTROL DAMPERS

a. Automatic louver dampers shall be constructed of multiple opposed blades of 16 gauge steel, crimped at the edge or of airfoil shaped extruded aluminum. Limit blade width to 10". Provide steel linkage and shaft, and nylon, teflon or oil-impregnated bronze bearings. Set damper blades in a welded steel channel frame.

b. Galvanized or zinc plate all steel parts. Finish with aluminum paint.

c. Damper blades and frame shall have butyl or neoprene mechanically edge gaskets fastened to insure airtight seal when closed. Provide top and bottom angle stops, full width of blades.

d. Jamb seals shall be fabricated of stainless steel.

e. Provide solid brass trunion bearings with set screws between blades.

f. Acceptable Manufacturers: Imperial or reviewed equivalent.

HV-57 CONTROL VALVES

a. Automatic control valves shall be fully proportioning with modulating plug or V-port inner valves unless specified otherwise. The valves shall be quiet in operation and fail-safe in either normally open or normally closed position in the event of control air failure.

b. Control valves shall be sized by the control manufacturer and shall be guaranteed to meet the heating and cooling loads as scheduled.

c. Control valves shall be suitable for the pressure conditions and shall close against the differential pressures involved. Valve operators shall be of the molded synthetic rubber diaphragm type. Body pressure rating and connection construction shall conform to fitting and valve schedules. Control valve operators shall be sized to close against a differential pressure equal to the maximum system pressure plus 10 psi for valves and operators.

HV-58 CONTROL MOTORS
Actuators shall be provided with suitable corrosion resistant linkages for valves or dampers. Except as specified herein, all actuators shall be sized for the load/close off encountered in strict accordance with manufacturer’s recommendations. All actuators on outside air dampers, relief air dampers, and converter steam valves shall be spring return heavy duty type with oil immersed gear train. All actuators shall drive to their “normal” position anytime their associated equipment is shut down. Actuators for valves above 2” shall be spring return heavy duty type with oil immersed gear train.

HV-59 SEQUENCE OF OPERATION

a. Hot Water Boilers

1. The Secondary (boiler loop) hot water circulators (one per boiler) shall be started and stopped by the boiler’s master controller and shall operate continuously while its corresponding boiler is being called for heating. Both circulators shall be able to operate.

2. External water flow switch in hot water pipe shall prove flow prior to system start.

3. Boiler internal controls shall cycle heating capacity to maintain the hot water supply temperature set point. Hot water supply setpoint shall be determined based on outdoor air temperature.

4. The boilers’ master controller shall receive a signal from each of the three zone temperature sensors in the space and modulate the motorized valve controlling each zone.

b. Hot Water Pumps

1. Pump station shall be manually started from pump lead/lag control panel and run continuously. Time clock alternator shall alternate pump operation on a weekly basis.

2. Should lead pump fail as sensed by pressure switch at the pump, standby pump shall automatically start and alarm shall sound at the pump control station and at HVAC alarm panel.

3. Control panel shall include HOA switch, time clock alternator, silence switch and alarm light.

4. VFD shall modulate pump speed to maintain differential pressure setpoint.

c. Kitchen Make-Up Air System

1. Fan shall be interlocked with its respective kitchen exhaust system.

2. When fan is activated, its normal closed OAI damper shall first open. Fan shall be deactivated with OAI damper closed during off schedule, smoke detection, fire alarm condition on the floor, or ansul discharge at any hoods that it serves.

3. Unit’s gas fired heater shall modulate to maintain discharge air temperature of 65°F (adjustable).

4. Freeze Protection Alarm and Controls

   a) Heating mode shall be indexed.
b) After a five minute time delay (adjustable) and air temperature is still below 40°F (adjustable), fan shall be deactivated with OAI damper closed. Freeze protection alarm shall be annunciated at HVAC Alarm Panel.

c) Once temperature rises above setpoint (40°F adjustable) within the 5 minute interval, freeze protection pump shall be deactivated and heating coil shall operate in normal mode.

d. Kitchen Exhaust System

1. Fan shall be activated from kitchen control panel.

2. Upon Ansul discharge at any hood(s) that the system serves, kitchen exhaust fan shall continue to operate at full speed but its make-up air system shall be deactivated.

3. HVAC Alarm Panel shall monitor fan status, speed, and Ansul discharge alarm.

e. Ceiling Hung & Floor Standing Air Cooled AC Unit

1. AC unit shall be started and stopped from programmable control panel. System shall be programmed in accordance with occupancy schedule provided by end user.

2. A digital override timer located in the office space near the mechanical room door shall start AC units after-hours and allow up to 6 hours of operation (adjustable).

3. When AC unit is started, normally closed minimum outdoor air damper shall open. When AC unit is stopped, minimum outdoor air damper shall close.

4. Non-VAV Cooling: AC unit compressors and airside economizer shall cycle from internal controls in response to wall mounted space thermostat located in the office area or main return air duct where shown. Fan VFD shall reduce in speed to no higher than 66% of full speed in response to cooling demand under low load conditions.

5. Return air temperature definition:

   a) In constant air volume system, return air temperature shall be sensed by one or multiple temperature sensors located within the space or main return air duct.

6. Unit Heater: the electric unit heater shall be controlled by its own thermostat to maintain 50°F (adjustable).

7. Smoke Detector (units +2,000 CFM): Supply and return duct mounted smoke detector shall alarm the Building Fire Alarm system upon sensing smoke. When the Building Fire Alarm system is in the alarm condition for this floor, the AC units shall be de-energized. When the Building Fire Alarm system is cleared, the AC unit shall require manual restart to resume normal operation.

8. Condensate Pump: High level float switch shall alarm on the HVAC alarm panel or BMS system. AC unit shall continue to operate normally.

9. Water Leak Detection: Water leak sensor in the AC unit drain pan shall alarm the HVAC alarm panel or BMS system. AC unit shall continue to operate normally.
10. DX coil freeze protection – when discharge air temperature drops below 45°F (adjustable), AC compressors shall be off and OAI damper shall be closed. HVAC alarm panel or BMS shall be annunciated. Supply fan shall continue to run in recirculation mode. Normal operation shall resume when discharge air temperature rises above 50°F and after at least 10 minutes via time delay relay.

11. Unit’s common alarm, leak detection alarm, and low MER space temperature alarm shall be tied to HVAC alarm panel.

f. HVAC Alarm Panel

1. All alarms shall be wired to an HVAC alarm panel (location as shown on plans). An auto-dialer, (Sensaphone Web600 or equivalent), shall automatically dial out pre-programmed telephone numbers as directed by the Owner, inform of discreet alarm condition via user-recorded voice message.

2. The following alarm points shall be monitored:

   a) Leak detection of each AC unit.
   b) Common alarm of each AC unit.
   c) Leak detection of each hot water heater.
   d) Low space temperature.
   e) Boiler Failure.
   f) Hot Water Pump Failure.

END OF SECTION 15000
SECTION 15400 - PLUMBING

P-1 GENERAL

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

P-2 WORK INCLUDED

a. It is the intent of these specifications to have this Contractor provide for the furnishing of all labor, materials, protection and supervision necessary and required to complete the Plumbing Work as indicated on the Drawings and described or referred to in these specifications.

b. All plumbing and drainage systems shall be installed in accordance with the pertinent requirements of the New Jersey Building Code, National Sanitation Foundation, Health Department and other agencies or department having jurisdiction.

c. All work shown on the drawings is diagrammatic and shall be installed to fit actual building conditions, all subject to approval. This Contractor shall, as part of this Contract, furnish all incidentals such as pipes, fittings, valves, pipe hangers and supports, etc., and all removals, testing, cleaning and miscellaneous items necessary to leave each system complete in every detail and ready for operation.

d. If mention has been omitted in the specifications of any work shown on the drawings or if work not shown on the drawings is called for in the specifications, same shall be included as part of the work of this Contractor.

e. Special care shall be taken during construction to prevent unnecessary damage to existing structure. All removal and cutting to permit installation of new equipment or piping shall be done only after receiving approval of Owner's representative. Equipment to be removed is the property of the owner and shall be disposed of as directed.

f. Provide all labor and new materials required for the removal of plumbing fixtures with associated piping and the installation of new water closets, urinals, lavatories, sinks, drains, coffee makers, and refrigerator with ice makers, trap primers, filters, water heaters, kitchen equipment, waste, vent, cold and hot water, and gas piping, for a complete system ready for Owner's use.

g. A complete gas distribution system, including but not limited to: meter, booster, pressure regulators, piping distribution, supports, gas cocks, flexible connections, and gas supply to equipment.

h. Care shall be taken when cutting into existing water and drainage line to prevent accidental flooding of premises.

i. Filing and paying all fees and obtaining all approvals from the New Jersey Building Department and authorities having jurisdiction.

j. All shut-downs with connections to risers and stacks with new work in non-tenant ceilings including cost of ceiling repair shall be on overtime in coordination with Building Management and Tenant within work area.

k. Rigging for plumbing equipment.

l. Cutting and rough patching.
m. Prime painting of equipment.

n. Obtaining government approvals, permits, control inspections, sign-off of BFP, etc.

o. Start-up, testing, adjusting and balancing of systems, and training of Owner’s personnel.

p. Furnishing information on concrete pads.

q. Guarantees.

P-3 RELATED WORK IN OTHER SECTIONS

a. Patching and framing.

b. All electrical conduits, power wiring, etc. for equipment.

P-4 OPENINGS AND CHASES

a. Provide all openings, chases, recesses and bucks that are required for the admission of the work. This Contractor shall determine in ample time prior to the installation of his work all required openings for admission of drains, etc.

b. Inspect the general plans for pipe spaces. Do all necessary cutting, if such is required, to allow for the admission of the work. Remove all surplus materials and dispose of same, as and where directed.

c. Cutting shall be done with hand tools. No cutting by jackhammer will be permitted.

P-5 CONSTRUCTION NOTES

a. It is the intent that each part of the system shall be complete in all details and water lines provided with all control valves necessary for satisfactory operations and maintenance.

b. Examine carefully the plans of other trades in detail and all conditions relative to the installation of piping.

c. In no case shall piping be exposed beyond finished plaster lines unless specifically shown otherwise on drawings. Consult with the other trades in the building and install piping in such a way as to least interfere with the installation of other trades.

d. The water piping shall be installed so as to drain and branches shall not be trapped but shall have continuous pitch.

e. Piping shall be installed so as to avoid ducts and electric light outlets and before the installation of same consult with the other trades and facilitate the erection of the equipment.

f. After cutting, all pipes shall be reamed out to full bore and before erection the inside of all pipes shall be thoroughly cleaned.

g. Piping connections to ductwork are not permitted.

P-6 MATERIALS - GENERAL REQUIREMENTS
All materials shall be new and the best of their respective kinds, suitable for the conditions and duties imposed upon same at the building. Materials shall match existing for similar service except as otherwise noted herein. They shall generally be of representative manufacture. Brand names are specified to indicate a standard of quality only.

All piping, pipe fittings, plumbing fittings and fixtures installed within potable water systems shall be in compliance with Section 1417 of the Safe Drinking Water Act (Reduction of Lead in Drinking Water Act).

Origin of Manufacture - Contractor shall not use any product that is made in China. If the contractor wants to use a product made in another country outside of the USA or Canada, the contractor must demonstrate that such is of an equal or better quality than the specified product. By using products made outside of the United States and Canada, the contractor assumes all liabilities associated with the performance of the product and shall indemnify and hold Robert Director Associates harmless and shall pay for all legal and attorney fees against any claims as a result of the use of said product.

P-7 DRAINAGE SYSTEM

a. Sanitary Sewer and Storm Water Piping, Above Grade
   1. Waste and vent piping shall be cast iron no-hub drainage pipe ASTM A-74 and fittings shall be SD 4000 couplings as manufactured by Husky. Piping shall be supported at every five feet and at every change in direction for horizontal piping. Screw plug clean-outs shall be provided at each change of direction in drainage piping.
   2. All cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute (CISPI) and be listed by NSF International.
   3. All couplings for Hubless cast iron soil pipe and fittings shall conform to CISPI 310 and be certified by NSF International.

b. Sanitary Sewer and Storm Water Piping, Buried
   2. Fittings: Cast iron.

c. Indirect waste shall be copper Type "L".

P-8 WATER PIPING

a. Install new domestic water piping as indicated with hot and cold water connecting to fixtures requiring same as indicated on the drawings.

b. Piping concealed in hung ceiling or partitions shall be copper type "L" ASTM B-88 with cast brass fittings and conforming to requirements to USAS B16.18. Joints shall be soldered joints. Installations within potable water systems shall utilize lead-free solder and flux compounds.

c. Exposed hot and cold water piping shall be standard weight IPS brass pipe, chrome plated.

P-9 GAS PIPING

a. Natural Gas Piping, Above Grade – Low Pressure (0.5 PSIG)
1. Steel Pipe: ASTM A53 or A120, Schedule 40 black.

2. Fittings: ASME B16.3, malleable iron for 4” and smaller pipe, or ASTM A234, forged steel welding type for 5” and larger pipe.


P-10 HANGERS AND SUPPORTS

a. All piping shall be substantially supported from the building structure. All hangers, rods and supports shall be specifically approved for use intended. Hangers and supports shall be installed in strict conformity with New Jersey Building Code requirements.

b. Where overhead construction does not permit fastening of hanger rods, inserts, etc., in required locations, provide additional steel framing as required and approved.

c. Expansion shields shall be provided to support hanger rods at required intervals. Expansion shields shall be Star Expansion Manufacturing, "Phillips" Anchors, Diamond "Redhead", or Hilti Co.

d. Water closet carriers for horizontal pipe installation shall be Zurn Z1201-N.4 Adjustable, high performance horizontal siphon jet water closet "Rigid System" with 4” No-Hub connections. Complete with Dura-Coated cast iron right hand, left hand, or double main fitting, with 2” vent, adjustable gasketed faceplate, universal floor mounted foot supports, corrosion resistant adjustable ABS coupling with integral test cap, fixture bolts, trim, and stud protectors. Rear anchor tie down and bonded "Neo-Seal" gasket or approved equal.

e. Water closet carriers for vertical pipe installation shall be Zurn ZN1204-N4 Adjustable, narrow wall system vertical siphon jet water closet "Rigid System" with 4” size No-Hub connections and side inlets. Complete with Dura-Coated cast iron right hand, left hand, or double main fitting, with 2” vent, adjustable gasketed faceplate, universal floor mounted foot supports, corrosion resistant adjustable ABS coupling with integral test cap, fixture bolts, trim, and stud protectors. Rear anchor tie down and bonded "Neo-Seal" gasket or approved equal.

f. Back to back Water closet carriers for horizontal pipe installation shall be Zurn Z1201-ND4 Adjustable system horizontal back to back siphon jet water closet "Rigid System" with 4” No-Hub connections. Complete with Dura-Coated cast iron fitting, with 2 [51] vent, adjustable gasketed face plates, universal floor mounted foot supports, corrosion resistant adjustable ABS couplings with integral test cap, fixture bolts, trim, stud protectors and bonded "Neo-Seal" gaskets or approved equal.

g. Urinal carriers shall be Zurn Z1221 Wall urinal support system with top support plate, complete with Dura-Coated rectangular steel uprights with welded feet, adjustable support plate and mounting fasteners or approved equal.

h. Chains, straps, perforated bars or wire hangers are not permitted.

P-11 VALVES

a. Furnish all valves of NIBCO, Walworth or other approved manufacture, as indicated on the plans, or as may be required for the proper control of the pipe lines installed under these specifications, so that any fixture, line or piece of apparatus may be cut out for repair without interference or interruption of the service to the rest of the building. All water valves shall be full port ball valves and shall be brass, 125 PSI steam rated. All valves shall be of one manufacture.
b. All gate valves within the building shall be wedge gate valves with painted iron wheel handles, shall have gland followers in stuffing boxes, and shall be so constructed that they may be repacked while open and under pressure. All valves shall have the name of the manufacturer and working pressure cast or stamped thereon.

c. Provide valves of type and size as shown on the Drawings and as specified herein and as may be necessary for isolation, balancing and maintenance of piping distribution systems and equipment. Valves shall be of minimum working pressure and materials as pipe fittings specified for the service. Provide chain operator assemblies for valves mounted over 8 feet high in machine rooms.

d. Ball Valves: Use for shut off services for sizes 2” and below for non-corrosive service. Extended stems and handles shall be provided on insulated piping systems to coordinate with insulation thickness. Ball valves for 250 psig service and below shall be provided with bronze bodies, stainless steel ball, stem and seat ring, TFE bushing and ring gasket. Ball valves rated above 250 psig shall be carbon or 316 stainless steel body with 316 stainless ball. Full port ball valves shall be used.

1. Bronze Ball Valves:

a) Three-Piece, Full-Port, Bronze Ball Valves with Stainless Steel-Trim:

1) Basis-of-Design Product: Subject to compliance with requirements, provide NIBCO Model S-595-Y-66-LF or T-595-Y-66-LF or Milwaukee UP509 or UP1509. Comparable product by one of the following manufacturers may be submitted:

   (a) Conbraco Industries, Inc.; Apollo Div.
   (b) Jamesbury, Inc.

2) Description:

   (a) Standard: MSS SP-110.
   (b) SWP Rating: 150 psig (1035 kPa).
   (c) CWP Rating: 600 psig (4140 kPa).
   (d) Body Design: Three piece with threaded body packnut design (no threaded stem designs allowed) with adjustable stem packing.
   (e) Body Material: Bronze ASTM B 584 Alloy C844.
   (f) Ends: Threaded or Solder.
   (g) Seats: PTFE or TFE.
   (h) Stem: 316 Stainless steel.
   (i) Ball: 316 Stainless steel
   (j) Port: Full.

b) Two-Piece, Full-Port, Bronze Ball Valves with Stainless-Steel Trim:

1) Basis-of-Design Product: Subject to compliance with requirements, provide NIBCO Model S-585-70-66-LF or T-585-70-66-LF or Milwaukee UPBA400S or UPBA450S. Comparable product by one of the following manufacturers may be submitted:

   (a) Conbraco Industries, Inc; Apollo Div.
   (b) Jamesbury, Inc.

2) Description:
2. Bronze Swing Check Valves

a) Class 125, Bronze Swing Check Valves with Nonmetallic Disc:

1) Basis-of-Design Product: Subject to compliance with requirements, provide NIBCO Model S-413-Y-LF or T-413-Y-LF or Milwaukee UP509 or UP1509. Comparable product by one of the following manufacturers may be submitted:

(a) Crane Co.; Crane Valve Group; Crane Valves
(b) Powell Valves.

2) Description:

(a) Standard: MSS SP-80, Type 4.
(b) CWP Rating: 200 psig (2070 kPa).
(c) SWP Rating: 125 psig (1035 kPa).
(d) Body Design: Y-pattern Horizontal flow.
(e) Body Material: ASTM B 62, bronze.
(f) Ends: Threaded or Solder.
(g) Disc: PTFE or TFE.

b) Class 150, Bronze Swing Check Valves with Nonmetallic Disc:

1) Basis-of-Design Product: Subject to compliance with requirements, provide NIBCO Model S-433-Y or T-433-Y or Milwaukee UP509 or UP1509. Comparable product by one of the following manufacturers may be submitted:

(a) Crane Co.; Crane Valve Group; Crane Valves.
(b) Powell Valves.

2) Description:

(a) Standard MSS SP-80, Type 4.
(b) CWP Rating: 300 psig (2070 kPa).
(c) SWP Rating: 150 psig (1035 kPa).
(d) Body Design: Y-pattern Horizontal flow.
(e) Body Material: ASTM B 62 bronze.
(f) Ends: Threaded or Solder.
(g) Disc: PTFE or TFE.
e. Provide solder to screwed adapters as required.

f. Gas Valves:

1. Low pressure natural gas valves shall be AGA standard bronze gas cocks. Up to 1" size tee head equal to Walworth No. 594. Up to 2" size square head equal to Walworth No. 590. 2½" and over, flanged, iron body lubricated plug type 175 psi WOG equal to Walworth No. 1796. Provide operating wrenches with each valve.

2. Emergency gas shutoff valve shall be a 2 way normally closed, 24 volt electrically operated valve. Valves shall be ASCO model 8210 or approved equal.

3. Emergency master gas shutoff valve for kitchen gas services shall be 24 volt electrically operated valve. Valves shall be ASCO model 8044 Manual Reset Shutoff Valves or approved equal. Valve shall trip closed instantly when solenoid valve is de-energized, and shall require manual operator reset after power energized. Emergency gas shutoff valve shall be wired to an emergency gas shutoff switch with the following specifications – flush mounted, maintained contact, manual turn to reset (twist and unlock), red push button, clear plastic lift cover with warning horn, colored yellow and labeled “EMERGENCY GAS SHUTOFF” Emergency gas shutoff switch shall be safety technology international model #SS-22A9-CUSTOM-LBL. Switch to be mounted at 60" AFF.

P-12 AIR CHAMBERS

a. Provide air chambers for all isolated fixtures at least 12" high and same size for piping but not less than 1/2".

b. Provide and coordinate vacuum breakers on water connections to equipment where required by code and not furnished as part of the equipment.

c. Pressure vacuum breakers as required shall be installed 12 inches above the highest outlet they are protecting. Vacuum breakers shall be chrome plated brass, T&S Brass No. B-929-A or approved equal.

d. Water Hammer Arrestors

1. Install permanently sealed water hammer arrestors on all hot and cold water branches and headers to plumbing fixtures whether indicated on the Plumbing Drawings or not.

2. Shock absorbers are to be of size and location in accordance with the manufacturer's recommendations and with PDI Standard WH 201, shock absorbers shall be PDI approved.

3. Provide accessibility to all shock absorbers.

4. Provide shock absorbers at the top of water risers.

5. Provide shock absorbers at all quick closing valves, solenoid valves and at equipment such as dishwashers, etc.

e. The water hammer arrestors shall be Zurn 1250XL (Lead-Free), or approved equal and shall be installed as per manufacturer's recommendation.

P-13 INSULATION
a. All new cold and hot water piping, including mains, and branches shall be insulated with 1" glass fiber covering with factory-applied all-service jacket "ASJ", with self-sealing laps, molded fittings, securely wired on with copper wire.

b. Jacket of insulation shall have a flame spread rating of 25 or less, smoke developed rating of 50 or less.

c. Insulation shall be as manufactured by Certainteed, Johns-Manville, or approved equal.

d. All valves, flanges, etc., in insulated piping shall be covered similar to the fittings. Valve handles shall not be covered.

e. Covering shall be continuous through walls and floors.

f. This Contractor shall furnish and install "Insul-Shield Multi Purpose Pipe Saddle" as manufactured by Insul-Coustic Corp. Insul-Shield shall be installed at each support point when the pipe is erected. The thickness of press-glass support segment shall be equal to the thickness of the adjoining insulation when load is applied.

g. Contractor shall provide protector kits for drains and supply stops at all ADA accessible sinks and lavatories. Protectors shall be satin white PVC, antimicrobial, thermal transfer resistant and ADA compliant. Kits shall be Zurn model Z8946 Combination kit or approved equal.

P-14 FIRESTOPPING

a. Work, in general includes furnishing and installation only those through penetration fire and smoke seals for openings in floors, wall and other elements of construction that are in accordance with ASTM E-814 (ANSI/UL 1479). CAN4-S115 and ASTM E-119 (ANSI/UL 263).

P-15 DRAINS

a. Drains-General

1. Drains shall have heavy cast iron, with double drainage flange and weep holes, with outlet connections as indicated and of sizes indicated on Drawings. Drains (except as noted) shall be furnished with high polished brass tops consisting of a one-piece rim secured to the body and vandal-proof spanner type screws, and a solid brass grate with reinforcing members on underside. Removable sediment basket shall be of heavy duty one-piece construction as specified hereinafter. All strainers or grates shall be secured with vandal-proof spanner type screws, unless otherwise specified.

2. All drains in floors with a waterproof membrane shall be equipped with 6 lb. lead flashing or 20 oz. soft rolled sheet copper and secured to the flashing flange with brass bolts and cast iron clamping device. Flashings shall bond not less than 1'-0" on all sides into membrane waterproofing.

3. Set all drains in such a way that the floor finish and top of the drain will be plumb and flush with finish floor without requirements for future additional extension, modifications, etc.

4. When Dex-O-Tex and/or vinyl waterproof floor is indicated on the Architectural Drawings, all drains must be provided with required flanges.

5. All drains, except as noted, shall be Zurn Mfg. Co. or approved equal.
a) Floor drains shall be Zurn Industries, Inc. or approved equal ZN-415 standard dura-coated cast iron body with bottom outlet, seepage pan and extension frame with type B light duty strainer.

b) Funnel drains shall be 2" Zurn Industries Inc. or approved equal to Z-1019 dura-coated cast iron body and 4" diameter x 4" high funnel.

c) Funnel Floor Drains (Kitchen Finished Area, etc.) - Similar and equal to No. Z-415E cast iron body, flashing collar, square nickel bronze top and funnel attached to grade where indicated on the Drawings.

d) Floor Drains (Kitchen) - Similar and equal to No. Z-415S cast iron body, flashing collar, adjustable square nickel bronze top, flat bottom strainer

e) Floor Sink - equal to No. ZN-1910-KC-1 cast iron porcelain enameled, with dome strainer, flashing flange less grate.

f) Shower drain shall be Zurn Industries, Inc. or approved equal ZN-415B with dura-coated cast iron body with bottom outlet, membrane clamp and adjustable collar with polished nickel bronze strainer.

6. Provide the proper air gaps for indirect waste spilling over funnel drain.

b. Cleanouts

1. Cleanouts for cast iron pipe shall consist of tapped extra heavy cast iron ferrule caulked into cast iron fittings and extra heavy brass screw plug with solid hexagonal nut.

2. Cleanouts shall be full size at the pipe up to and including 6 inch pipe. On larger size piping, 6 inch size plugs shall be used.

P-16 PLUMBING FIXTURES AND EQUIPMENT

a. Plumbing fixtures shall be as specified by Architect, furnished and installed under this contract. Provide all necessary P-traps, flushometers, water supplies, angle stops, escutcheons, etc., and make all final connections to new. All exposed trim shall be cast brass chrome plated.

b. Water Heater

1. Related Documents

   a) Drawings and general provisions of the Contract, including General and Supplementary Conditions and Divisions 1 Specification Sections, apply to this section.

2. Summary

   a) This section includes condensing gas-fired storage water heaters for potable water.

3. References

   a) ASME Boiler and Pressure vessel code, section IV, Part HLW

   b) UL 795 “Industrial Gas Heating Equipment”
c) ANSI Z21.10.3 -2004/CSA 4.3-2004 “Gas Water Heaters”
d) ASHRAE/IES 90.1-2010
e) ISO 9001 Quality Management System
f) CSD-1-2009 “Controls and Safety Devices for Automatically Fired Boilers”
g) NFPA 70- National Electric Code
h) NFPA 54- National Fuel Gas Code
i) NSF/ANSI Standard 61- Drinking Water System Components

4. Submittals
   a) Product Data: Include rated capacities; shipping, installed, and operating weights; furnished specialties and accessories for each model indicated.
   b) Shop Drawings: Detail equipment assemblies and indicate dimensions, required clearances, components, and size of each field connection.
   c) Wiring Diagrams: Detail for wiring power signal, differentiate between manufacture-installed and field-installed wiring.
   d) Field Test Reports: Indicate and interpret test reports for compliance with performance requirements. A copy will be furnished to the owner.
   e) Maintenance Data: Include in the maintenance manuals specified in Division 1. Include maintenance guide and wiring diagrams.

5. Regulatory Requirements
   a) Conform to applicable code for internal wiring of factory wired equipment.
   b) Units: ETL, UL or CSA Certified as a Complete Gas Fired Water Heater Assembly.
   c) Gas Train shall comply with ANSI Z.21.10.3 or UL 795.
   d) Conform to ASME Section IV, Part HLW for Water Heater construction.

6. Quality Assurance
   a) Listing: The water heater will be listed ETL listed to UL 795 or ANSI Z21.10.3 -2004/CSA 4.3-2004 “Gas Water Heaters”
   b) ASME Compliance: Water heater shall bear the ASME HLW stamp and be National Board listed.
The water heater will operate at a minimum 96% thermal efficiency at full firing rate when tested to the ANSI Z21.10.3 thermal efficiency test protocol.

The water heater will comply with current ASHRAE 90.1 requirements.

Water heater manufacturer certified to the ISO 9001 International Quality System.

7. Coordination
   a) Coordinate size and location of concrete bases

8. Warranty
   a) Storage tank, heating surfaces, and combustion chamber will have a 15-year warranty (8 full, 7 prorated) covering manufacturing or material defects, leaks, the production of rusty water, chloride stress corrosion cracking and/or fireside condensate corrosion of heating surfaces.
   b) The heater shall have a long-life service policy, which shall cover labor and freight costs under certain conditions for warranty covered services.
   c) Burner and all heater parts: 1 year

9. Manufacturers
   a) Available Manufacturers: Manufacturer shall be a company specializing in manufacturing the products specified in this section with minimum twenty years’ experience. The water heaters shall be manufactured by a company that has achieved certification to the ISO 9001 Quality Management System.
   b) The water heaters shall be ETL listed as a complete unit. The heater shall satisfy current Federal Energy Policy Act standards for both thermal efficiency and stand-by heat losses as established for gas fired water heaters incorporating storage tanks.
   c) Service Access: All gas train components must be accessible and able to adjust without the removal of cabinet components.
   d) Manufacturers: PVI is the basis of design. Acceptable manufacturers shall be subject to compliance with the requirements.

10. Construction
    a) The water heater will be a vertical fire tube design that is constructed and stamped in accordance with Section IV, Part HLW of the ASME code. Water heater will be National Board Registered for a working pressure of 150 psi and will be pressure tested at 1-1/2 times working pressure.
    b) Water heater will be a three-pass configuration
    c) Tank and fire tubes will be unlined. Lined or plated water heaters will not be acceptable
d) Tank and fire tubes will be constructed from phase-balanced austenitic and ferritic duplex steel with a chemical structure containing a minimum of 21% chromium to prevent corrosion and mill certified per ASTM A 923 Methods A to ensure that the product is free of detrimental chemical precipitation that affects corrosion resistance. The material selected shall be tested and certified to pass stress chloride cracking test protocols as defined in ISO 3651-2 and ASTM G123-00(2005) “Standard Test Method for Evaluating Stress-Corrosion Cracking of Stainless Alloys with Different Nickel Content in Boiling Acidified Sodium Chloride Solution.”

e) Waterside surfaces shall be welded internally utilizing joint designs to minimize volume of weld deposit and heat input. All heat affected zones (HAZ) shall be processed after welding to ensure the HAZ corrosion resistance is consistent with the mill condition base metal chemical composition. Weld procedures (amperage, volts, welding speed, filler metals and shielding gases) utilized shall result in a narrow range of austenite-ferrite microstructure content consistent with phase balanced objectives for welds, HAZ and the base metal.

f) All internal and external tank surfaces shall undergo full immersion passivation and pickling processing to meet critical temperature, duration and chemical concentration controls required to complete corrosion resistance restoration of pressure vessel surfaces. Other passivation and pickling methods are not accepted. Immersion passivation and pickling certification documents are required and shall be provided with each product.

g) Materials shall meet ASME Section II material requirements and be accepted by NSF 61 for municipal potable water systems. Storage tank materials shall contain more than 80% post-consumer recycled materials and be 100% recyclable.

h) Water contacting tank surfaces will be non-porous and exhibit 0% water absorption.

i) All tank connections/fittings will be non-ferrous.

j) Finished vessel will not require sacrificial anode rods and none will be used. Water heaters or sidearm storage tanks that employ anode rods of any type will not be acceptable.

k) Combustion will be provided by a premix, fan-assisted surface burner with a gas train meeting ANSI and FM requirements for the input specified.

l) Burner will be stainless steel

m) Burner will employ non-linkage modulation utilizing only a VFD drive to vary gas and air.

n) Burner NOx emissions will be less than 20 ppm when corrected to 3% oxygen.

o) Water heater will be a category IV, condensing appliance and vent through CPVC

11. PERFORMANCE
a) When tested to the ANSI Z21.10.3 standard, the water heater shall operate at 96% thermal efficiency at full firing rate.

b) When modulated to low fire, water heater will be capable of 99% thermal efficiency.

c) Water heater will meet the thermal efficiency and standby heat loss requirements of ASHRAE 90.1 – 2010.

12. Water Heater Trim

a) As a minimum, the heater will be equipped with the following:
   
   1) electronic flame monitoring
   2) an *immersion* operating control
   3) an *immersion* temperature limiting device
   4) an ASME- or AGA-rated temperature and pressure relief valve
   5) and options as selected on form PV 8002

b) Operating and safety controls shall meet the requirements of UL 795 and FM, or ANSI Z21.10.3.

c) The water heater shall employ an electronic operating control with digital temperature readout. Operator shall be capable of connecting to a building automation system through serial connection using Modbus RTU protocol.

13. Installation

a) Install water heaters level and plumb in accordance with manufacturers written instructions and referenced standards.

14. Finishing

a) The storage and heating sections shall be completely factory packaged on a single skid, requiring only job site hookup to utilities, venting, and plumbing. The heater shall be insulated to ASHRAE 90.1-2010 requirements, jacketed with coated steel panels, and mounted on heavy-duty channel skids. Pressure vessel shall include a ball-type drain valve. The heater shall fit properly in the space provided and installation shall conform to all local, state, and national codes.

15. Start-Up

a) Start up on the unit will be performed by factory trained and authorized personnel. A copy of the startup report will be provided to the owner.

16. Hot Water Circulating Pump

1. Furnish and install within hot water circulating piping, Bell & Gossett or approved equal in-line circulators.

2. Model numbers and sizes as scheduled on the Drawings.
3. Provide for each pump a combination circuit breaker and magnetic across-the-line motor starter with Hand-Off-Automatic switch all mounted in a safety cabinet. Starter to be actuated by a Honeywell immersion type aquastat connected into a tee in the main hot water return line ahead of the pump and with adjustable temperature ranging from 100°F to 180°F with differential of approximately 10°F.

4. Provide motor starters with proper size thermal overload and pilot light.

5. Provide 24-hour, repeating, adjustable timer mounted in the safety cabinet specified above. Timer shall override immersion-type aquastat as a pump starter actuator.

d. Provide Bell & Gossett Circuit Setter calibrated balancing valve Model CB Plus as shown on contract documents. Valves to have either sweat or NPT ends.

e. Expansion Tank shall be a diaphragm or bladder type expansion tank which will accommodate the expanded water of the system generated within the normal operating temperature range, limiting this pressure increase at those components in the system to the maximum allowable pressure at those components. It shall maintain minimum operating pressure. The expansion tank shall be welded steel, constructed, tested and stamped in accordance with Section VIII, Division 1 of the ASME Code for a working pressure of 150 PSIG, factory air pre-charged and field adjustable. All welds conforming to ASME Section IX. All internal parts must comply with FDA regulations and approvals. Each tank shall have a steel shell and an internal butyl/EPDM diaphragm or butyl bladder with code approvals NSF/ANSI 61 used to isolate the air charge from fluid. The manufacturer shall be AMTROL THERM-X-TROL® or approved equal. The manufacturer shall have at least five years experience in the fabrication of bladder / diaphragm-type ASME expansion tanks.

f. The self-regulating heater for grease waste piping shall consist of two nickel-plated copper bus wires embedded in a radiation cross-linked semi-conductive polymer core. The heater shall be capable of varying its heat output all along its length, allowing the heater to be crossed over itself without overheating. The heater shall be covered by a fluoropolymer insulating jacket and a nickel-plated copper braid (16 AWG equivalent wire size) with a fluoropolymer outer jacket. The heater shall operate on line voltage of 208-277 VAC without the use of transformers. The heating cable shall be suitable for use on metallic and non-metallic piping. On non-metallic piping, the cable shall be attached to the pipe with a parallel covering of aluminum tape. All heating cable core will be permanently marked with the manufacturer's identification number for traceability.

1. To maintain the grease waste line at 110 deg F, the heating cable shall be controlled by:

   a) An adjustable pipe wall sensing thermostat, Model #E4X-1-SR, set at 110°F with a switch rating of 30 amps at 120 or 240 VAC based on current loads for each circuit.

2. Acceptable products and manufacturers are: HTSX™ cables as manufactured by Thermon Manufacturing Company.

g. Heat Trace Monitoring System

1. To monitor the condition of the heating cable, install a Low Pipe Temperature Alarm Thermostat, Model #E4X-1-SR, on the pipe, under the insulation. This thermostat shall be set at 100 deg F and shall be wired to a heat trace alarm panel, Model #1000-1, which will include an audible alarm buzzer, an alarm light and a remote alarm relay.
h. Accessories:
   1. Accessories shall include but not be limited to power connections, end seals, splices and tees.

i. Manufacturer
   1. The manufacturer shall demonstrate experience manufacturing and designing electric heat tracing temperature maintenance systems with self-regulating heating cables specifically for grease waste lines. This experience may be demonstrated with a list of 5 projects utilizing at least 500 feet of self-regulating heating cable.
   2. Manufacturer’s Quality Assurance Program shall be certified to ISO9001 Standard.

j. Installation
   1. Refer to the manufacturer’s installation instructions for proper installation and layout methods. Deviations from these instructions could result in performance characteristics different than intended.
   2. All installations and terminations must be made to conform to the NEC and any other applicable national or local code requirements.
   3. Circuit breakers supplying power to the heat tracing shall be equipped with 30mA ground-fault equipment protection. 5mA GFCI should not be used as nuisance tripping may result.
   4. Piping shall be pressure tested prior to installation of heating cable. Thermal insulation shall not be installed until heating cable installation is complete and a megohmeter test has been passed. Heat traced lines shall be insulated promptly after the heat tracing installation.
   5. The insulation shall not be installed with staples. Insulation jackets should be closed with adhesive to avoid damage to the heating cable.
   6. System shall be connected to power by the electrician.

k. Testing
   1. Heating cable should be tested with a megohmeter between the heating cable bus wires and the heating cable’s metallic braid. While a 2,500 Vdc megger test is recommended, the minimum acceptable level for testing is 500 Vdc. This test should be performed a minimum of three times:
      a) While the cable is still on reel(s); prior to installation.
      b) After installation of heating cable and completion of circuit fabrication kits but prior to installation of thermal insulation.
      c) After installation of thermal insulation but prior to connection to power.
   2. The minimum acceptable level for the megger readings is 20 megohms, regardless of the circuit length.
3. Results of the megger readings should be recorded and submitted to the construction manager.

l. Solenoid valves shall be 2 way normally close, 24 volt electrically operated valves. Valves shall be ASCO model 8210 or approved equal.

m. Leak detectors shall be Liebert Liqui-Tect model LT-410. Leak detector shall be wired to solenoid valves and local/base building BMS panel.

n. Grease interceptors shall be as manufactured by MIFAB. Sizes and capacities shall be as indicated on drawings. Units shall be of stainless steel construction. Flow control devices shall be installed on inlet side of unit.

o. Water filter shall be Triple Clear Force Field Filters to filter impurities out of the well water.

p. Trap primer shall be Jay R. Smith Manufacturing Company No. 2699 water saving type to spill over funnel drains. Trap primers shall be equipped with air gap fittings, where they are directly connected to the trap of a drain. Trap primers shall be provided for all floor drains and floor sinks.

q. Hot Water Mixing Valve shall be a 3-way self-actuating type, with bronze body. Unit shall be complete with valve stem lubricator, copper bulb and flexible tubing with protective sheathing and shall be adjustable. Unit shall be as manufactured by Lawler Co. 80X series (Lead-Free) or approved equal. For model number, valve size and outlet temperature, refer to Drawings.

r. Backflow preventer shall be a double check valve assembly, Watts model 007-QT, or approved equal.

s. Sump pump shall be Flygt model C3045.

P-17 ESCUTCHEONS AND SLEEVES

a. Where pipes pass through wall, floors or partitions, suitable 16-gauge galvanized pipe sleeves shall be provided and extend 2" above the top of the finished floor. The spaces between sleeves and pipes shall be firestopped utilizing an approved assembly.

P-18 TESTS

a. All tests shall be made in the presence of the Architect and Engineer or their representatives, and the local authorities having jurisdiction of the work to be tested, as may be directed; and at least 72 hours notice shall be given in advance of all tests.

b. The Work of this Contractor shall include the furnishing of all testing instruments, gauges, pumps, smoke machines, and other equipment required or necessary for tests, required by laws, rules and regulations and as specified.

c. Provide all other tests required by local inspectors and all other authorities having jurisdiction and in conjunction with Section 312 of the New Jersey Plumbing Code.

1. All appurtenances shall be operated after installation to determine whether or not they meet the requirements of the Specifications.

2. All defects disclosed in the work by tests and otherwise shall be corrected or the Work replaced without additional cost to the Owner. No caulking on screwed joints, cracks or holes will be acceptable.
3. Tests shall be repeated after any defects disclosed thereby have been made good or the work replaced if it is deemed necessary.

4. All tests shall be made at the expense of the Contractor.

5. Tests are not permitted to be made with air except as noted.

6. Contractor to provide required test plug tee fittings during erection of pipe system.

7. If the pipe installation fails to meet testing requirements, the Contractor shall determine at his own expense the source or sources of leakage, and he shall repair or replace all defective materials or workmanship. The completed pipe installation shall meet the requirements of the tests after the leaks have been corrected.

8. All piping which is to be enclosed in partitions or hung ceilings shall be tested and made tight when directed by the Construction Supervisor and in adequate time to permit the installation of partitions and ceilings. When necessary, the Contractor shall drain the piping and/or take over such precautions as required to prevent damage by freezing.

9. The Contractor shall also be responsible for the Work of other trades that may be damaged or disturbed by the tests, or the repair or replacement of his Work, and he shall, without extra charges, restore to its original condition any Work so damaged or disturbed.

d. Natural Gas System

1. Test in accordance with State and Local Standards, and NFPA.

2. Test of low pressure system for 10 minutes without drip with approved mercury gauge. Set air at 6 to 10 inches of mercury.

3. Test on site, at high and/or low pressure system shall be made as required by the Architect.

P-19 DISSIMILAR METALS

a. Connection between dissimilar metals, such as ferrous and nonferrous, shall be isolated by means of a dielectric material such as Teflon, micarta or screwed insulating unions or flange unions as manufactured by Epco Sales, Inc., to provide cathodic protection currents and to stop galvanic corrosion.

P-20 FLASHING

a. All floor drains, clean-outs, sleeves, etc., set in membrane waterproofed floor slabs shall have six (6) pound lead flashing furnished and installed. The flashing shall extend eight inches (8") beyond the flashing flange around the entire perimeter of the unit.

b. Provide 3'-0" x 3'-0" 16 oz. copper flashing or 3 lb. lead flashing for floor drains in non-membrane waterproofed floor.

P-21 IDENTIFICATION OF SYSTEMS

a. Provide adhesive bands identifying equipment, services and flow direction in piping systems. Bands shall be located at least every 30 feet with a minimum of one in each space. Colors of bands shall conform to ANSI Standard. Provide 10 additional markers of each type for future use by Owner’s personnel.
b. Bands shall be manufactured by Seton Name Plate Co. or an approved equal

P-22 SHOP DRAWINGS

a. Submit to the Architect for approval six (6) copies of shop drawings for the following equipment: Piping, insulation, valves.

1. Submit shop drawings prior to installation covering the following items:

   a) Plumbing fixtures, equipment, plumbing fixture trimmings, shut-off valves, faucets, supports, accessories and traps.

   b) Valve tags, color coding and valve charts.

   c) Vacuum breaker, backflow preventors and shock absorbers.

   d) Insulation for piping and equipment.

   e) All drains including floor, funnel, floor sinks, etc.

   f) Hose bibbs.

   g) Sleeves, escutcheons, hangers and inserts.

   h) Motors, starters and wiring diagrams and equipment.

   i) Gauges and thermometers.

   j) All types of piping, fittings, valves, etc.

   k) Vibration isolators.

   l) Hot water heaters and accessories.

   m) Domestic hot water circulating pumps.

   n) Gas booster system

   o) Detailed plumbing piping layout, coordinated with all other trades.

   p) Detailed coordinated sleeves and insert drawings for approval by Structural Engineer. In addition, the Contractor shall indicate all piping sleeved through beams.

2. The above listed items are to be considered major equipment and do not limit the Contractor's responsibility from submitting shop drawings for all equipment and accessories which are to be provided under this Section of the Contract.

b. Shop drawings shall include all dimensions, materials and auxiliary equipment.

P-23 VERIFYING CONDITIONS
a. Before starting any work examine existing conditions, and thoroughly check drawings, specifications, adjoining or underlying conditions in which the work of this Section is to be performed, and all dimensions.

b. Report in writing, to the Owner with a copy to the Engineer, any and all conditions which may interfere with or otherwise affect or prevent the proper execution and completion of the work of this Section.

c. Do not commence any work until any and all such conditions have been corrected.

d. Failure to notify the Owner and/or the Engineer of unsatisfactory conditions will be construed as an acceptance of all conditions.

e. Execution of work of this Section Constitutes acceptance of the base or adjoining work and other conditions as satisfactory in every respect and later claims of defects in such cases will not be allowed.

P-24 CONDUCT OF OPERATIONS

a. The building in which work of this contract will be performed in an existing structure and will be occupied during the term of this contract.

b. Services to and throughout the building shall be maintained. Services may be interrupted only by obtaining permission to do so from the Owner in writing.

c. All materials and debris removed from construction shall become the property of the Contractor and he shall remove same from the premises as directed.

d. The work of the Contract shall be progressed in such a manner as to interfere as little as possible with the functioning of the Premises and with the safety and convenience of the occupants, staff, and others employed in and about the premises.

e. Contractor's attention is directed to the phasing of the work as determined by the Owner and shall schedule all delivery of materials and manpower requirements to expedite the work accordingly.

f. Routes of ingress and egress to the building and within the building to the site of the work shall be over routes as directed by the Owner's representative.

g. Delivery of materials and removals of debris shall be arranged for within time limits established by the Owner. The Contractor shall not, except as otherwise agreed to, deliver any materials to the site unless his forces are present and available to receive and unload it.

P-25 RECORD DRAWINGS (AS-BUILTS)

a. Concurrent with progress of installation, maintain a set of as-built record drawings, consisting of a marked set of drawings with additional sketches as required, denoting and dimensioning accurately all changes in elevation, location and size of all items deviating from contract drawings.

b. Upon completion of work, deliver to Architect and Engineer one set of prints containing these as-built drawings for their review. Engineer will return accepted as-built drawings to the Contractor together with an AutoCad Release 14 disc containing the latest set of the engineering drawings. Contractor shall arrange for the files on these discs to be updated to conform to the as-built conditions.
c. Within three weeks following beneficial occupancy of the project, "As-Built" drawings in the form of a complete set of discs and two sets of paper plots, as well as two sets of maintenance manuals, operating manuals and drawings (including shop drawings) of all equipment shall be submitted to the Owner.

P-26 REGULATIONS

a. The Contractor shall familiarize himself with and comply with building regulations and rules to maintain the safety of the premises and its occupants at all times.

P-27 CLEANING

a. Clean and disinfect potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.

2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:

   a) Flush piping system with clean, potable water until dirty water does not appear at outlets.

   b) Fill and isolate system according to either of the following:

      1) Fill system or part thereof with water/chlorine solution with at least 50 ppm (50 mg/L) of chlorine. Isolate with valves and allow to stand for 24 hours.

      2) Fill system or part thereof with water/chlorine solution with at least 200 ppm (200 mg/L) of chlorine. Isolate and allow to stand for three hours.

   c) Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.

   d) Repeat procedures if biological examination shows contamination.

b. Clean non-potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.

2. Use purging procedures prescribed by authorities having jurisdiction or; if methods are not prescribed, follow procedures described below:

   a) Flush piping system with clean, potable water until dirty water does not appear at outlets.

   b) Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

b. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.
d. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

END OF SECTION 15400
SECTION 15500 - SPRINKLER

SP-1 GENERAL

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

SP-2 WORK INCLUDED

a. Work shall include the providing of all labor, materials, equipment, accessories, and tests necessary to complete and make ready for operation the installation of the automatic wet pipe sprinkler system with light and ordinary hazard occupancies as indicated on the drawings, the fire pump assembly and the dry-pipe sprinkler system.

b. The installation shall be accomplished by a licensed sprinkler contractor recognized as a fully experienced specialist in the automatic sprinkler systems by the State of New Jersey.

c. The installation shall be made on the basis of items, methods, and requirements of the local building department, office of the Fire Marshal or prevailing Authority Having Jurisdiction (AHJ). The provisions shall be followed in total, whether the stipulations listed therein are directed or recommended.

d. See Architectural, Structural, Mechanical and Electrical Drawings for construction and interference details. Any changes that may be necessary because of the physical conditions or compliance with the standards shall be made under this Section without additional cost.

e. System shall include, but not necessarily be limited to the following:

1. New sprinkler booster pump and jockey pump on 4" concrete pads with control panels.
2. New upright sprinkler heads.
3. All piping hangers, supports.
4. Obtaining all necessary approvals, permits and certificates including filing drawings with hydraulic calculations signed and sealed with the local Building Department.
5. Cutting and patching.

f. Submittals

1. Submit catalog cut sheets samples of the following for approval:
   a) Pipe and fittings.
   b) Hangers and supports.
   c) Mechanical valves and tamper switches.
   d) Sprinkler Booster Pump
   e) Sprinkler heads. (submit sample of each type of head)
   f) Waterflow detection devices - manual release station, waterflow switch.
   g) Dry-Valve Assembly

2. Submit sprinkler system working drawings showing locations and types of heads, pipe sizes, test tees, and valves, drain valves, hydraulic calculations and other related items.

3. Shop drawings of equipment with multiple parts shall be submitted as a package.

4. Grooved joint couplings and fittings shall be shown on drawings and product submittals and shall be specifically identified with the applicable Victaulic style or series number.
5. Sprinklers shall be referred to on drawings, submittals and other documentation, by the sprinkler identification or Model number as specifically published in the appropriate agency listing or approval. Trade names or other abbreviated designations shall not be allowed.

g. Working Plans

1. Before commencement of any work, complete and detailed working plans shall have been submitted and approved by RDA, the Building Department and other agencies having jurisdiction thereof. Two certified copies of such approved working plans shall be furnished to the Owner promptly after such approval.

2. Working plans shall be drawn to an appropriate scale on tracing cloth or film.

h. The Contractor shall prepare the hydraulic calculations and any required 20-minute sprinkler variance forms. Design criteria for the hydraulic calculations for each floor shall include:

1. Available static pressure.
2. The minimum water supply requirement density and GPM per square foot.
3. Area of hydraulic demand.
4. Occupancy hazard classification.
5. Sprinkler piping and fitting material.

i. All special inspections as required by the local Building Department.

j. Insurance: This Contractor shall carry Liability and Workmen's Compensation Insurance for the duration of the Contract and protect the Owner, Architect and Engineer against all lawsuits from accidents to the public and workmen. All premiums are to be paid by this Contractor and the policies are to cover any and all persons and contingencies in connection with the installation of the work included in this section.

SP-3 RECORD DRAWINGS (AS-BUILTS)

a. Concurrent with progress of installation, maintain a set of as-built record drawings, consisting of a marked set of drawings with additional sketches as required, denoting and dimensioning accurately all changes in elevation, location and size of all items deviating from contract drawings.

b. Upon completion of work, deliver to Architect and Engineer one set of prints containing these as-built drawings for their review. Engineer will return accepted as-built drawings to the Contractor together with an AutoCAD disc containing the latest set of the engineering drawings. Contractor shall arrange for the files on these discs to be updated to conform to the as-built conditions.

c. Within three weeks following beneficial occupancy of the project, "As-Built" drawings in the form of a complete set of discs and two sets of paper plots, as well as two sets of maintenance manuals, operating manuals and drawings (including shop drawings) of all sprinkler equipment shall be submitted to the Owner.

SP-4 INSTALLATION

a. Specific reference in this section or on the drawings to any article, device, project, material or equipment by name, make, or catalog number shall be interpreted as establishing a basis and standard quality. All the devices shall be of the made and type listed by the Underwriters' Laboratories, Inc., approved by the local building code, and NFPA. No consideration will be granted for any alleged misunderstanding of the materials to be furnished or work to be done due to lack of information on the drawings or in the specifications.
b. This Contractor shall make modifications in respect to location of sprinkler heads, as may be required by field conditions or as may be found necessary by the Architect at the time of installation. Fittings, hangers, means of draining system and all necessary appurtenances shall be installed as required.

c. Any changes that may be necessary because of physical conditions or compliance with the standards and requirements of any agency having jurisdiction shall be made by this Contractor without additional cost to the Owner.

d. General contractor is responsible for coordination of sprinkler where field conditions cause sprinklers to be less than 18” above furniture or equipment. Additional sprinkler heads may be required and engineer shall be notified for design adjustments for sprinkler coverage.

e. The sprinkler bulb protector must remain in place until the sprinkler is completely installed and before the system is placed in service. Remove bulb protectors carefully by hand after installation. Do not use any tools to remove bulb protectors.

f. The system shall be so installed that no part thereof will interfere with doors, windows, heating, plumbing or electrical equipment, and sprinkler heads shall not be located closer than one foot from lighting fixtures or other obstructions. In connection therewith, the Contractor shall coordinate his work with the other trades so as to avoid any interference with the automatic sprinkler system.

g. This Contractor shall furnish and set sleeves in walls as required.

h. After the piping installation has passed the hydrostatic test, all iron and steel parts shall be thoroughly cleaned and ready for painting.

i. All piping shall be accurately cut to measurements established by this Contractor and shall be worked into place without springing or forcing.

j. Grooved joint piping systems shall be installed in accordance with the manufacturer's (Victaulic) guidelines and recommendations. All grooved couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components. The gasket style and elastomeric material (grade) shall be verified as suitable for the intended service as specified. Gaskets shall be molded and produced by Victaulic. Grooved end shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove for proper gasket sealing. A Victaulic factory-trained field representative shall provide on-site training for contractor's field personnel in the proper use of grooving tools and installation of grooved piping products. Factory-trained representative shall periodically review the product installation. Contractor shall remove and replace any improperly installed products.

k. Drips and drains shall be installed at low points and where required and shall discharge to an approved drain receptacle with an air gap. Provide 12”x12” access doors for all drains located in inaccessible ceilings.

l. All pipe openings shall be capped or plugged during construction and all piping shall be flushed out before closing system.

m. The use of bushings to reduce the size openings of fittings is prohibited.

n. Before ordering any material or doing any work, the Contractor shall verify all measurements, ceiling heights and conditions at the site and will be held responsible for the correctness of the same.

o. Extra charges or compensation will not be allowed on account of the differences between actual measurements and the dimensions shown on the drawings, but any such differences which may be
found shall be submitted to the Architect for adjustment, before proceeding with work.

p. The Contractor shall insure that drainage will be discharged to an approved location or receptacle without causing damage to other work and property.

**SP-5 MATERIALS**

a. Origin of Manufacture - Contractor shall not use any product that is made in China. If the contractor wants to use a product made in another country outside of the USA or Canada, the contractor must demonstrate that such is of an equal or better quality than the specified product. By using products made outside of the United States and Canada, the contractor assumes all liabilities associated with the performance of the product and shall indemnify and hold Robert Director Associates harmless and shall pay for all legal and attorney fees against any claims as a result of the use of said product.

b. Underground fire-suppression water-service piping shall be ductile-iron pipe and fittings.

1. Comply with NFPA 24 for fire-service-main piping materials and installation.

2. Comply with excavating, trenching, and backfilling requirements in Division 31 Section "Earth Moving."


4. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.

5. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

6. Ductile-Iron Deflection Fittings - Compound, ductile-iron coupling fitting with sleeve and one or two flexing sections for up to 15-degree deflection, gaskets, and restrained-joint ends complying with AWWA C110 or AWWA C153. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.


8. Install continuous underground detectable warning tape during backfilling of trench for underground fire-suppression water-service piping. Locate below finished grade, directly over piping. Underground warning tapes are specified in Division 31 Section "Earth Moving."

9. Clean fire-suppression water-service piping by purging new piping systems before use. Use purging procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in NFPA 24 for flushing of piping. Flush piping system with clean, potable water until dirty water does not appear at points of outlet.

c. Fire-Department Connections:

1. Freestanding, with cast-bronze body, thread inlets according to NFPA 1963 and matching local fire-department hose threads, and threaded bottom outlet. Include lugged caps, gaskets, and chains; lugged swivel connection and drop clapper for each hose-connection inlet; 18-inch- high brass sleeve; and round escutcheon plate in compliance with UL
Standard 405.

2. Connections: Two NPS 2-1/2 inlets and one NPS 6 outlet.

3. Finish Including Sleeve: Polished chrome plated

4. Escutcheon Plate Marking: "AUTO SPKR"

d. All wet system sprinkler piping shall be standard weight schedule 40 black steel pipe, conforming to ASTM A795/A53 with threaded cast iron fittings and Teflon tape, Class 125, or malleable iron fittings Class 150.

e. In lieu of threaded fittings for wet pipe and dry-pipe systems 2-1/2” and larger, Victaulic grooved mechanical couplings and fittings may be used. Couplings and fittings shall meet the requirements of NFPA 13 and shall be UL listed and FM approved.

1. Grooved end fittings shall be ductile iron conforming to ASTM A536, full flow, short radius FireLock® fittings, or shall be standard radius ductile iron or steel fittings, alkyd enamel coated or galvanized, with factory grooved ends designed to accept Victaulic couplings.

2. Grooved mechanical couplings shall consist of two ASTM A536 ductile iron housings, alkyd enamel coated or galvanized, a pressure-responsive, synthetic rubber gasket and plated steel bolts and nuts.

   a) Rigid Type: Housings shall be cast with offsetting, angle-pattern bolt pads to provide system rigidity and support and hanging in accordance with NFPA 13. Tongue and recess rigid type couplings shall only be permitted if the contractor uses a torque wrench for installation. Required torque shall be in accordance with the manufacturer’s latest recommendations.

      1) 2-1/2” through 8”: “Installation Ready” stab-on design, for direct ‘stab’ installation onto grooved end pipe without prior field disassembly and no loose parts. Victaulic FireLock® EZ Style 009H (2-1/2” through 4”) and Victaulic Style 107H QuickVic™ (2-1/2” through 8”).

      2) 10” and Larger: Standard rigid coupling. Victaulic FireLock® Style 005 or Style 07 Zero-Flex®.

   b) Flexible type: Use in seismic areas and where required by NFPA 13.

      1) 2-1/2” through 8”: “Installation Ready” stab-on design, for direct ‘stab’ installation onto grooved end pipe without prior field disassembly and no loose parts. Victaulic Style 177 QuickVic™.

      2) 10” and Larger: Standard flexible couplings. Victaulic Style 75 or 77.

3. Mechanical coupling gaskets shall be listed, supplied, and approved for use as follows:

<table>
<thead>
<tr>
<th>Fire Protection Service</th>
<th>Temperature Range</th>
<th>Gasket Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry Systems</td>
<td>Ambient</td>
<td>FlushSeal®, EZ Style 009H, or QuickVic™ design, Grade EPDM, Type A</td>
</tr>
</tbody>
</table>
Freezer Applications | -30°F to 0°F (-34°C to -17°C) | FlushSeal®, Grade L, Silicone
---|---|---
Water/Wet Systems | Ambient | C-Shape, EZ Style 009H, or QuickVic™ design, Grade EPDM, Type A

4. Grooved Joint Flange Adapters: ASTM A536 ductile iron casting, flat faced designed for direct connection to ANSI Class 125 and 150 flanged components. Victaulic Style 741 or 744.

f. Sprinkler Heads

1. Only new sprinklers shall be employed in the installation of sprinkler systems as per NFPA 13 Section 6.2.1.

2. In all finished areas, sprinkler heads shall be Reliable Automatic Sprinkler Co., Model G5-56, MEA. NO. 258-93-E with a 165°F temperature rating or Victaulic Model V27 with a 155°F temperature rating. The cover plate of heads must be factory painted white. Orifice size shall be 1/2" with a 165°F temperature rating and centered on ceiling tiles within ±1/2 inch.

3. Sidewall horizontal for standard or quick response, standard or extended coverage Model F1FR56 NYC MEA No. 258-93-E or Victaulic Model V27 or V34.

4. Upright type sprinkler head shall be Reliable Automatic Sprinkler Co., Model F1FR56, or Victaulic Model V27 MEA #258-93-E chrome plated with a 155°F temperature rating and ½" orifice.

5. Pendant-Dry type sprinkler head shall be Reliable Automatic Sprinkler Co., Model F3QRR56DRY, or Victaulic Model V3606 MEA #258-93-E chrome plated with a 175°F temperature rating and ½" orifice.

6. Sprinkler heads subject to damage shall be provided with a protective type cage. All sprinkler heads below 7’ – 0” above the finished floor will require the protective type cage.

7. Sprinkler guards and escutcheons shall be listed, supplied, and approved for use with the sprinkler by the sprinkler manufacturer.

g. Valves

1. All valves shall be approved by the Underwriters, Factory Mutual and authorities having jurisdiction.

2. Dry pipe valve shall be differential type similar to Reliable Model A, BS&A # 587-75-SA or Victaulic Firelock NXT Series 768. The valve assembly shall include all necessary valves, gauges, fittings, piping and nipples to provide the following connections:

   a) Air supply
   b) Priming water;
   c) Drain
   d) Alarm
   e) Accelerator
   f) Alarm test bypass
The dry pipe trim shall be from the same manufacturer as the valve itself.

Dry valve assembly shall include air compressor, accelerator and its trim similar to Reliable Model A, high/low pressure alarm switch and low air pressure switch.

3. Dry Pipe Air Compressor
   a) Provide sprinkler type air compressor similar to Reliable Model A or Victaulic Series 7C7 of sufficient capacity to restore the working air pressure during 30 minutes.
   b) Provide manual starter and automatic start stop pressure switch control.
   c) Compressor shall include suction muffler filter, MVD with cooling fan, flywheel and centrifugal unloader, inter-cylinder manifold with single inlet connection, NEMA open drip-proof motor, motor slide rails all assembled on steel base and mounted on housekeeping pad. Provide automatic air maintenance device with required trim.
   d) Provide in compressed air piping a high/low pressure alarm switch wired to alarm panel by Electrical Trade.
   e) Provide compressed air piping system with type “L” copper tubing, valves and all required accessories.

h. Hangers: Supports
   1. Furnish and install hangers, brackets, beam clamps, clips, inserts, and mounting devices to support all piping in accordance with NFPA 13 Chapter 9.
   2. Hangers size and spacing shall be within the following limits:

<table>
<thead>
<tr>
<th>Pipe Size</th>
<th>Maximum Hanger Spacing</th>
<th>Minimum Rod Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>1&quot;</td>
<td>8 ft. o.c</td>
<td>3/8&quot;</td>
</tr>
<tr>
<td>1-1/4&quot; to 2&quot;</td>
<td>10 ft. o.c</td>
<td>3/8&quot;</td>
</tr>
<tr>
<td>2-1/2&quot; to 4&quot;</td>
<td>12 ft. o.c</td>
<td>1/2&quot;</td>
</tr>
</tbody>
</table>

   The above hanger spacings apply to straight runs of pipe only. At points where valves, specialties, or branch connections are located, additional hangers, or supports shall be used to properly support the load.

3. Victaulic Style 009H, 107H and 07 rigid couplings may be used with IPS steel piping systems, which meet the support and hanging requirements of NFPA 13. An adequate number of Victaulic Style 177, 75 and 77 flexible couplings shall also be used to compensate for thermal expansion/contraction of the pipe.

i. Escutcheons
   1. Unless otherwise noted, provide approved type chrome plated cast brass escutcheons on all exposed piping through floors, walls or partitions in finished areas.
   2. Escutcheons on uninsulated pipes shall be held in place by set screws.
3. Where sleeve or fitting projects slightly from walls or partitions provide special deep type escutcheons to cover each case.

j. Sprinkler Cabinet

1. Furnish new sprinkler cabinet with six (6) extra heads of the type(s) noted in SP-5.c.
2. Sprinklers shall correspond to the types and temperature ratings of the sprinklers in the property.
3. Cabinet shall be located in an area where the temperature they are subjected to will at no time exceed 100 degrees F.
4. Location and mounting of cabinet shall be coordinated with Owner.
5. A special sprinkler wrench shall be provided and kept in the cabinet to be used in the removal and installation of sprinklers. One sprinkler wrench shall be provided for each type of sprinkler installed.

SP-6 SPRINKLER BOOSTER PUMP

a. Fire Pump Info

1. This specification covers a line shaft turbine pump with above ground discharge, the line shaft bearings lubricated by the water being pumped and furnished with suitable driver and accessories as specified herein. The pumping unit shall be designed and furnished in accordance with the latest Hydraulic Institute, NFPA-20 and UL/FM Standards.

b. Service Conditions

1. The pump shall be designed and constructed to operate satisfactorily with a reasonable service life, when installed in a dependable and adequate water resource location. The pump shall be the product of, and manufactured by AC Fire Pump. Other manufacturers will be considered providing the unit offered is an approved equal in all respects to the brand & model preferred by the customer. Factory pump curves for alternate pumps shall be submitted.

c. Operating Conditions

1. The pump will provide a rated capacity of 750 GPM and a differential pressure of 71 PSI. At 150% of rated capacity, the pump shall develop at least 65% of its rated head and shall not exceed 140% of the rated head at zero capacity. The overall length of the pump will be 10 feet. The pump shall be tested at the factory and a test curve shall be submitted showing the performance and horsepower requirements based on this test before final acceptance.

d. Pump Construction

1. Bowl assembly: The intermediate bowls, suction bell, and discharge bowl shall be flanged type constructed of close grained cast iron, and shall conform to ASTM designation A48, class 30. They shall be free from sand holes, blowholes, or other faults and must be accurately machined and fitted to close tolerances. The intermediate bowls shall have enamel or epoxy lined waterways for maximum efficiency and wear protection. All intermediate bowls shall be of identical design for interchangeability. A discharge bowl shall be used to connect bowls to the discharge column. All the bowls shall be fitted with
sleeve type bearings of bronze alloy C89835.

2. Impellers: The impellers shall be constructed from ASTM B584 Silicon Bronze and shall be the enclosed type. They shall be free from defects and must be accurately cast, machined for optimum performance and minimum vibration. Impellers are to be balanced to grade G6.3 of ISO 1940 as minimum. They shall be securely fastened to the bowl shaft with taper locks of C1018 steel and key and split thrust ring of SS. The impeller running position shall be adjustable by shaft adjusting nut in the discharge head or on top of the hollow shaft driver.

3. Suction: The suction bell shall be provided with a non-soluble grease packed bronze bearing, and a bronze sand collar shall be incorporated in the pump design to protect this bearing from abrasives. The bearing housing shall have sufficient opening at the bottom for easy removal of the bearing. A bronze basket type strainer shall be attached to the suction bell. It shall have a free area of at least four times the flow area of the suction connection size and the opening shall be sized to restrict the passage of ½” solids.

4. Wear Ring: Bowl assembly shall be fitted with replaceable wear rings of C95200 bronze material in the suction bowl and intermediate bowls. Wear rings shall have the minimum practical clearance to the mating cylindrical surface of the impeller to provide adequate sealing independent of vertical positioning of the impellers.

5. Shaft: The bowl shaft shall be constructed from ASTM 582 type 416 stainless steel. It shall be precision turned and ground with surface finish better than 40 RMS and shall be supported by water lubricated bearings of C89835 bronze alloy.

e. Column Assembly – Water Lubricated

1. Column pipe: The column pipe shall be furnished in sections not exceeding a nominal length of 10 ft and shall be connected by threaded-sleeve couplings or flanges. The length of the top and bottom sections shall not be more than 5 ft. It shall be of ASTM A53 grade A steel pipe and the weight shall be not less than schedule 30. The threaded pipe shall be with 8 threads per inch with 3/16” taper per foot thread and faced parallel to butt against the centering spiders to form accurate alignment. All column flange faces shall be parallel and machined for rabbet fit to permit accurate alignment. The inside diameter of the pipe shall be such that the head losses shall not be more than 5 feet per 100 feet of pipe.

2. Lineshaft: The lineshaft shall be furnished in interchangeable section not over ten feet in length, and shall be coupled with threaded steel couplings machined from solid steel bar. It shall have left-hand thread to tighten during pump operation. The diameter of the shaft shall be based on a combined shear stress of not more than 18% of the ultimate strength or not excess of 30% of the elastic limit in tension of the shafting material. The coupling shall be designed with higher safety factor than shaft. Lineshaft and coupling shall be of type 416 stainless steel. Centering spiders shall be furnished at each column pipe joint for shaft stabilization. Bearings shall be fluted rubber.

f. Discharge Head Assembly – Water Lubricated

1. Discharge Head: It shall be of the high profile type to allow shaft coupled above stuffing box and provided for mounting the driver and support the column and bowl assemblies it shall be of high-grade cast iron, ASTM A48 Class 30, or fabricated steel. The above ground outlet shall be flanged to match ANSI class 125 (for cast iron) or class 150 (for steel. It shall have a 1/2” NPT connection for a pressure gauge.

2. Stuffing Box: The stuffing box shall be cast iron and shall contain a minimum of five rings
of packing with lantern ring. It shall have a pressure relief connection. The packing gland shall be a 316SS split type secured in place with non-corrosive stud and nuts. The bearing shall be C89835 bronze. A rubber slinger shall be secured to the shaft above the packing gland.

g. Electric Motor

1. The Fire Pump shall be driven by 40 HP, 3500 RPM, 480 Volt /3 Phase - 60 Hz standard Vertical Close-Coupled open drip-proof motor with 1.15 service factor.

h. Fire Pump Controller


2. The fire pump controller shall be of the combined manual and automatic Full Service Across the Line Torna-Tech Model GPA-GPU with Built-in Power Transfer Switch for use when the normal power source is a utility and the emergency power source is a generator set. The power transfer switch is listed by Underwriters’ Laboratories, Inc. for transfer switch service and also as fire pumps transfer switches. The transfer switch is built to meet the standards of NFPA-20 Centrifugal Pumps and NFPA-70 National Electrical Code. The automatic/manual power transfer switch is listed by the Underwriters’ Laboratories, Inc. under UL-1008 “Transfer Switches” as well as UL-508 for “Fire Pump Service”.

3. Additional auxiliary NO and NC contacts are wired to terminals for customer use to indicate position of the power transfer switch and emergency source isolating disconnect switch.

4. The entire package of power transfer switch controller is completely factory assembled, wired, tested and shipped as a complete unit for easy field connection to the power sources and the fire pump motor.

5. The interrupting capacity of the circuit breaker shall be 100,000 RMS symmetrical amperes at 480 Volts.

6. The control panel starts the pump automatically at the pressure cut-in point and shall be stopped manually.

7. Running period timer set to keep motor in operation when started automatically for a time period of (10) minutes. (This timer may be deleted for automatic start with manual stop operation).

8. Pilot lamp to indicate circuit breaker closed and power available.

9. Power availability relays, complete with alarm contact to energize an audible or visible alarm through an independent source of power, to indicate circuit breaker open or power failure in any phase.

10. Provision for convenient voltage and current measurement.

i. Standard Accessories

1. The Fire Pump shall be supplied with the following accessories

a) One (1) combination 30" Hg to 100 PSI Suction Gauge, 4 1/2" dial type with 1/4" cock and lever handle.

b) One (1) 0 to 160 PSI Discharge Gauge, 4 1/2" dial type with 1/4" cock lever and handle.

c) 1 1/2" automatic air release valve

d) One (1) 3/4-inch Casing Relief Valve (175#)

e) One (1) 4 inch x 4 inch Main Relief Valve

f) One (1) 4 inch x 4 inch Enclosed Waste Cone with sight glass

j. Jockey Pump and Controller

k. The jockey pump shall be a multi-stage submersible type Grundfos SQ series Model 10SQ07, centrifugal close-coupled vertical type, mechanical sealed, stainless steel construction, impellers, shaft, diffusers, vanes, cable guards, couplings, bolts and nuts are all made of stainless steel. Designed for 10 GPM at 81 PSI - 3450 RPM complete with vertical TEFC motor rated 1.5 HP, 480 Volt, 3 Phase, 60 Hz.

l. The Jockey Pump Controller shall include an Across-the-Line magnetic starter, fused disconnect switch, HOA switch and a pressure switch.

m. Fire Pump Testing

n. Inspection of the completed installation prior to start-up including proper installation of fire pump, fittings, fire pump controller (including wiring), jockey pump and jockey pump controller. Any discrepancies shall be brought to the attention of the sprinkler and/or electrical contractors and corrected under supervision of the fire pump manufacturer’s representative.

o. Start-up and adjustment: Prior to start-up, the fire pump manufacturer’s representative shall check the pump and make any adjustments as recommended by the pump manufacturer. All controllers will be thoroughly check for looseness of wires and/or connections and adjustments made where necessary. The pump and jockey pump motors shall be “bumped” for proper rotation by manufacturer’s representative and any corrections that are necessary will be performed by the Electrical Contractor under the supervision of the pump/controller Manufacturer’s Representative.

p. Field Test of Fire Pump: The fire pump shall be given a complete field flow test by the pump manufacturer’s representative under the direction, supervision and as required by the representative of the “authority having jurisdiction”.

q. Verification of pressures, voltages, amperes and RPM’s shall be recorded. Flow and pressure results shall be superimposed on a factory certified performance test curve provided by the manufacturer’s representative and six (6) copies shall be furnished to the sprinkler contractor for distribution as required.

r. Any corrections, repair and/or modification to the equipment necessary to meet the field performance
shall be accomplished at no cost to the Owners or his representative.

s. The Manufacturer’s Representative for ITT A-C Fire Pump Company is Quimby Equipment Co., Inc. 159 Express Street, Plainview, New York 11803. Phone: 516-349-5959.

SP-7 FIRESTOPPING

a. Work, in general includes furnishing and installation only those through penetration fire and smoke seals for openings in floors, wall and other elements of construction that are in accordance with ASTM E-814 (ANSI/UL 1479). CAN4-S115 and ASTM E-119 (ANSI/UL 263)

SP-8 ALTERATION WORK

a. This contractor shall not interrupt or shutdown the existing sprinkler systems without the Owner’s permission. All shutdowns of the existing system shall be coordinated with the Owner, building and local fire department. The Contractor shall keep the shut-down time to a minimum and drainage shall be to a properly connected receptacle without causing damage to other work and property.

b. Remove debris, rubbish and superseded material from the site daily. Clean work to Owner's approval.

c. A fire watch guard with a certificate of fitness shall be maintained during all shut-downs.

SP-9 VISITING THE PREMISES

a. Visit the site and become familiar with all visible existing conditions. As a result of having visited the premises, this Contractor shall be responsible for the installation of the work as it relates to such visible existing conditions.

SP-10 PAINTING

a. All finished painting of piping shall be done under this section.

b. All piping and equipment, whether painted in shop, factory of field, shall be wire brushed and cleaned of dirt, rust, grease and other foreign matter before prime coating.

SP-11 TESTS

a. Owner shall engage the services of a licensed professional engineer in the State of New Jersey and/or a certified third party inspection service to complete all special sprinkler inspections.

b. The entire sprinkler system shall be tested as required in the State of New Jersey Building Code and as required by all agencies having jurisdiction.

c. No part of the system to be concealed shall be covered up or closed in until such portions have been tested and approved.

d. Contractor shall notify the Engineer, and the various agencies, departments and bureaus having jurisdiction in advance of the time that the tests are to be made. Give not less than 48 hours' notice.

e. The contractor shall test the installed sprinkler system in the following manner:

1. Perform hydrostatic tests for all sections of the piping systems installed under this section, at not less than 200 psi pressure for two hours, or at 50 psi in excess of the maximum pressure, when the maximum pressure to be maintained in the system is in excess of 150
psi. The test pressure shall be read from a gauge located at the low elevation point of the individual system, or portion of the system being tested.

SP-12 GUARANTEE

a. This Sprinkler Contractor shall submit in writing (triplicate) a guarantee of this sprinkler work in accordance with the standard conditions.

b. Such guaranteed shall be for a period of one (1) year after the date of final acceptance of the work, and shall include the making of any repairs which may be required owing to the defective workmanship and materials.

c. The guarantee shall include replacing same at this Sprinkler Contractor's expense, including all other work disturbed by such repairs and work damaged by defective workmanship and materials under this contract, to the entire satisfaction of the Owner.

END OF SECTION 15500
E-1 SCOPE OF WORK

a. General: Provide complete electrical systems in accordance with the Contract Documents. Include all labor materials and appliances required for the furnishing, installing and testing complete and ready for operation in a manner satisfactory to the Owner, all herein specified.

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

c. Related work specified elsewhere and provided by others.

1. Furnishing of motors, motor control devices, motor starters, motor control centers, and unit heaters.

2. Furnishing of mechanical and plumbing system alarm and control devices, unless otherwise specifically mentioned herein or noted on drawings.

3. All finished painting of exposed conduits, panelboards, apparatus, etc.

4. Base flashing for conduits through the roof.

5. All patching, except as specifically modified in these specifications and on the drawings.


7. Concrete housekeeping pads for switchboards, motor control centers, emergency control gear, automatic transfer switches (floor mounted), transformers (floor mounted) and other floor mounted electrical equipment.

8. Concrete curbs around floor openings for bus duct, conduits and sleeves.

9. Installation of access doors furnished by this contractor.

E-2 VERIFYING EXISTING CONDITIONS

a. Before commencing work, examine all adjoining work on which this work is in any way dependent for perfect workmanship according to the intent of this specification, and report to the Construction Manager any condition which prevents performance of first-class work. No “waiver of responsibility” for incomplete, inadequate or defective adjoining work will be considered unless notice has been filed before submittal of a proposal.

b. Become thoroughly familiar with actual existing locations at the building of the present installations to which connections must be made or which must be changed or altered. The intent of the work is shown on the drawings and described hereinafter, and no consideration will be granted by reason of lack of familiarity with actual physical conditions at the site.
c. Survey existing panelboards to determine suitability of existing panels to accommodate new branch
circuiting and new breakers (as scheduled). No allowance shall be made for the unavailability of new
breakers (sized as required) for existing panels. In such cases replace existing panel and provide new
panel of similar type (bus rating, main circuit breaker, number of poles, etc.). Connect new panel to
existing feeder and reconnect any “existing-to-remain” branch circuits as well as new work as
indicated on drawings.

d. Where new panels are to be sub-fed from a new 3-pole branch circuit breaker in an existing panel and
this breaker is unavailable, provide a new feeder (full size) tapped ahead of the existing panel’s main
bus or main circuit breaker to feed the new panel.

e. The total number of circuit breakers that are active or spare in existing panels is dependent upon the
number of existing circuits left after demolition work. If, after demolition work, there are no spare
poles or breakers to accommodate new work (as scheduled), reroute branch circuits to spare circuit
breakers of nearest similar type (same voltage) panel.

E-3 DEMOLITION

a. During construction and demolition, do not interrupt the power serving occupied sections of the floor.
Provide temporary feeds as required in order to maintain continuity of these circuits. All shut-downs
of power shall be coordinated with the Owner. Remove existing lighting fixtures, receptacles,
conduit, junction boxes and their associated wiring in the hung ceiling, convectors, and existing walls,
back to the panel where they originate. (This does not refer to the conduits and boxes imbedded in
the slab above or below.)

b. Convecto enclosures shall be suitably repaired to eliminate all holes and irregularities from previous
conduit and boxes. If this is not possible, new convector enclosures shall be provided.

c. All telephone and communications wiring shall be removed by the Construction Manager. Remove
all associated junction boxes and conduit after such wiring has been removed.

d. Unless otherwise noted, all existing base building fire alarm systems (fire alarm pull station, strobes,
bells, smoke detectors, etc.) shall be removed.

e. Existing circuiting that serves base building equipment (Mechanical Equipment Rooms, Elevator
Machine Rooms, stairs, life safety system, etc.) shall not be removed unless otherwise noted.

f. Before removing existing branch circuits, Electrical Contractor shall make certain that these circuits
do not feed other spaces or systems in the building, adjacent buildings or site utilities.

g. Dispose of all debris related to the electrical demolition and construction.

h. All receptacles in areas not being demolished which are not shown are existing to remain (U.O.N.).

i. Disconnect all existing motors and/or HVAC equipment which are to be removed, relocated or
replaced as part of this project. Refer to mechanical drawings and specification Section 15000 for
extent of work. Where required, remove existing feeders back to point of origin.

E-4 QUALIFICATIONS

a. Furnish all equipment of any equipment type (such as panelboards, wiring devices, lighting fixtures,
etc.) from one manufacturer.
b. The drawings show the various conduit systems schematically. No added compensation will be permitted for variations due to field conditions.

E-5 TOOLS

a. All special tools needed for proper operation, adjustment and maintenance of equipment shall be delivered to Owner.

E-6 PROTECTION

a. Be responsible for work and equipment until finally inspected, tested and accepted. Materials and equipment shall be carefully stored which are not immediately installed after delivery to site. Close exposed parts of the work with temporary covers or plugs during construction to prevent entry of moisture or obstructing materials.

b. Protect the work and material of others from damage that might be caused by work and make good any damage thus caused.

E-7 SUBMITTALS

a. Prior to shipment or start of installation of system components, submit the following for approval to the engineer:

1. Grounding
2. Switchboards
3. Panelboards
4. Automatic Transfer Switches
5. Dry Type Transformers
6. Lighting Equipment and Lamps
7. Wiring Devices
8. Cable Supports
9. Panels
10. Receptacles
11. Receptacle Plates
12. Disconnect Switches
13. Heating Cable
14. Lighting Fixtures
15. Fuses
16. Dimmers and Dimming System
17. Fire Alarm System
18. Outlet Boxes
19. Switches
20. Switch Plates
21. Conduit and Conduit Fittings
22. Emergency Generator

b. Whenever items or class of material is specified exclusively by trade name, manufacturer’s name or by catalog reference, use only such items unless prior written approval for substitution is secured. When applying for substitutions, state credit or extra involved and provide all necessary supporting data.

E-8 CUTTING AND PATCHING
a. Furnish to the Construction Manager necessary information so that openings for this work can be built into the floors and walls in time. Such cooperation is required to keep cutting of walls and floors to a minimum.

b. Set sleeves for pipes accurately before concrete floors are poured, or set boxes on the forms to leave openings in the floors and subsequently set required sleeves in the openings.

c. Should this contractor neglect to perform preliminary work, and should cutting be required in order to install equipment, the expense of this cutting and restoring of surfaces to their original condition shall be borne by this contractor.

d. Do any cutting required for the passage or installation of pipes, supports, and the like, provided under this Section. In general, demolition of existing walls and ceilings will be done under another Section of the Specifications.

E-9 RECORD DRAWINGS (AS-BUILTS)

a. Concurrent with progress of installation, maintain a set of as-built record drawings, consisting of a reproducible marked set of AutoCAD drawings with additional sketches as required, denoting and dimensioning accurately all changes in elevation, location and size of all items deviating from contract drawings.

b. Upon completion of work, transfer all the above information to magnetic diskettes using an Auto-Cad Computerized Drafting system.

c. Within three weeks following beneficial occupancy of the project, two Diskette containing "As-Built" drawings and two sets of maintenance manuals, operating manuals and drawings (including shop drawings) of all electrical equipment shall be submitted to the Owner.

E-10 OPERATING AND MAINTENANCE INSTRUCTIONS

a. Three sets of operating and maintenance instruction manuals covering completely; equipment starting sequences, operation, maintenance, automatic controls, calibration, adjustments, and listing of all spare parts, shall be furnished to owner, including a technical description and narrative, in lay terms, fully describing the system operation.

b. Furnish a list of manufacturers (with names and telephone numbers of local representatives) in order to expedite ordering of replacement parts.

E-11 MAIN DISTRIBUTION SWITCHBOARDS

a. Main distribution switchboards shall be 277/480 volt or 120/208 volt, 3 phase, 4 wire, grounded, with stationary, electrical trip bolted pressure switches (QA-CBC) or quick-make, quick-break (QMQB) switches, as indicated on the drawings.
b. Bolted pressure switches shall be 250 volt or 600 volt bolted pressure load break type, 3 pole, ampere rating as indicated on drawing schedules, equipped with current limiting fuses of the silver sand type. All switch contacts, fuse terminals, line and load terminals shall be silver plated. Switch mechanisms shall provide sliding contact pressure at jaws during opening or closing operation of switch and positive bolted contact pressure when switch is in the closed position. Any arcing during opening of switch shall occur at the auxiliary contacts. Arcing shall not occur on any part of the main jaw and switchblade contact areas. Switch bases shall be in two sections to provide maximum air movement and heat dissipation around fuses. Switches shall be dead-front and externally operated, enclosed in properly designed ventilated enclosures. An access door shall be provided with wired glass insert for visual inspection of switch without opening the door. The external operating mechanism shall be provided with positive mechanical lock when switch is in closed position. Access door to fuses shall be arranged for opening only when switch operating handle is in the “Off” position.

c. All distribution switchboard switches shall be provided with blown-fuse lamps indicator.

d. All QMQB switches shall be dead-front, 3 pole, fused, equipped with current limiting fuses. All switch contacts, fuse terminals, line and load terminals shall be silver plated. Pressure switch mechanism shall provide sliding contact pressure at jaws during opening or closing operation of switch and positive bolted contact pressure when switch is in closed position. Any arcing during opening of switch shall occur at the auxiliary contacts. Arcing shall not occur on any part of the main jaw and switchblade contact areas. Switches shall be dead-front and externally operable, enclosed in properly designed, naturally ventilated enclosure. The external operating mechanism shall be provided with positive mechanical lock when switch is in closed position.

e. All distribution switches shall be provided with a ground fault protection system. All main distribution devices shall be provided with a ground fault alarm system. Ground fault protection/alarm on main distribution devices shall constitute the second level of ground fault. Each ground fault system shall consist of a current monitor, zero sequence current transformer, relay coil and shunt trip coil.

f. Provide a pair of isolated Form “C” contacts rated 10 amperes, 125 volts from each distribution device ground fault sensor for remote alarm sensing under the Building Automation and Temperature controls Section. Extend contacts with No. 12 AWG wire to terminal strips in a splice box mounted on each main distribution switchboard.

g. Switchgear shall be dead-front, completely metal-enclosed, self-supporting structures, consisting of the required number of vertical sections, bolted together to form one rigid structure. Sides and rear panels shall be fastened with captive machine screws with rear panels hinged. All covers or panels shall be code gauge steel, and shall be provided with necessary ventilated openings to maintain minimum operating temperatures.

h. Each section shall be provided with adequate lifting means, and shall be capable of being rolled or moved into installation position and bolted to the housekeeping pad. Individual shipping sections shall be designed for bolting together at the installation site. All necessary hardware required for bolting, including steel channels with shims for leveling, as well s main bus splices, shall be supplied with the switchgear sections.

i. Adequate conduit space shall be provided in the rear compartments to satisfy the current ratings of the individual devices within a vertical section. All cable terminations shall be made with two-bolt hole concentric compression type lugs, which shall be supplied with the switchgear section and approved by the Engineer.

j. Individual Vertical Compartments
1. Each vertical steel unit, which forms part of each switchboard line-up, shall be a self-contained, self-supporting, totally enclosed housing, containing one or more individual overcurrent devices or instrument compartments, main bus section, sectional bus for feeders to individual devices, and a rear cabling compartment.

2. Each individual device or instrument compartment or cell shall be completely segregated from adjacent compartments by means of barriers at rear, top, bottom and sides. Main bus assembly and section bus shall be segregated from the rear cabling compartments by means of formed solid insulating barriers. All barrier material shall be molded fiber glass or glass polyester material, or its equivalent, non-tracking and suitable for the voltage level of the switchboard as dictated by Underwriters Laboratories or local authorities having jurisdiction.

k. Bus Bars

1. Main bus and section buses shall be provided in each switchgear section and shall be copper (or aluminum) with either silver or tin plating at all joints. All main bus shall be either welded or bolted to section bus and bolted where main bus extends to adjacent shipping sections. Bolted joints shall consist of silver or tin plated splice plates and high tensile strength steel bolts with nuts and Belleville washers tightened to the proper torque requirements as dictated by the Belleville washers and UL requirements.

2. Bus bars shall be sized to maintain UL temperature rises for each particular section of bus when operating in an ambient room temperature of 40°C.

3. Bus bars shall be adequately braced to withstand resulting mechanical forces exerted during short circuit conditions when subjected to short circuit currents but no less than 200,000 amperes RMS symmetrical.

4. All buses shall be assembled so as to maintain the minimum UL electrical clearances without the use of insulating material. Load studs shall be equipped with load extension buses, terminating in solderless concentric compression type 2 bolt-hole lugs in the rear cable compartment of each structure. Bus extensions shall be silver or tin plated where outgoing lugs are attached.

5. All full capacity neutral bus, fully insulated from frame, shall be provided with suitable disconnect link.

6. Each switchboard assembly shall contain a continuous ¼ inch x 3 inch copper ground bus, readily accessible upon removal of rear panels, run through and connected to all component parts of the switchboard structure. Provided for connection of 500 MCM copper ground connection.

l. Provide, for each main distribution device, three current transformers of suitable ratio, 3 phase ammeter switch and ammeter.

m. Provide a voltmeter with six position selector switch for each switchboard main bus.

E-12 DISTRIBUTION PANELS; SWITCH AND FUSE TYPE

a. Three phase, 3 or 4 wire with copper bus bars. All through bus shall be insulated.

b. NEMA Class I Construction to accommodate fusible, individually enclosed switches, front removable, with switch and door interlocks. Covers to be padlockable.
Panel constructed of code-gauge steel, gray finish over rust inhibitor, for surface mounting. Box and panel frame shall be flanged and reinforced for rigid support of interior and accurate alignment of interior with front. Trims to be fastened to back box with screws.

All branch switches shall have individual engraved laminoid nameplates (black with white core).

Disconnects:
1. Disconnects shall conform to NEMA and UL Standards, and shall be horsepower rated.
2. Switching mechanism shall be quick-make, quick-break, single throw with external operating handle mechanically interlocked with enclosure cover to provide access to interior when disconnect is in OFF position only. Provide means to lock operating handle in the OPEN and CLOSED position. Designate on the enclosure the OPEN and CLOSED position of the operating handle.
3. Switches shall be of the double stationary contact type.
4. Switches shall be equipped with rejection type fuse holders, fusible as shown on the drawings; provide complete with fuses as scheduled.

Installation
1. Distribution panel shall be mounted to structural steel channel (Kindorf) which shall be bolted to the wall using expansion anchors for large panels.

Identification:
1. Provide nameplate at each switch identifying the load served.
2. Nameplates shall be mounted on the front cover secured with self-tapping screws or nuts and bolts. Nameplates shall be laminated phenolic, black with a minimum of 1/4" high white lettering.
3. Power panels shall be similar to General Electric type "QMR", or approved equal by square D or EATON.

DISTRIBUTION PANELS, CIRCUIT BREAKER TYPE

Three phase, 4 or 5 wire, copper bus bars, with 2, 3, or 4 wire branches, as noted. Capacity of panel and circuits, as noted below. Panelboard to have ground bus same size as phase buses.

Cabinets: Code gauge galvanized sheet steel primed and painted with trim and door, type as noted. Lap and rivet corners or form as approved.

Trim: One piece full finish primed and painted sheet steel. Trim shall be mounted with a continuous piano hinge configured in such a manner that it shall be possible to gain full access to circuit breakers and wiring gutters without removing the trim. Provide a multi-pin cylinder lock (Yale, Corbin or equal) to latch the trim. Keys shall be milled.

Hardware: Multi-pin, cylinder locks with milled keys. All panels shall be keyed alike. Door over 48" high shall be equipped with a chrome plated vault handle, built-in lock and 3-point catch fastening door at top, bottom and center.
e. Hinges: Concealed, continuous piano hinge as described above.

f. Directory Holder: Metal frame with non-breakable transparent cover and directory card. Entries to be typewritten by installer. Provide an engraved laminated nameplate adjacent to each branch breaker. Mount with self tapping machine screws.

g. Furnish multi-cable lugs where required. Double lugging not permitted. Secure lugs to bus by stud bolts.

h. Panelboard construction for bolted type breakers. Minimum short circuit rating 25,000 amperes, RMS symmetrical. Breakers shall have minimum 225A frame, trips sized as shown on the plans.

i. Minimum Gutter Spaces: Panels with 225 ampere mains, 5-3/4" minimum, 400 amperes and over, minimum gutters 8". For panels with through feeders, increase gutter width by 2" minimum and provide a sheet metal barrier between the panel gutter and the through feeder portion of the back box.

j. Panel shall have main circuit breaker or main lugs as indicated on the drawings. Quantity, poles and trip ratings of branch circuit breakers to be as indicated on drawings.

k. Panel shall have engraved white core, black laminoid nameplate screwed onto panel trim with designation listed. (Panel name, voltage, rating of mains in amps).

E-14 LIGHTING AND UTILITY PANELBOARDS

a. New panelboards installed shall have interior as described below and shall be installed in enclosures fabricated of code gauge galvanized sheet steel without knockouts. Panelboards shall be manufactured by Electrotech, Gallagher, Metropolitan, Atlas, Lincoln or as approved.

b. Circuit wiring in panelboards shall be trimmed and dressed in a neat and workmanlike manner. All wiring shall be tagged. Panelboards shall be provided with a detailed typewritten directory.

c. Three-phase, 3 or 4 wire, copper bus bars and main circuit breaker, with 2, 3, or 4 wire branches, as noted. Quantity and capacity of panels and circuits as shown on panel schedules.

d. Cabinets: Code gauge galvanized sheet steel with door in door lockable trim. Back box and trim to be primed and painted with grey enamel. Lap and rivet corners or form as approved. All panels to be keyed alike. Keys to be cut as directed.

e. Directory Holder: Metal frame with nonbreakable transparent over and directory card. Entries to be typewritten by installer.

f. Panelboard construction for bolted type circuit breakers.

g. 277/480 Volt Panels: Minimum short circuit rating 14,000 amperes, RMS symmetrical.

h. 120/208 Volt Panels: Minimum short circuit rating 10,000 amperes, RMS symmetrical. Panel shall be constructed with double size neutral bars, with an equipment ground, and if indicated, with an isolated ground bar.

i. Minimum Gutter Space: For panels with main buses rated over 100 amperes, 6" minimum on all sides.

j. Panels shall have quantity, poles and trip ratings of branch circuit breakers as scheduled.
k. All main and branch bus bars, double size neutral, and ground bus bars, cable lugs and all connectors to be made of copper. Dual rated alloys or aluminum not permitted.

l. All circuit breakers shall have copper lugs, whenever possible.

m. Panels shall have engraved white core, black lamicoid nameplate screwed on to panel trim. Glued or taped on nameplates are not acceptable.

n. Where several panels are fed by one feeder, solid tap connections shall be made in the gutters as required with tapped connectors. Gutter space shall be increased as required to accommodate feeder taps. Specified lugs or connectors shall be provided for feeders. See Article “Taps and Splices”. Where panelboards for power distribution are shown mounted free standing, provide angle iron rack suitably braced to support these panels, if required.

o. Certain panels shall be equipped with integral mechanically held contactors or remote mounted multiple relays for remote control of sections or circuits. These contactors shall be 600 volt, ASCO Bulletin 920 of ampere rating and poles as indicated; with fuse and fuse adapter and two wire control circuit relay. Multi-pole relays shall be ASCO Bulletin 1255-766, of ampere rating and number of poles as indicated, mounted in NEMA I enclosure with hinged lockable cover. Provide local “open” and “close” stations for controlling contactors and relays adjacent to associated panels unless shown otherwise. Include terminals for connections to building automation system. Provide time switches where indicated on drawings for automatic control of contactors and relays. Time switches shall be Tork Series DGUM momentary contact type, astronomic dial, or as approved.

E-15 MOLDED CASE CIRCUIT BREAKERS

a. Provide new circuit breakers for new and existing panels as scheduled on the drawings.

b. Electrical contractor may reuse circuit breakers in existing panels provided that they are in good operating order and in compliance with the requirements listed below.

c. General characteristics of molded case circuit breakers shall be:

1. Single, 2 or 3 pole, as noted.

2. Thermal-magnetic type.


5. Automatic Tripping: Clearly indicated by handle automatically assuming position distinctive from normal "ON" and "OFF" positions.

6. Provide shunt trip or GFI type circuit breakers where indicated on the panel schedules.

7. Bolt-on Type.

d. All circuit breakers shall have interrupting capacities adequate for their locations, generally. Unless indicated otherwise, the interrupting capacity of any circuit breaker shall be greater than the let-through current of the protective device next ahead of it in the distribution system. The circuit breakers shall be rated for not less than 10,000 amperes interrupting capacity for 120 or 208 volt, and not less than 14,000 amperes interrupting capacity for 277/480 volt.
e. Interrupting capacities referred to are symmetrical values, RMS according to NEMA standards.

E-16 TRANSFORMERS

a. Furnish and install all transformers indicated on the drawings.

b. Transformers shall be 3 phase, 60 hertz. Primary winding (480 volt) shall be delta connected and 120/208 volt secondary winding shall be wye connected.

c. The insulation system shall be a UL Component Recognized 150 degree C system. Temperature rise with a 50% Linear and a 50% Non-Linear load shall not exceed 80 degrees C rise by resistance.

d. The windings shall be copper, continuously wound and impregnated with a non-hygroscopic, thermostetting varnish.

e. The primary winding shall have two -5% FCBN taps. A copper electrostatic shield shall be inserted between the primary and secondary windings to attenuate high frequency harmonics and transmission of common mode and transverse mode transients. Maximum effective coupling capacities between primary and secondary windings shall be 33 picofarads.

f. The secondary conductors shall all be individually insulated, as small in size as possible, and transposed where necessary to keep hysteresis and eddy current losses at the harmonic frequencies to an absolute minimum. Conductor shall be of sufficient size to limit the temperature rise to its rated value even with the circulating third harmonic current.

g. The core flux density shall be well below the saturation point to prevent core saturation caused by the non-linear harmonics even with a 10% primary over-voltage.

h. Transformer enclosure shall be suitable for indoor installation.

i. Transformer terminals shall be front connected for east of installation. Provide double size neutral lugs for connection of larger or doubled secondary neutral wiring.

j. Install, test and adjust taps on all transformers.

k. Where noted, transformers shall be trapeze mounted from the building structure.

l. Transformers shall be equal to Square "D" or approved equal by G.E. or EATON.

E-17 FUSES

a. All fuses shall be of the same manufacturer, Bussman, or as approved, and shall be installed, as required, in all cut-outs, panels, motors, starters and safety switches.

b. Fused circuits rated 601 amperes and larger shall be protected by time delay current limiting fuses listed by Underwriters Laboratories to interrupt 200,000 amperes. These fuses must hold 5 times rated current for a minimum of 4 seconds and clear 20 times rated current in .015 seconds or less.

c. Fused motor circuits, 600 amperes or less, serving groups of motors, shall be protected by dual-element current limiting fuses listed by Underwriters Laboratories to interrupt 200,000 amperes. These fuses must hold 5 times rated current for a minimum of 10 seconds.

d. Fused motor circuits, 600 amperes or less, serving individual motors shall be protected by dual element fuses listed by Underwriters Laboratories to interrupt 200,000 amperes.
E. Spare Fuses: Upon Owner’s acceptance of the electrical distribution system, provide the Owner with spare fuses and rack to hold same as follows: Fifteen percent of each type and rating installed (minimum of three).

f. Submit selective coordination fuse curves as required by Code and as directed.

E-18 CONDUIT

a. General

1. Conduit sizes shall be in accordance with National Electrical Code.

2. The types of conduits used shall be as described below under "Conduit Types."

3. Conduit Types:
   
a) EMT - Use for all work concealed in walls and above hung ceiling (3/4" minimum) EMT up to trade size 1-1/2" may also be used for work run exposed. Steel compression fittings only.

b) Rigid Aluminum - Use for all risers and for exposed runs 2" trade size and larger.

c) Greenfield shall be used for lighting fixture tails (1/2" minimum) and for final connections to motors and transformers. Greenfield may be used as a general wiring method only where it must be fished through existing walls, columns or sheetrock ceilings. In this case a separate green insulated ground wire shall be included with the circuit conductors. Use insulated throat bite-tite connectors with Greenfield.

d) Rigid Galvanized Steel – Use for all outdoor runs.

e) IMC - Use for conduit concealed in poured concrete floors.

f) The use of armored cable (BX) is permitted as a final connection to lighting fixtures and equipment for branch circuiting in concealed drywall construction.

g) All unused conduits shall be removed back to original source.

4. Conduits shall be of such size and shall be so installed that the required conductors may be drawn in without injury or excessive strain.

5. Mechanically join all metal conduit, enclosures, raceways, etc. to form a continuous electric path. Indent fittings are not acceptable. Threaded type fittings only for rigid metallic conduit and IMC. Compression type fittings for EMT. Flexible conduit fittings, compression type secured with wire.

6. Layout and install all conduit runs so as to avoid proximity to sprinkler, chill water and hot water pipes. Do not run conduit within three inches of such pipes except where crossings are unavoidable, then the conduit shall be kept at least 1" from the covering of the pipe crossed.

7. Support riser conduits at each floor level by clamp hangers Kindorf type C-210. Arrange hangers for minimum obstruction of opening when installed in pipe shafts. All conduit openings shall be fire stopped in an acceptable manner. See section on fire stop sealant, elsewhere in these specifications. This paragraph pertains where applicable.
8. Where physical constraints prevent the use of standard threaded couplings use bolted split couplings as manufactured by O.Z. Gedney.

9. When not terminated in a threaded hub, secure conduits entering sheet metal enclosures and outlet boxes in place by two locknuts (one inside and one outside) and terminate each conduit with a bushing. Conduits 1¼" trade size and larger shall terminate in a metal insulated grounding bushing bonded to the box or enclosure with a #6 ground wire.

10. When running conduits outdoors or in fresh air intake plenums install a compound filled sealing fitting immediately on the warm or building interior side of the wall where conduit enters and/or leaves the above locations. Conduit run in these cold locations shall slope toward sealing fittings, and away from outlets and devices. Sealing fittings shall be drainable type, Crouse Hinds type EYD or as acceptable, with drains toward cold sides. Install fittings at low points in the conduit system to permit draining of moisture. Where possible, conduits shall enter these locations from below. Terminate all conduits at outlets and devices in these spaces with threaded hubs.

11. Use flexible metallic conduit from outlet boxes in hung ceiling to lighting fixture housings. The final raceway connection to motors, transformers, and other equipment subject to vibration shall be flexible metallic conduit. Use aluminum flexible conduit with aluminum rigid conduit, and flexible steel conduit with EMT, IMC or galvanized rigid conduit. Flexible conduits 2" trade size and larger shall be provided with an external bonding jumper of #6 AWG bare copper.

12. Where a flexible raceway is installed in plenums or other indoor locations where exposed to continuous or intermittent moisture, use liquid tight flexible conduit installed in such a manner that liquids tend to run off the surface and not drain toward the fittings. Provide sufficient slack to reduce the effects of vibration.

13. Where flexible conduit is used as a wiring method, to run wiring to new receptacles in existing GYP-Board walls, provide a separate ground conductor. Bond ground wire to the conduit grounding system at the first junction box.

14. All empty conduits, except those which are vertical for their entire length and except conduits connecting ceiling lighting outlets together, shall have drag line.

b. Concealed Conduit:

1. Install conduit so as not to cut or run through structural members, except by special written permission of the Engineer or where specifically shown on drawings.

2. Do not run conduits horizontally or crosswise in building type partitions or side walls.

3. Except for branch circuit work install all conduits in hung ceiling on acceptable hangers and inserts. Conduit for branch circuit work and control and instrument wiring shall be supported by clamps or pipe straps supported from the purlins (black iron members supporting the ceiling) where available, or from structural members or from the deck.

4. In lay-in ceilings install conduit high enough to permit removal of ceiling panels.

c. Exposed Conduit:

1. Run exposed conduit and extensions from concealed conduit systems parallel with or at right angles to the walls or beams of the building, to present a neat and workmanlike appearance.
2. Support rigid metallic conduit runs on each side of bends, and not greater than 10'-0" on centers. All other conduit shall be secured as required by Code.

d. Expansion Fittings:

1. Provide conduit expansion fittings, O.Z. Type "EX" or "AX" together with an O.Z. Type "EXJ" or "AXJ" bonding jumper where required as follows:

   a) A conduit expansion fitting shall be installed in each conduit run wherever it crosses an expansion joint in the structure to which it is attached.

   b) A conduit expansion fitting shall be installed in each conduit run wherever it crosses an expansion joint in the concrete structure. The expansion fitting shall be installed on one side of the joint, with its sliding sleeve end flush with the joint and with a length of bonding jumper in the expansion joint equal to at least three times the nominal width of the joint.

e. Conduit Types:

1. Aluminum

   a) Aluminum conduit shall conform to ANSI Standard C80.5 and UL Standard #6 for rigid aluminum conduit. Interior of conduit shall have a silicone or as acceptable coating; all threads shall have an application of Pentrox "A" or other acceptable conductive lubricant.

2. Flexible Metallic

   a) Flexible metallic conduit shall be threadless, continuous, spirally wound and interlocked, aluminum or zinc coated steel conforming to UL Standard #1 for flexible metal conduit.

3. Liquid Tight Flexible Steel

   a) Liquid tight flexible steel conduit shall be similar to flexible metallic except with a PVC jacket. Conduit shall be Anaconda "Sealtite" type UA or as acceptable.

   b) CAUTION: When using liquid tight flexible conduit, wiring must be derated to 60 C ampacities.

4. Electric Metallic Tubing

   a) Electric metallic tubing (EMT) shall be threadless type, steel, conforming to ANSI Standard C80.3 and UL Standard #797, with fused zinc on outside and inside walls with an additional high corrosion-resistant finish coat.

5. Rigid Galvanized Steel Conduit

   a) Rigid full-weight steel pipe galvanized inside and out using the hot-dip method. Conduit shall conform to standards for Rigid Steel Conduit of the Underwriters Laboratory, Inc.
b) Zinc coating shall be sufficiently well bonded and elastic to prevent flaking or cracking when a sample of finished conduit is bent 90° with a radius of 6 times the inside diameter of the conduit.

6. Metal-Clad Cable (MC Cable)

a) Flexible, zinc coated steel interlocked armor, continuously spirally wound, over one, two, three or four color coded "hot" legs, separate color coded two neutrals (white with blue stripe, white interior, red stripe, etc.) for each "hot" leg, and two insulated ground conductors.

b) All conductors shall have THHN insulation rated for 600V.

c) Cable shall be UL listed, and shall meet National Electric Code Standards.

f. Conduit Sleeves (where applicable):

1. General

a) Conduit sleeves shall be installed so that proper position and alignment will be maintained during construction.

2. Sleeves through Interior Walls and Floors

a) Sleeves through interior walls and floors shall be minimum of No. 20 gauge galvanized steel, black enameled rigid steel conduit or Schedule 40 black steel pipe. Aluminum conduit shall not be used. Where specific sizes are not indicated on the drawings, sleeves shall be sized to provide one-half (1/2) inch clearance around the outside surface of the item for which they are installed. They shall be cut flush with wall surfaces, and shall extend two inches above finished floor levels. The space between conduit and sleeves shall be packed with fibreglass or other acceptable non-combustible packing material to prevent passage of air, liquid or fumes from one area to another. Seal with "Duxseal" or other acceptable compound.

g. Conduit Fittings:

1. Rigid Threaded Conduit and IMC

a) All bushings for terminating conduit 1" and smaller shall be cast threaded type with smooth edge to prevent injury to wire and cable. Use aluminum bushings for aluminum conduit.

b) Use insulated grounded bushings for conduits 1¼" and larger. Insulated grounded bushings shall be cast, threaded type equipped with a lug for grounding. Upper edge shall have a nylon ring or bakelite ring which is molded into the bushing. Ground lug shall be sized to take conductor sized according to Code with a minimum size of No. 12. Use aluminum locknuts and bushings with aluminum conduit.

2. Thinwall (EMT) Conduit
a) Where electrical metallic tubing is installed, connectors and couplings shall be rain-tight, die cast zinc, compression connector type. Connectors shall be of the nylon insulated throat type as manufactured by the Thomas & Betts Co. Series "5120" and "5123" respectively or as acceptable. On tubing larger than 1" use bonding locknuts.

3. Flexible Metallic Conduit (Greenfield)

a) Where flexible metallic conduit is installed connectors shall be the Tite Bite type with nylon insulated throats as manufactured by The Thomas & Betts Co., Series "3110", or as acceptable.

4. Liquid Tight Flexible Steel Conduit (Sealtite)

a) Where terminating liquid tight flexible steel conduit (Sealtite), fitting assembly shall be sealing type consisting of steel gland, nylon ring and ground cone on the outside and a nylon insulated throat fitting on the inside. Fittings shall be Thomas & Betts Co., Series "5331", or as acceptable.

E-19 CONDUCTORS

a. Wire and Cable (600 Volt Building Wire):

1. Unless specified otherwise all wires No. 10 AWG and smaller shall be solid; No. 8 AWG and larger shall be stranded.

2. No wire shall be drawn into a raceway until work of a nature which may cause injury is completed. Use acceptable lubricants.

3. Unless otherwise indicated all control wiring shall be No. 14 AWG. Minimum size wire for power or branch circuit work shall be No. 12 AWG. Use No. 10 AWG wire to the first outlet for branch circuit runs more than 70 feet for 115 volt circuits. All control and circuit wires in cabinets, boxes, panels, pull and junction boxes shall be trained neatly and tied.

4. All wires and cables shall be continuous from origin to destination without splices unless written permission is given by the Engineer. In branch circuit wiring, make connections to fixtures or devices using "T" taps only.

5. All 600 volt wire and cable unless otherwise specified shall be single conductor suitable for use in wet and dry locations.

6. All conductors shall be annealed copper.

7. All wiring shall have copper conductors and THHN/THWN insulation. Branch circuit wiring shall be No. 12 AWG minimum. No. 14 AWG wiring may be used for control work only. All branch wiring must be factory color coded for its entire length. For feeder wiring No. 1/0 AWG and larger colored stripes along the full cable length is acceptable with all visual areas taped with applicable color type.

8. All wire and cable shall be color coded as follows unless otherwise authorized:
9. All cables in indoor dry locations in pull, splice and cable support boxes, in panels and points of termination shall be bundled and laced by circuits and tagged using nylon tie-wrap material, flame resisting tags of adhesive material or coded sleeves. Tags shall identify cables and pieces of equipment served. Tags shall be T&B "TY-RAP" or "E-Z Code" or as acceptable. All cables, power and signal shall be routed and trained by system.

10. Tag all cables in interior damp locations with stainless steel, zinc or lead embossed tags secured with tinned copper wire. Tags shall be as manufactured by The Thomas & Betts Co. or as acceptable.

11. On each panel and on the entire system, circuits shall be connected so that the load on each phase shall balance within ten percent with all lamps burning and all equipment in operation.

b. Connectors: Splices and Taps for 600 Volt Wire and Cable

1. For Wire No. 8 AWG and Smaller (Power Conductors Only)
   a) Splices and taps shall be pressure indent type with insulated cover; or insulated, rustproofed spring thread-on type. Manufacturer's recommended tooling shall be used.
   b) Except where terminating in panelboards, switches, and motor controllers all terminations shall be made with compression lugs. The manufacturer's recommended tooling shall be used to apply. Where compression terminals are not isolated safely from other metallic parts, the nylon self-insulated type shall be used. Lugs shall be Burndy "Insulug" or as acceptable

2. For Cable No. 6 AWG and Larger
   a) Except in motor controllers, switches and in panelboards where lugs cannot be changed, all cables shall be terminated, spliced and tapped with color keyed, double indent compression connectors as manufactured by Thomas and Betts Co.
   b) Series 54000 or as acceptable. Manufacturer's recommended tooling shall be used to apply. Lugs shall be the two hole type. Insulate all splices and taps with heat shrinkable insulation, Raychem or as acceptable.
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E-21 INSULATING BUSHINGS

a. Insulating bushings or insulating throats shall be installed on all terminations.

b. All rigid conduit 1¼ inches and larger terminating in cabinets, panel boxes, pull boxes and similar boxes shall have insulating bushings, Type “B” or Type “BL” for grounding bushings, as manufactured by O.Z. Electric Manufacturing Company.

c. All EMT fittings, light-tight flexible conduit fittings, flexible metal conduit fittings, chase nipples and metal-clad cable fittings shall have insulating throats.

E-22 JUNCTION AND PULL BOXES

...
a. Junction or pull boxes shall be provided where indicated, and wherever else such a box may be required by Code or deemed necessary, providing location is approved by the Architect, to facilitate the pulling of wires and cables. All such boxes must be made accessible and built of heavy gauge steel, unless otherwise specified, and shall be built only from approved detail working drawings. The covers of boxes shall be designed for quick removal. When the system is finished the boxes shall contain no openings, except that into which the conduit passes. Generally, junction boxes and pull boxes shall be installed every 100 feet in a conduit run and shall not be exposed in finished spaces and, where necessary to do so, reroute these conduit or make other arrangements to meet the approval of the Owner. Pull boxes or junction boxes occurring in finished areas shall have the removable cover plates flush with finished ceiling. All cables within pull boxes shall be properly tagged for identification, using one inch diameter brass tags. Suitable supports shall be provided in all pull boxes to support feeders passing through the boxes so that the conductors will not remain unsupported for a distance greater than required by Code.

b. 120/208 volt feeders shall not occupy the same pull box with 277/480 volt feeders unless suitable barriers are provided within pull boxes to separate these feeders.

c. Emergency feeders, normal feeders, and normal/emergency feeders shall each be segregated from the other by separate pull boxes or barriers within pull boxes.

d. Feeders originating from different services shall be segregated from each other by separate pull boxes or barriers within pull boxes.

E-23 TAPS AND SPLICES

a. All copper cable lug connections to copper bus bar mains and branches made in main service switchboards, panelboards, etc., shall use copper solderless connectors having either 2-bolt cast copper pressure plate clamp or indent compression connectors, Thomas & Betts Series 54000. Aluminum cable connections to all equipment shall use aluminum, solderless, concentric compression connectors, Thomas & Betts Series 60000. Use Thomas & Betts joint compound, Cat. No. 21059, for all aluminum cable joints. All lugs accommodating cables of 200 ampere ampacity and larger shall be of the two hole type. Where compression connectors are used, they shall be installed using compression tooling manufactured by the lug manufacturer.

b. Copper cable branch taps from copper cable main lines under 600 volts shall be made in junction, panelboard or pull boxes, with approved cast copper alloy solderless connectors in a hi-impact phenolic insulating cover having at least two spring clip fasteners. Connectors shall be O.Z. Type “PT” parallel tap with “PTC” cover, Type “PM” parallel looped tap with “PMC” cover and Type “T” cable tap with Type “TC” cover. These connectors shall be hot tinned aluminum when used on aluminum conductors, as manufactured by Dossert, with noxide paste.

c. Splices of copper conductors shall be made in junction or pull boxes with an approved O.Z. Type “TW” or “XW” cast copper alloy solderless connector in a hi-impact phenolic insulating cover, Type “TWC” or “XWC”.

d. Splices of aluminum conductors shall be made in junction or pull boxes with aluminum compression connector, Thomas & Betts Series 60000. Use Thomas & Betts Series 60900 connectors for aluminum copper cable splices.

e. All splices shall be insulated with T&B heat shrink insulation tubing, HS Series, using T&B heat gun.
f. Parallel taps for aluminum-to-aluminum and aluminum-to-copper stranded conductors shall be the “H” type color keyed compression tap Thomas & Betts Series 63000, which includes grooves prefilled with special oxide inhibitor. Thomas & Betts Compression Tool TBM15 shall be used for all Series 63000 or 60000 connectors with hex dies.

g. Any electrical equipment being furnished under this Section, or under other Sections, for which aluminum cable connections are being provided, if not furnished with aluminum connectors of the type specified herein, shall be connected by means of one of the following methods:

1. Replace connectors with proper approved aluminum connectors.

2. Use copper conductor for final connection to the equipment and splice to aluminum conductor using the herein before specified connector. This splice may be made within the equipment if permitted by the Inspection Authority or in a splice box which shall be located in an accessible location.

3. Use T&B bi-metal pin connector with stranded copper pigtail for final termination, T&B Series 61905. Insulate connector with T&B heat shrink tubing as described in Paragraph “e.” above to point of copper entry to lug.

h. Terminal lugs with bolting pads shall be tinned-plated.

i. Belleville type compression washers, Thomas & Betts Series 60800, shall be used for bolting aluminum lugs to electrical equipment.

E-24 RECEPTACLES

a. Receptacles shall be of ampere and voltage ratings and type as indicated on the drawings. All receptacles shall be mounted at a height above finished floor unless otherwise noted on architectural drawings. The following listing, which is general and not limited to the following catalogue numbers, shall be for type and grade only:

1. 20 ampere, 125 volt, single receptacle, 3 wire grounded, straight blade, Hubbell Cat No. 5361.

2. 30 ampere, 125 volt, single receptacle, 3 wire grounded, straight blade, Hubbell Cat. No. 9308.

3. 50 ampere, 250 volt, single receptacle, 3 wire grounded, straight blade, Hubbell Cat. No. 9367.

4. 20 ampere, 125/250 volt, single receptacle, 4 wire grounded, straight blade, Hubbell Cat. No. 8410.

5. 50 ampere, 125/250 volt, single receptacle, 4 wire grounded, straight blade, Hubbell Cat. No. 9450.

b. All receptacles for general purpose use shall have white colored bodies. All receptacles for computer use shall have gray colored bodies.

c. Provide ground fault circuit interrupter type receptacle in all exterior locations, next to sinks and in other “wet” areas.

E-25 LOCAL SWITCHES
Flush quiet type tumbler switches shall be installed at each switch outlet. In all cases where two or more are shown together, they shall be grouped behind a common plate with barriers installed in back box to isolate adjacent switches connected to different phases.

Switches indicated on plans for various rooms shall be installed directly adjacent to the entrance door or on the wall directly past the full opened position of the door or as detailed.

In general, switches shall be for single pole, 20 ampere, 265 volt, Leviton Decora Plus No. 5621-W, and shall be white in color. Three-way switches shall be 20 ampere, 265 volt. Leviton Decora Plus No. 5623-W.

Check drawings for the door swings so that all switches are located on the lock side of the opening unless specifically noted otherwise, as in Paragraph “b.” above. In general, switches shall be installed at elevations indicated on architectural drawings.

Provide screw-fastened type engraved lamicoid nameplate with ¼ inch high white lettering on black background, clearly indicating the function, designation or equipment controlled for each of the following:

1. Switchboards
2. All panelboards
3. Motor starters and miscellaneous control switches
4. Disconnect switches
5. Enclosed circuit breakers
6. Contactors and relays
7. Time switches
8. Transformers
9. ATS units

Provide nameplates for all equipment as described above for all new and existing equipment shown on drawings.

Disconnects shall conform to NEMA and UL Standards, and be installed where indicated and where required by Code. Disconnects shall be horsepower rated units to maximum size listed by UL.

Disconnects shall be located where they are readily accessible and capable of being used without reaching above, around, under, etc., equipment and/or obstructions.

Provide quick-make, quick-break mechanism with external operating handle mechanically interlocked with enclosure cover to provide normal access to inside of enclosure when disconnect is in OFF position only. Provide means to lock the operating handle in the OPEN and CLOSED position. Designate on the enclosure the OPEN and CLOSED position of the operating handle.

Switches shall be of the double stationary contact type.
3. Switches shall be fusible or unfusible as shown on the drawings and/or as required. Fused switches shall be complete with rejection type fuse holders and fuses as required.

4. Each safety switch shall be single-throw, mounted in separate heavy duty industrial enclosure, with arcquenching device on each pole for all disconnects, and with means to bypass the mechanically interlocked door and handle. Switches shall be General Electric "QMR Heavy Duty Type" or as acceptable.

5. All disconnects shall be rated 600 volts.

c. Enclosure

1. In general all switches in indoor, dry locations shall be mounted in NEMA Type 1 enclosures. Outdoors and indoors in damp locations, switches of 200 ampere capacity and less shall be mounted in NEMA 4 enclosures; switches above 200 amperes shall be mounted in NEMA 3R enclosures.

d. Identification

1. Provide nameplate identifying the system and defining the designation and function for all disconnects.

2. Each unfused switch also shall have a nameplate reading: FOR ISOLATING USE ONLY. DO NOT OPEN UNDER LOAD.

3. Nameplates shall be mounted on the front cover secured with self-tapping screws or nuts and bolts. Nameplates shall be laminated phenolic, black with a minimum of ¼” high white lettering.

E-28 ACCESS DOORS

a. Furnish access doors to the General Contractor for installation by him, where required in finished walls, partitions, ceilings, etc., for access to junction boxes, controls, etc., concealed behind finished construction. Submit drawings indicating locations of access doors for Architect's approval.

b. Door shall be 20 gauge steel sandwich type, insulated with continuous hinge and flush cylinder lock. Doors not less than 12” x 12” for hand access.

c. Construct frame of 16 gauge steel with four masonry anchors per door. Door shall be Milcor "fire rated access door".

E-29 AUTOMATIC TRANSFER SWITCHES

a. Automatic transfer switches shall be provided and rated as scheduled on the drawings. Each transfer switch shall be capable of switching all classes of load and shall be rated for continuous duty when installed in a non-ventilated enclosure constructed in accordance with Underwriter's Laboratories, Inc. Standard UL-1008.
b. The transfer switch shall include a test switch to simulate normal power failure, pilot lights on the cabinet door to indicate the position of the switch (red - emergency, green - normal, white - neutral, where provided), pilot lights on the cabinet door to indicate source availability (yellow -emergency available, white - normal available), pilot light on the cabinet door to indicate automatic transfer switch in load shed (blue), emergency pilot lights shall be push-to-test type, and four additional auxiliary contacts on the main shaft, two closed on normal and two closed on emergency, unless a greater quantity is called for on drawings or required by terms within this Article.

c. The transfer switch, complete with timers, relays and accessories, shall be listed by Underwriters Laboratories, Inc., in their Electrical Construction Materials Catalogue under Standard UL-1008 (automatic transfer switches) and approved for use on emergency systems outlined in NFPA 110.

d. Provide terminals for connection to the generator control panel to permit automatic shedding and restoration of loads on the emergency power plant and indication of source availability and switch position. Automatic load shedding shall be achieved by transferring back to a de-energized normal source or to a dead neutral position upon signal from the generator control panel.

e. Each switch shall have two positions (normal, emergency) or three positions (normal, emergency, neutral) and shall be double-throw. The switch shall be electrically operated and mechanically held, with the operating mechanism energized only during time of transfer. All main contacts shall be silver alloy, wiping action type, protected by separate arcing contacts and blowout coils. Contacts shall be of a design specifically intended for automatic transfer switch service, and shall not be circuit breaker contact assemblies.

f. All switch contacts, coils, springs and control elements shall be removable from the front of the transfer switch without removal of the switch panels from the enclosure and without disconnection of drive linkages or power conductors. Sensing and control relays shall be continuous duty industrial control type with minimum contact rating of 10 amperes. All timers shall be field adjustable without de-energizing control circuits.

g. The control circuit shall include, but not be limited to, the following:

1. Voltage monitors shall be provided to sense all ungrounded lines of the normal source voltage and initiate and emergency sequence of operation upon loss of or reduction in any line of the normal source to 86 percent or less for an adjustable period of 0.5 to 6 seconds. Upon return of the normal source to 95 percent or more on all lines, the voltage monitors shall initiate a retransfer to normal. The voltage monitor shall be solid-state and field adjustable on pickup from 85 percent to 95 percent of pickup. Monitors shall have a minimum repetitive accuracy of 2 percent of the set point over a temperature ranged of 0°C to 45°C.

2. A time delay shall be included to allow stabilization of the normal source at acceptable limits before retransfer of the load from the emergency source. The time shall be adjustable in one minute increments, from 0 to 30 minutes maximum.

3. Control circuitry shall provide for the retransfer to a dead normal source or neutral position for load shedding upon loss of sufficient generating capacity and bypass to emergency under test condition. The controls shall include necessary auxiliary contacts to give indication of transfer switch position and source availability. The controls shall also include a pilot contact, to close to initiate the start of the emergency system and open to stop the system. In addition, these controls shall include a voltage sensing relay to sense the availability of emergency power prior to allowing transfer, to insure its acceptability.
4. Switches serving 3 phase, 4 wire loads shall be provided with overlapping neutral transfer contacts which shall be "overlapped" only during transfer operation and remain so "overlapped" until the main contacts close to the source being transferred to. Overlap time shall not exceed 100 ms. 4-pole switches may be substituted for overlapping neutral.

5. Switches serving large motor loads shall be provided with "in-phase" monitors or neutral position with time delay to prevent excessive currents during transfer of these loads.

6. All control relays, solid state voltage monitors, transfer switch assemblies, shall be the product of a single manufacturer regularly engaged in design, development and production of automatic transfer switches. Said manufacturer shall provide service and spare parts on a 24-hour a day, 7 days a week, availability at a local level.

7. Adequate conduit space shall be provided in each automatic transfer switch to satisfy the cabling design. All cable terminations shall be made with two-bolt hole, long barrel, copper bodied, concentric compression type lugs, which shall be supplied with the automatic transfer switch.

8. Automatic transfer switches serving elevators shall be provided with two sets of form "C" contacts (in addition to those described herein and those required to perform the specified functions) to be wired to the elevator controllers to provide status of power source to the elevator system.

h. Automatic Transfer Switches shall be manufactured by Automatic Switch Company (ASCO) or as approved.

E-30 ELECTRIC HEAT TRACING

a. The self-regulating heater shall consist of two 16 AWG tinned-copper bus wires embedded in parallel in a self-regulating polymer core that varies its power output to respond to temperature all along its length, allowing the heater to be crossed over itself without overheating. The heater shall be covered by a radiation cross-linked modified polyolefin dielectric jacket, and have an outer braid of tinned-copper and an outer jacket of modified polyolefin.

b. In order to provide energy conversation and to prevent overheating, the heater shall have a self-regulating factor of at least 90 percent. The self-regulation factor is defined as the percentage reduction, without thermostatic control, of the heater output going from 40º F pipe temperature operation to 150ºF pipe temperature operation.

c. The heater shall operate on line voltages of 208 volts without the use of transformer.

d. The heater shall be sized according to the manufacturer's recommendation for particular pipe size and insulation thickness of 2" fiberglass at the minimum ambient temperature. The minimum ambient temperature shall be -10ºF. The heater output rating is to be given in watts per foot at 50ºF.

e. Provide all necessary power connection and end seal kits, tee kits, pipe labeling and tape for a complete installation.

f. Heater cables and components shall be Model XL-Trace by Raychem Corporation.

g. Installation

1. Apply the heater linearly on the pipe after piping has been successfully pressure tested. Secure the heater to piping with cable ties or fiberglass tape.
2. Apply "electric traced" signs to the outside of the thermal insulation.

3. Active end seals shall not be installed until cable is tested. Protect exposed ends from moisture during construction.

4. After installation and before and after installing the thermal insulation, subject heater cable to testing using a 1000 VDC megger. CABLE MUST BE MEGGER TESTED BEFORE POWER AND END CONNECTIONS ARE MADE. Minimum insulation resistance should be 20 to 1000 megaohms regardless of length.

5. Four hours of start-up and training by factory authorized personnel shall be provided.

E-31 FIRE STOP PENETRATION SEALANT

a. Provide fire-resistant silicone foam sill to restore fire ratings to all wall or floor or ceiling penetrations. Foam sill must be UL classified and have a New Jersey Materials and Equipment Acceptance (MEA) listing for use as wall or floor opening multiple cable system protective materials.

b. All penetrations through fire rated floors and walls shall be sealed to prevent the passage of smoke, fire toxic gas or water through penetration either before, during or after a fire. The fire rating of the penetration seal shall be at least that of the floor or wall into which it is installed, so that the original fire rating of the floor or wall is maintained as required by Article 300-21 of the National Electric Code.

c. No flammable materials are to be used to line the chase or hole in which the firestop material is to be installed.

d. When damming materials are to be left in place after the seal is complete, then all such materials shall be non-flammable.

e. The sealant shall be poured into the hole after each cable for pipe has been spread to allow approximately ½” of foam to flow between them. No cable or pipes may be touching each other and thereby allow voids to form in the fire stop.

f. When plastic cartridges are used for smaller installations, the chemical components of the foam shall be premeasured within the cartridges to insure the proper ratios. For larger installations, where a Chase-Foam Mixing Machine is used, the machine should be preset so that only the correct ratio of the two chemical components will be delivered without any possibility of error and without the need for constant technical supervision.

g. The sealant shall remain resilient and pliable to allow for the removal and/or addition of cable without the necessity of drilling holes. It shall adhere to itself perfectly to allow any and all repairs to be made with the same material. It shall allow for vibration, expansion and/or contraction of anything passing through the penetration without affecting the seal, or cracking, crumbling and spalling.

h. When sealant is injected into a penetration, the foam shall expand to surround all the items within the penetration and maintain pressure against the walls of the penetration as well as the pass-through items. The foam shall cure within five minutes and to fire resistance at the time. No heat shall be required to further expand the foam to block the passage of fire and smoke or water.

i. The foam sealant shall have been subjected to fire exposure in accordance with standard time-temperature curve in the Standard, UL, ASTM E119, and NFPA 251. The foam fire-stop shall have also been subjected to the hose stream test in accordance with UL 10B. The foam sealant shall be UL Classified as a Fill, Void or Cavity Material for use in Wall or Floor Openings.
E-32  FIRE ALARM SYSTEM

a. General

1. The owner warrants to the contractor that all systems are fully operational at the time the contractor commences work. The contractor assumes full liability for damages to equipment that are the result of their work where the procedures and practices of this section are not followed.

2. The work, in general, includes but is not limited to all removals, modifications, adjustments, and installations involving the Fire Alarm System.

3. The contractor shall fully protect all existing equipment and materials from damage when work is performed on or around any installed systems. Each system shall be reinstalled to the condition found prior to the start of any work by the contractor.

4. The contractor shall utilize the Landlord's designated service company for system installed (No Exceptions).

5. No work on any system is to be performed without 48 hours advance written notice to the Building Management.

6. Wiring

   a) All wiring for the interior Fire Alarm System should conform to International Building Code, International Fire Code, NFPA and NEC.

   b) Conductors shall be copper throughout. All wiring for peripheral devices (i.e.: smoke, heat, duct, pull stations) is to be teflon or its equivalent. It shall have a minimum 600 volt rating, be protected with a sheath and an outer jacket of 24 mils minimum insulation colored fire department red and labeled for its entire length - "Fire Alarm Service".

   c) All conductors and cables shall be installed in protective metal raceway or shall be teflon jacketed as herein before specified.

   d) Teflon jacketed cables shall be run in conduit in all exposed retail areas, in all mechanical and electrical rooms, unfinished areas and in stairwells. Wiring is to be supported at intervals no greater than 8' on center.

7. Conduit, Raceway and Fittings

   a) No conduit shall be less than 3/4" commercial trade.

   b) All conduit runs shall conform to electrical section of building standards and rules.

8. Test all devices that have been added to the building Fire Alarm System including but not limited to smoke detectors, duct detectors, fan shut-down relays, door release devices, etc. Verify that all alarm devices upon activation cause appropriate annunciation at the Fire Alarm Panel and proper sequence of operation within the premises. Verify that all control points operate properly when initiated either by an alarm device within the space or from the Fire Alarm Panel. Test horn audibility throughout the space and test strobe operation. Submit written test report to the Owner and to the Engineer.

ELECTRICAL
9. After Fire Department inspects the premises and issues their Letter of Defect, this contractor shall perform all corrective work described therein. Contractor shall file self-certification affidavit affirming that all work is complete and obtain final sign-off from the Building Department prior to project completion and move-in. Coordinate this work closely with the project schedule for tenant move-in.

E-33 GROUNDING

a. Provide complete systems and equipment grounding as shown on the drawings and/or described herein. All ground wires shall be stranded type.

b. Ground conductors shall be insulated and colored green or colored green with a yellow stripe or stripes. Ground conductors in general shall be run together with phase conductors inside raceways or enclosures. Exceptions to the above include transformer grounding conductors and external bonding jumpers on flexible conduit.

c. Connect system components mechanically and electrically to provide an independent return path to the grounding electrode.

d. Clean metals thoroughly where ground terminal connectors are brazed to equipment and repaint impaired surfaces. Remove paint before mounting ground lugs to equipment enclosures.

e. Size ground conductor in accordance with National Electrical Code requirements, except do not use conductor smaller than No. 12 AWG.

f. Extend existing grounding system to include all the electrical work in the scope of this alteration.

g. Equipment grounding shall consist of connecting electrically non-current carrying conductive equipment enclosures and raceways as shown on the drawings.

h. Ground motors by connecting a green covered conductor from a grounding bushing in the starter to the motor frame. Conductor shall be installed inside the conduit with the circuit conductors, and terminated in the motor connection box. If this is not feasible, terminate grounding conductor using a listed or labeled “G” clip or ground screw. Conduit size between starter and motor shall be increased if necessary to accommodate the addition of the ground wire.

i. Ground lighting fixtures by connecting a green covered conductor from the ground lug welded within the fixture housing to a grounding conduit bushing or acceptable grounding clip in the outlet box. Run grounding conductor inside raceway with circuit conductors.

j. All ground connections to building steel shall be made using Cadweld connectors.

k. At all computer and equipment receptacles, connect a green covered conductor from each receptacle grounding terminal to the ground bus of the associated panelboard. Provide No. 12 ground wire shared up to no more than three computer/equipment circuits.

l. All conduits 2" trade size and larger shall be terminated in grounded bushings. Bond to box with a No. 6 AWG bare copper wire.

m. Ground raised floor as shown on drawings.

E-34 ELECTRICAL CONTROLS AND POWER WIRING
a. Provide power and control wiring to all electrically operated equipment devices furnished for this project. All controls shall be on ungrounded side of control circuit.

b. Wire and connect the electrical, heating, ventilating, air conditioning protection and control devices except as otherwise noted.

c. Provide 120-volt service to control panels and miscellaneous control devices in accordance with approved wiring shop drawings furnished by other trades. Install all interlock wiring between equipment starters and control devices.

d. The electrical Contractor shall wire up all devices and equipment so as to provide a fully operating and satisfactory system.

e. All control wiring shall be installed in conduit.

f. Final connections to low voltage control will be by Electrical Contractor, except where otherwise noted.

E-35 LIGHTING FIXTURE INSTALLATION

a. For general information on lighting fixtures refer to the abbreviated lighting fixture schedule on the electrical drawings and the detailed lighting fixture data which is on the Architectural drawings.

b. Install new lighting fixtures of the types indicated at each location where called for on the drawings.

c. Do not scale the electrical drawings for exact locations of the lighting fixtures. The electrical drawings are intended only to be indicative of proportional spacing for the effect desired. In general, the architectural reflected ceiling plans indicate the proper locations of lighting fixtures.

d. Install required lamps in every new lighting fixture of wattages, quantities, and types specified and shown on the drawings. Consult Architectural Drawings for fluorescent phospher requirements. Fluorescent fixtures may be furnished to the jobsite pre-lamped.

e. Furnish each fixture with not less than 6'-0" of wire in 3/8" flexible metallic conduit for connections to outlet box. Wire size shall be not less than #14 AWG. Tails may be factory installed.

f. Install each fixture properly and safely. Furnish and erect hangers, rods, mounting brackets, supports, frames and other equipment required. Existing hardware in good condition may be reused.

g. Support all lighting fixtures independently of ductwork or piping.

h. Recessed incandescent and compact fluorescent fixtures shall have a 4" pullbox permanently attached to the plaster ring so that it is accessible when the fixture trim or reflector is removed. Connection between fixture and pullbox shall be of sufficient length so that when the fixture is dropped, the pullbox is readily accessible.

i. Recessed fixtures in ceilings shall be provided with the proper trim and mounting hardware compatible with the ceiling system being installed.

j. In all mechanical equipment areas, lighting fixtures shall be installed on ceilings after all piping and equipment therein has been installed. Exact locations for such fixtures will be determined at the job site.
Electrical contractor shall verify all recess depths of fixtures against AC ducts, pipes, beams, etc., before ordering fixtures and shall submit shop drawings of all fixtures to architect for approval.

Wiring for fixture tails and wiring run through lighting fixtures shall have insulation rated for 90°C (i.e. THHN) \( \frac{1}{2}'' \) minimum.

All conduit and flexible conduit (Greenfield) shall be secured at intervals as required by the National Electrical Code.

**MARKING AND CIRCUIT IDENTIFICATION**

a. All panels, disconnect switches, etc., and the circuits therein, shall be marked. All circuits originating from these identified sources shall be identified by the Contractor at all disconnect switches, circuit breakers, motor controllers, junction and pull boxes, etc.

**ELECTRIC TESTING**

a. Provide all necessary meters, instruments, temporary wiring and labor to test and adjust all equipment and wiring installed and/or connected under this Contract, including electrical equipment furnished by others, to determine proper polarity, phasing, freedom from grounds and shorts and operation of equipment. All measuring instruments must be properly calibrated.

b. Whenever any authorities having jurisdiction require that any work be tested or approved, Contractor shall provide proper facilities for access and for inspection.

c. Check all lighting fixtures and receptacles for proper operation.

d. Motors:

1. Make the following tests on all motors before starting up:
   a) Check motor nameplate for horsepower, speed, phase and voltage.
   b) Check all bearings to see if they are properly filled with oil or grease.
   c) Check coupling alignment and shaft end play.

2. Make the following tests on all motors during or immediately after start-up (if applicable):
   a) Check shaft rotation. Check bearing temperature. Check motor for smooth operation.
   b) Take a current reading at full load using a clamp-on ammeter. If ammeter reading is over the rated full load current, determine the reason for the discrepancy and take the necessary corrective action.
   c) Following established procedures, equipment shall be energized after certifications by the Mechanical Contractor that the installation is satisfactory. All motors and equipment shall be tested for proper operation.
   d) Overload elements in motor starters shall be adjusted and checked for suitability to the motor characteristics. Contractor shall replace any overload element that is inadequate. The cause of any motor operating above full load rating should be investigated and the cause removed instead of increasing the overload relay trip rating. These final operational tests shall determine that the installation is correct.
e. Thermographic Acceptance Testing

1. The Owner shall have the option of engaging an electrical testing laboratory approved by the engineer who shall take a thermographic scan of all new and existing power distribution equipment in this premises.

2. Cost of initial testing will be paid by the Owner. Results of this testing shall be made available to the Owner, the Engineer, and the Contractor. Any equipment, component, or termination showing readings of more than 20°C above ambient temperature shall be repaired. Contractor installed equipment shall be repaired by the Contractor prior to the contractor sign-off and at no additional cost to the Owner. Existing equipment defects shall be repaired by the contractor at owner's expense.

3. After all equipment found to be deficient during the initial thermographic scan has been repaired, it shall be retested by the Owner's choice of testing laboratory representative. If a defect is still detected contractor shall continue to take corrective action until subsequent testing indicates that equipment is performing in an acceptable manner.

4. Cost of all thermographic testing required as a result of contractor's errors will be paid by the Contractor.

f. After completion of adjusting, take current readings at full load using a clamp-on ammeter and submit to Engineer for review and approval.

g. Check all system and equipment grounds for proper value of resistance using the Megger ground tester in accordance with manufacturer's standard instruction. Test insulation resistance of all new and affected existing feeders prior to energizing.

E-38 PHASE BALANCING

a. Balance, as equally as possible, the loads connected to each phase of all circuits connected to panelboards.

b. At the completion of the work, check the load current in each phase of each feeder and make such adjustments as are necessary to correct load imbalance. Maximum imbalance shall not exceed 10%.

c. After all adjustments are made and the premises are fully occupied take current readings on each phase at the feeders to the panelboards using clamp-on ammeter. The readings should be taken for 30 minutes at full load (all fans, pumps, air conditioning units, etc. should run at full capacity) during normal working hours. Submit the readings to the Engineer and to the Building Management for review and approval.

E-39 WIRING AND OUTLET LOCATIONS

a. Coordinate work so that exact locations may be obtained for all outlets, apparatus, appliances and wiring.
b. The location of outlets shown on diagrammatic wiring plans shall be considered as approximate. Before installing outlet boxes, pertinent drawings shall be studied and precise information obtained from the architectural schedules, scale drawings, large scale and full size details of finished rooms, reviewed shop drawings or from the Architect. It shall be understood that any outlet may be relocated a distance not exceeding five feet horizontally from the location shown, if so directed by the Owner. Make any necessary adjustment of the work to fit conditions for recessed fixtures and for outlets occurring in glazed tile, block, wood paneling or other special finish material in order that all boxes may register flush with finish and shall be centered properly. In centering outlets make due allowance for overhead piping, ducts, window and door trim, variations in thicknesses of furring, plastering, etc., as erected, regardless of conditions which may be otherwise shown on small scale drawings. Outlets incorrectly located shall be properly relocated without expense to the Owner. Locate local switches which are shown near doors at the strike side of the door.

E-40 MOTOR WIRING AND CONTROLS

a. The power leads to all motors shall be in conduit. Where motors have conduit terminal boxes, the feeder conduit shall not be connected directly into same. Provide a flexible conduit for final connection to motor terminal box. Flexible conduit shall be long enough (but in no case less than 24 inches long) and of suitable arrangement to achieve a true flexible connection between motor and rigid conduit. Under no circumstances shall rigid conduit terminate in or be fastened to motor foundation. Anaconda “Sealtite” flexible conduit shall be installed to pump motors and motors located outside and indoors where subject to moisture or oil, or where located within fan plenums.

b. Connect to motor starting devices for all motors; provide all necessary connections between controllers and motors in conduit, and leave motors ready to start. Change connections, if necessary, to secure proper rotation of motors. The power supply leads to the motors, from the controllers, shall be of the same size as the feeds indicated.

c. Include the erection and connection of all motor control groups or centers, pushbuttons, relays, controllers, etc. Single starters shall be suitably mounted either of wall or separately on angle iron racks.

d. Include being responsible for the exact location of the motor controllers or control center and motors as far as wiring is concerned. Ascertain the proper location of the controllers, control groups, or groups and motors in each case before installing the circuit work.

e. Perform all the necessary wiring in connection with the motor starting and remote control equipment, where so designated. Where control or starting equipment is sent to the job as individual units they shall be installed, wired up complete and left ready for operation.

f. All motor controllers will have fusible switches either in combination or as separate units.

g. Including making all the electrical connections between motors, starters, controllers, and leaving unit heaters ready to operate.

h. For elevators, provide and install power conduit and cables connecting to control panels with sufficient slack in conductors to reach control terminals. Provide wiring and outlets in Machine Rooms for lighting, relay and signal controls as shown on drawings. Provide outlets and lighting fixtures in each elevator shaft and pit as required.

i. Include in the general requirements for motor control equipment wiring and connections, the following specific items shall be performed:
1. Installation and connection up of motor controls singly, in groups, or in centers. These control groups or centers will be arranged and contain certain equipment indicated.

2. Wherever indicated or required when motors and their respective controls are out of sight of one another, an unfused motor rated disconnect switch shall be located at the motor or the branch circuit protective device of combination starter shall have provisions for padlocking in the open position. If padlocking provisions are provided, disconnect switches shall still be provided if so noted. Motors in outdoor locations shall require weatherproof disconnect switches.

j. Where existing motor starter groups are being replaced or modified, remove and replace starters as necessary. Provide all additional trough, pull boxes, wire, connections, etc., to extend existing starter groups to allow for new starters to be installed.

E-41 NATURAL GAS ENGINE GENERATOR SET

a. General

1. Design, engineering, manufacturing, testing, delivery, supervision and training for one (1) new 200kW/250kVA standby rated, 0.80 PF, 277/480V three phase, four wire, solidly grounded Natural Gas engine generator set to be installed in separate outdoor, weather proof enclosure with the following features and accessories, including, but not limited to:

   a) Terminal housings
   b) Battery charger
   c) Starting batteries
   d) Battery Heater
   e) Internal Exhaust silencer
   f) Flexible exhaust connections
   g) Aftercooler exchangers
   h) Radiator
   i) Jacket water heater
   j) Electronic engine fuel and speed controls
   k) Fuel oil cooler
   l) Control panel
   m) Remote Alarm Indication
   n) Vibration isolators
   o) Voltage regulator
   p) Air intake silencer
   q) Mesh standoff screens for personnel protection where required
   r) Generator circuit breaker(s)
   s) Alternator Strip Heater
   t) Rodent Guards
   u) Automatic Transfer Switch (ATS)

2. This specification includes the purchase, payment of all taxes, delivery, manufacturer's supervision, testing and warranty of this unit, critical spare parts, training of the Owner's Personnel, and post-warranty maintenance contract.

3. Applicable Documents

   a) The equipment shall all be designed in accordance with the applicable sections of the following documents:
1) EGSA  
2) NEMA  
3) NEC  
4) OSHA  
5) IEEE  
6) ANSI  
7) NFPA  
8) UL 1558  
9) UL 2200  
10) Local Federal and State Codes and Laws  
11) Standby Ratings: SAEJ1349/ISO3046/1  
12) EPA: 40 CFR parts 60, 85, 89, 94, 1039, 1065 and 1067  
13) Standards for performance of stationary compression ignition internal combustion engines

4. Vendor must indicate on his proposal firm dates for the following:
   a) Time in days from award to issue of shop drawings.
   b) Time in weeks from issue of shop drawings to delivery of all equipment to site.

b. Definitions

1. Standby Rating: Power output rating equal to the power the generator set delivers continuously under normally varying load factors for the duration of a power outage or a minimum of 250 hours per year.

2. Operational Bandwidth: The total variation from the lowest to the highest value of a parameter over the range of conditions indicated, expressed as a percentage of the nominal value of the parameter.

3. Power Output Ratings: Gross electrical power output of diesel engine generator set minus total power requirements of cooling fans, pumps and other accessories.

4. Steady-State Voltage Modulation: The uniform cyclical variation of voltage within the operational bandwidth, expressed in hertz.

c. Shop Drawings

1. Within 2 weeks of receipt of notification of acceptance of his proposal and prior to shipment of equipment or start of installation of system components, the Contractor shall submit the following for approval:
   a) Product Data: For each component. Include data on features, components, ratings, and performance. Include dimensioned outline plan and elevation drawings of diesel generator, generator control panel, circuit breaker distribution panel, outdoor enclosure and other system components.
   b) Shop Drawings: Show details of fabrication, piping, wiring, and installation of field-installed portions of system. Include general arrangement drawings showing locations of auxiliary components in relation to generator and duct, piping, and wiring connections between generator set and auxiliary equipment. Show connections, mounting, and support provisions and access and workspace requirements.
c) Wiring Diagrams: Show details of power and control connections and differentiating between factory-installed and field-installed wiring.

d) Adjustment for Site Ambient: Provide criteria used to adjust ANSI standard ratings to specified site operating ambient conditions.

e) Field Test and Observation Reports: Indicate and interpret test results for compliance with performance requirements.

f) Certified summary of prototype-unit test report including the following:
1) Natural Gas engine mechanical data at varying loads up to full load, including heat rejection, exhaust gas flows, combustion air and ventilation air flows, noise data, fuel consumption, etc.

2) Generator electrical data including temperature and insulation data, cooling requirement, excitation ratings, voltage regulation, voltage regulator, efficiencies, waveform distortion and telephone influence factor.

3) Generator resistances, reactances and time constants.

4) Generator current decrement curve.

5) Generator thermal damage curve.

6) Fuel consumption at ¼, ½, ¾ and full load.

7) PM, CO, CO₂, NOX, SO₂ exhaust emissions at 25-50-75-100% load.

8) Governor speed regulation at ¼, ½, ¾ and full load and during transients.

9) Generator temperature rise in accordance with NEMA MG1-22.40.

10) Harmonic analysis and voltage waveform deviation.

11) Generator short circuit capability.

12) Cooling system performance.

13) Generator reactive capability curve.

h) Certified Test Reports of Components and Accessories for devices that are equivalent, but not identical, to those tested on prototype unit.

i) Certified Summary of Performance Tests: Demonstrate compliance with specified requirement to meet critical performance criteria including EPA Tier IV criteria.

j) Factory Test Reports: For units to be shipped for this Project showing evidence of compliance with specified requirements.

k) Exhaust Emissions Test Report: To show compliance with applicable regulations.
k) Provide certified sound measurement test report for outdoor enclosure. Provide details of sound level at different octave band analysis and itemize the noise data to identify engine and combustion exhaust separately with Generator running at 25/50/75/100% of rated load.

l) Certification of Torsional Vibration Compatibility: Comply with NFPA 110.

m) Operations and maintenance data for system and components to include in the maintenance manuals specified in Division 1. Include the following:
   1) List of special tools recommended being stored at the site for ready access.
   2) Detailed operating instructions for both normal and abnormal conditions.
   3) Copy of approved shop drawings.
   4) Documents indicating the recommended service intervals.

n) Four (4) hard copies of shop drawings shall be required for Architect/Engineer review and one copy shall be sent directly to the Owner for the Owner’s review.
   1) Two copies of the reviewed submitted will be returned to the Vendor.
   2) Submit electronic copy of approved shop drawings to Owner. The electronic copy shall be in Autocad for Drawings and Adobe Acrobat Reader for text.

d. Performance Tests
   1. Upon completion of the installation, test and adjust all equipment and components under simulated full load operating conditions to demonstrate compliance with specification requirements.
   2. Should the apparatus fail to meet the contract requirements, adjust, repair or replace all defective or inoperative parts and again conduct the complete performance tests.
   3. Submit tests reports to the Owner's representative.

e. Manufacturer’s Warranty
   1. The manufacturer shall warrant that the equipment which he has furnished is free from defects in material and workmanship. The final acceptance will be made after the manufacturer has adjusted his equipment, demonstrated that it fulfills the requirement of the Drawings and Specifications, successful Site Acceptance Test and has furnished all the required Certificates of Inspection and approval.
   2. The equipment manufacturer or supplier shall provide and pay for all labor parts, accessories, materials freight and other services to replace any equipment or part thereof which, in the course of installation, start-up, and acceptance testing is found to be defective.
   3. For a period of two years from date of final acceptance by the Owner the manufacturer shall procure, and replace any defective equipment or part thereof. This shall include installation labor, startup and testing.
4. The manufacturer shall state what work is covered (as well as exclusions) by the warranty, where the repair work will be performed, by whom it will be performed, whether new or rebuilt parts will be used and other terms and conditions.

f. Service and Preventative Maintenance Contract

1. Include projected cost of a full service and preventative maintenance contract to cover adjustment, repair or replacement of all parts and labor to accomplish same for a full two years after the generators have been fully commissioned.

2. Maintenance shall be performed by skilled employees of the manufacturer’s own service organization. During the maintenance period include quarterly four-hour full load testing to check for proper starting, momentary paralleling, load transfer and live load transfer test using building or artificial load. Include other routine preventive maintenance as recommended by manufacturer and adjusting as required for proper operation. Provide new parts and supplies as used in the manufacture and installation of original equipment.

3. As a minimum, maintenance work shall include quarterly maintenance inspection visits with an annual lubricating oil and filter (lube oil and fuel) change.

g. Extra Materials

1. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and identified with labels describing contents. Deliver extra materials to the Owner.

2. Provide the following spare parts:
   a) Fuses: 1 for every 10 of each type and rating, but not less than 1 of each.
   b) Indicator Lamps: 2 for every 6 of each type used, but not less than 2 of each.
   c) Filters: One set each of lubricating oil, fuel and combustion air filters for each engine.
   d) A set of spare fan drive belts for each engine.
   e) Two quart cans of touchup paint of each color.

3. Spare Parts: Include the minimum list of spare parts, in addition to the list above, recommended by diesel engine generator manufacturer for two years standby operation.

h. Standby Generator

1. General Requirements
   a) Furnish a complete standby/emergency power supply system suitable to meet the requirements of Local Laws, National Electrical Code and NFPA 110 level 2 standby power supply system. Each system shall be capable of providing backup power for multiple type loads including designated lighting, alarm and communication systems, Fire Pump and mechanical equipment.
b) Each power supply system shall be a complete package capable of being installed in a designated area and requiring only connections to interface with building power. Packages shall include a natural gas-engine-generator with all required appurtenances including starting system, air and water cooling system, engine heaters, exhaust system, vibration isolators, complete control and annunciator panels.

c) Engine, generator, and radiator shall be mounted on an assembly of steel rails in a manner that will permit break down into its major components for shipping purposes.

d) Manufacturer shall be responsible for meeting all field conditions for installation, shipping and handling. Coordinate with rigger for size of components to be shipped to the site.

e) Generator set shall be as manufactured by:
   1) Kohler
   2) Generac
   3) Cummins

f) After factory testing, the set shall be shipped to the site with no compromise to the integrity of the system.

g) The engines and generators shall be oversized, if required, to meet the performance requirements specified herein.

h) Generator Nameplate: For oversized generators, show ratings required by the Contract Documents that are consistent with engine capacity rather than component oversize ratings.

i) Steady-State Voltage Operational Bandwidth: Plus or minus 0.5 percent of rated output voltage from no load to full load at 0.8 power factor, lagging to 0.98 pf leading, non-linear load with Total Harmonic Current Distortion (THD) of 25%.

j) Steady-State Voltage Modulation Frequency: Less than +/-0.25 Hz.

k) Transient Response: Upon load removal (0.8 power factor, full load), there shall be a maximum of five seconds for voltage recovery time and six seconds for frequency recovery time. The engine generator shall be capable of accepting a one-step application of 100% of nameplate standby kW load at 0.8 power factor and recover to 88% of nominal voltage and 97% of nominal frequency within six seconds. A small increase in recovery time may be accepted if the specified voltage and frequency drops can be guaranteed. Submit maximum voltage dips and recovery time transient response curves from no load to full load at either 0.8 or 1.0 power factor.

l) Steady-State Frequency Operational Bandwidth: Plus or minus 0.25 percent of rated frequency from no load to full load.
m) Steady-State Frequency Stability: When system is operating at any constant load within the rated load, there are no random speed variations outside the steady-state operational band and no hunting or surging of speed.

n) Output voltage Waveform: At no load, harmonic content measured line-to-neutral does not exceed 2.0 percent total with no slot ripple and 5.0 percent line-to-line at full load. The telephone influence factor, determined according to NEMA MG 1, does not exceed 50.

o) Sustained Short-Circuit Current: For a 3-phase, bolted short circuit at the system output terminals, the system will supply a minimum of 300 percent of rated full-load current for not less than 10 seconds and then clear the fault automatically, without damage to winding insulation or any other generator system component.

p) Temperature Rise of Generator: Within limits permitted by NEMA MG 1 when operating continuously at full-rated load.

q) Nonlinear Load Performance: System performance is not degraded from that specified in this Article by continuous operation, with full-load current having a minimum total harmonic content of 25 percent RMS, with a minimum single harmonic magnitude of 16 percent RMS.

r) Starting Time: The unit shall be capable of reaching full rated voltage and frequency and accepting full rated load in one step within 10 seconds after receiving a start signal, under the ambient conditions specified herein.

s) Transient Overspeed Response: During recovery from transients caused by step load increases or step load decreases, or resulting from 100 percent load rejection, the speed of the diesel generator shall not reach the overspeed shutdown setpoint.

2. Installation Site Condition

a) The natural gas engine-generator shall be provided for the purpose of electrical power generation under the following conditions:

1) Location: 92 Mercer Road, Colts Neck, NJ

2) Altitude: Elevation zero feet to 1,000 feet above sea level.

3) Temperature at Installation Site: 105°F maximum, -5°F minimum.

4) Inlet air ambient temperature permissible at rated output: 105°F.

5) Air Quality: Suburban Environment.

3. Electrical Power Requirements

a) Under site service conditions specified above, the power output of the diesel engine-generator shall be, not less than, 200kW/250kVA for continuous standby electrical service during interruption of normal power, with radiator fan and fuel oil cooler, at 0.8 power factor, 277/480V, 60 hertz, 3 phase, 4 wire. The maximum temperature rise of the stator windings shall be 105°C over a 40°C ambient temperature.
b) The generator shall start and be on the line within 10 seconds of the onset of utility power failure.

4. Safety

a) Prior to shipment of the diesel engine-generator, ensure that all safety measures and protective devices function in accordance with the design. Comply with ASME B15.1.

b) All exposed rotating components shall have suitable guard covers designed to prevent accidental contact. The guard covers shall be substantially constructed, securely fastened in place and be able to be removed easily for maintenance.

c) High temperature and energized surfaces, where possible, shall be covered with protective material.

5. Shipping, Handling and Installation

a) The diesel engine-generators shall be capable of withstanding normal shipping and handling shocks and vibration.

b) The engine-generator set shall be a complete package configured with the following components for shipping purposes.

1) Control Panel
2) Engine Block Heater(s)
3) Engine
4) Generator
5) Radiator
6) Rails
7) Including all Piping, Wiring and Conduit.
8) Weather Enclosure

c) Final shipping splits must be coordinated with Contractor, Engineer, Architect and field conditions prior to shipment due to height limitations. Coordinate maximum weight and size for hoisting with Building Rules and Regulations and with the rigger.

d) Components shall be doweled and pinned prior to shipment.

e) Foundation and vibration isolation equipment shall be included and shall be specifically selected for compatibility among the engine-generator set and mounting surface at the installation site.

f) Provide suitable protection during shipment and storage for the engine-generator package in accordance with the site conditions. The package preservation is to include, but not be limited to, at least the following:

1) All oil lines, fuel line, and engine openings are to be capped and sealed.

6. Drawings and Information

a) Provide the following drawings:
1) Installation drawings including fuel and exhaust systems.

2) Electrical interconnect diagrams and schematics.

3) Electrical system building interface diagrams. This shall include point-to-point wiring diagrams.

b) Drawings shall contain sufficient detail to define installation, piping connection, wiring interconnection, and special requirements of all the equipment.

c) Provide certified factory test reports.

7. Manufacturing Experience and Responsibility

a) The diesel engine-generator set shall be the product of a firm regularly engaged in the manufacture of engine or generator whose products have been in satisfactory use in similar service for at least 10 years. The components of each plant, other than the engine-generator sets, shall be the product of firms regularly engaged in the manufacture of products of this type.

b) It shall be the engine-generator manufacturer's responsibility to provide engineering coordination of engine, generator and any required drives. Manufacturer shall assume responsibility for the operational mechanical integrity of all equipment. He shall also handle and expedite drawings and supervise and coordinate all tests as they pertain to the diesel engine-generator package as required.

8. Manufacturers Responsibility Summary

a) The work includes providing all labor, materials, equipment accessories, services and test necessary to complete and make ready for operation by the Owner, a natural gas generator set complete with batteries, charger, critical grade type silencer, exhaust piping, cooling piping and louvers, heating equipment, steel weather enclosure and all required appurtenances and accessories all pre-assembled and requiring only final connection to building systems.

b) The engine-generator set shall comply with pertinent ANSI, ASTM, IEEE, NEMA, NFPA 110, prototype testing as complete unit and UL standards for construction and installation.

c) The generator set shall meet all requirements of the local Building Department. The manufacturer shall supply all required information to allow the contractor to complete his forms for filing.

d) The entire system (the engine-generator, and all major items of auxiliary equipment) shall be built, tested, and shipped by the manufacturer. Small factories that buy the engine-generator and auxiliary equipment and then assemble them together relying on the equipment manufacturers for their supply of spare parts and engineering expertise, and are subject to normal vendor uncertainties contributing to project design fluctuations, do not meet the one source of supply criteria of this Specification.

e) To maintain environmental quality, the engines shall meet all local, federal and state regulations. Verification of the ability to meet these emission specifications shall be available from the engine manufacturer.
f) The units shall be shipped by the manufacturer to its authorized dealer having geographical jurisdiction in the area in which the job site is located. This dealer shall have a parts and service facility located within a 50 mile radius of the job site. These facilities shall be stocked with adequate parts and repair equipment to ensure a 24-hour on-call emergency service capability.

i. Natural Gas Engine Generator

1. General Responsibility

a) It shall be the natural gas engine-generator manufacturer's responsibility to provide engineering coordination of engine-generator assembly. Manufacturer shall assume responsibility for the operation and mechanical integrity of all set-mounted equipment. He shall also handle and expedite shop drawings and supervise and coordinate all tests as they pertain to the diesel engine-generator package as required.

2. Rating

a) Rating of the engine-generator set shall be based on operation of the set at rated 1800 RPM of the generator when equipped with all necessary operating accessories such as air cleaners, lubricating oil pump, electric power, jacket water and heater pump, governor, alternating current generator, exciter and fuel oil cooler.

3. General

a) The natural gas generator sets shall consist of a natural gas engine coupled to a single bearing generator, all mounted on a common base of fabricated structural steel. Operation shall be fully automatic upon normal source power failure.

b) Engine must be certified to meet applicable EPA emission tier 2 requirements (emergency standby).

4. Natural Gas Engine

a) General

1) The engine shall be of the full Natural Gas compression ignition, liquid cooled type, four cycle, 1800 RPM and shall utilize natural gas fuel. The engine shall be turbo-charged, after-cooled and equipped with crosshead malleable iron pistons, replaceable cylinder liners, counter balanced forged steel crankshaft, forged steel connecting rods, replaceable main and connecting rod bearings. The engine shall have full pressure lubrication to all main, connecting rod and camshaft bearings, a full flow lube oil filter and a suitable lube oil cooler. The engine shall be furnished complete, including exhaust silencer, batteries, battery charger, battery rack, battery cables and all flexible connectors for fuel, cooling water, lube oil and engine exhaust. The radiator shall be skid mounted and isolated from engine vibration.

2) The engine shall be low emissions four stroke design as produced by the manufacturer for at least three years. The replaceable cylinder liners shall be wetted.
3) Exhaust emissions shall conform to all Federal, State and local regulatory agency requirements.

4) Provide crankcase pressure fitting and overpressure switch with wide range adjustable alarm threshold.

5) Hoses from block heater shall be Teflon with standard clamps, not hydraulic hoses.

6) The engine shall be provided with heavy duty, high capacity fuel pre-filter/water separators as manufactured by Racor. Filters shall be Model 79/1000, three sets as required by fuel flow, installed in parallel to allow servicing while the engine is in operation. Filters shall be 30 micron with a maximum clean pressure drop of 1.7 psi at 540 GPH. Provide Kraissl (3 way valve) and differential pressure gage with alarm switch. Factory wire alarm contacts to engine control panel for remote monitoring.

7) Fuel lines shall be marine grade fire resistant. Provide firematic valve if required by the Local Building Code.

b) Engine Power Rating

1) The rated net horsepower of the engine at the generator synchronous speed shall not be less than that required to provide the kW and transient response requirements. The horsepower rating shall be capable of producing this rated power and the diesel generator set shall be capable of producing the specified kW without overheating while operating under the ambient conditions specified.

c) Governor (Engine Speed Control)

1) An isochronous electronic control system (ECS) shall be provided to maintain engine speed within the limits specified herein from no load to rated load. The ECS shall consist of an electronic control module (ECM), magnetic speed pickup mounted on the engine and various engine parameter sensors providing data to the ECM allowing optimization of the engine air to fuel ratio and thus minimizing transient and steady state exhaust smoke emissions. The ECM shall control fuel input to the engine by electrically operating the electronic unit injectors (EUI) and not require a mechanical fuel linkage. An automatic start fuel limiting feature shall limit exhaust pollution during engine starting. The ECM shall operate with power supplied from the 24 volt cranking batteries. The ECM shall provide steady state speed regulation of ±0.25 percent for any constant load. The ECM shall be Detroit Diesel MDEC, Caterpillar ADEM or Cummins.

d) Natural Gas Engine Crank-Start System

1) Cranking Motors

(a) The starting motor(s) shall be 24 VDC with positive engagement drive. Each starting system shall be able to start each engine.
(b) Include on each engine all controls and magnetic contactors to operate the starting motors either manually at the engine or from a remote location.

2) Batteries

(a) Two 12 volt lead acid storage battery sets, shall be provided. Each battery set shall be rated as recommended by the engine manufacturer for cyclic cranking of the engine. Intercell and inter-tier connections, cable connections with lugs and clear plastic covers shall be furnished for each battery set. Each battery set shall have sufficient capacity to provide a minimum 120 seconds total cranking time at an ambient temperature of 50°F without recharging. The batteries shall be shipped charged and wet. The batteries shall carry a two year full replacement guarantee followed by a three year prorated warranty.

(b) Provide two battery racks suitable for floor mounting adjacent to the skid. Each battery rack shall be coated or painted to resist acid and alkali corrosion. Each battery rack shall be suitable for specified seismic requirement and shall contain a spill protection and containment system.

(c) Rigid intercell connections shall be manufactured of nickel or lead plated, high quality copper bar. Flexible intercell connections shall be made of Type DLO copper cable with EPR insulation. All connections shall be tight, clean, and coated with manufacturers recommended coating.

3) Battery Chargers

(a) Fully automatic current-limiting battery chargers shall be furnished for each engine to maintain the battery sets at full charge. Each charger shall have a high charging rate of fifty amperes minimum capacity compatible with the batteries and when the batteries are brought up to full charge, it shall automatically reduce the charge rate to a continuous trickle charge. The charger shall be wall mounted within the enclosure and Factory wired to batteries and to AC panel for rectifier input.
(b) The charger float and equalize voltages shall be as required. It shall include overload protection, silicon diode full wave rectifiers and voltage surge suppressors. AC input voltage shall be 120 or 208 volts. The charger shall, within eight hours, automatically recharge its battery from the charge level resulting from 120 seconds total cranking time discharge, in addition to supplying the continuous load imposed by generator controls, paralleling switchgear controls (if applicable), indication and alarm circuits. The minimum output shall be 50 amperes. The charger shall have circuit breaker AC input, DC line circuit breaker, DC ammeter, DC voltmeter, adjustment for floating charge rate, adjustment for equalizing charge rate, automatic equalizer, manually set equalizing charge time, AC failure alarm relay, DC ground detection alarm relay, DC low or high voltage alarm relay and summary alarm relay. A dry C contact shall be provided for remote alarm to indicate any battery charger alarms. Meters shall be 2% accuracy, digital type. Red indicating lights shall be provided for above alarm, a green light for float mode and an amber light for high rate. The alarm contacts shall be factory wired to the engine control panel for remote monitoring.

e) Engine Cooling System

1) The diesel engine and aftercooler shall be liquid cooled and shall include engine driven pumps for primary loop coolant circulation. Engine coolant temperature shall be thermostatically controlled to maintain the optimum engine temperature during operation.

2) The entire cooling system (air-to-air after cooled circuits are not acceptable) shall be suitable for operation with a coolant solution of fifty percent inhibited ethylene glycol and fifty percent water provided with the diesel engine.

f) Inlet Air Cleaner

1) A replaceable element dry type engine inlet air cleaner shall be furnished and suitably mounted. At full load operation, the allowable air inlet restriction shall not exceed the recommendations of the engine manufacturer.

2) Provide mechanism to sense inlet air restriction caused by a “dirty” filter and alarm to the set mounted control panel.

g) Crankcase Ventilation Device

1) An air box crankcase ventilation vapor recovery system shall be provided. Provide gauges to measure pressure in assemblies.

h) Engine Generator Control Panel
1) The engine shall have a digital microprocessor based controller to provide control, protection and monitoring of the diesel engine operation. The control panel shall provide environmental protection for all devices. All systems shall have non-volatile memory. All fuses shall be provided with relays to indicate a blown fuse.

2) The engine generator control panel shall be in a NEMA 1 enclosure. The enclosure shall be mounted on the skid with vibration isolators. The enclosure shall be suitable for bottom and top conduit entrance for remote conduits.

3) The engine starting control logic shall provide at least twenty (20) electrically isolated single pole double throw contacts for electronic governor control, electric fuel control, battery charger disconnect during cranking, common shutdown alarm annunciation and opening combustion air louvers, starting fans, fuel cooler, etc. Control shall have the capability of modbus (serial output) through Ethernet gateway.

4) The engine control logic shall initiate operation of the engine upon receipt of a signal from a contact, which closes for engine run and opens for engine stop. Upon start of the engine, the engine control logic shall automatically disconnect the starting motor and prevent its reconnection until the engine has come to a complete rest.

5) If the engine fails to start after four adjustable cranking attempts (factory set at 10 seconds on, 10 seconds off, adjustable from zero to 120 seconds) or if any protective device should operate while the engine is running, the engine shall be disconnected from service and immediately stopped. The engine control logic shall lock the failed diesel generator out of service and require a manual reset.

6) Time delays shall be provided for unload cool-down, adjustable from 0 to 15 minutes (factory set at 5 minutes). The cool-down time delay shall be automatically bypassed for malfunction and manual shutdown of the engine generator set.

7) The control logic shall have provision for remote emergency stop switches and the engine shall be equipped with the following protective devices which, when operated, shall cause the engine to shutdown automatically. All alarm point thresholds shall be adjustable over a broad range. Vendor shall specify range and factory setpoint on submittals.

(a) Engine overspeed
(b) Jacket water high temperature
(c) Lube oil low pressure
(d) Overcrank
(e) Crankcase high pressure
(f) Emergency stop push-button
(g) Lube oil high temperature
(h) Over/under frequency and voltage
(i) Overload and overcurrent
(j) Low coolant level
(k) Blown fuse alarms – number of alarms as required
8) Pre-alarm switches shall signal the following abnormalities prior to shutdown.

(a) Lube oil low pressure pre-alarm
(b) Coolant high temperature pre-alarm
(c) Coolant low temperature alarm
(d) Low coolant level
(e) Low oil level
(f) Ground fault
(g) Main breaker “OPEN”

9) In the event of an overspeed or runaway condition, a mechanical means shall automatically initiate positive engine shutdown. This device shall be manually reset and shall include a 10 ampere, 120 volt, AC single pole double throw alarm contact.

10) All wiring for remote engine control, indication, alarm and monitoring shall be connected to terminal blocks in the engine generator control cabinet.

11) Overspeed Switch: An engine-driven two speed switch, which is independent of the governor, shall bypass the engine fault system during the cranking period and shut down the engine automatically in case of overspeed.

12) Provide the following engine gages and devices mounted in an enclosure on the skid via vibration isolators:

(a) Coolant temperature leaving engine
(b) Lube oil pressure
(c) Lube oil temperature
(d) Fuel flow
(e) Mechanical operating time meter
(f) RUN-OFF/RESET-AUTO selector switch
(g) Running time meter
(h) Pre-alarm LED and horn
(i) Alarm LED and horn
(j) Exhaust gas temperature
(k) Fuel pressure

13) Weld the copper ground bar with the NEMA drilling two hole copper compression lugs inside the control panel.

14) Factory install power and control wiring between the engine generator and the control panel.

15) Provide GREEN-YELLOW-RED light assembly for mounting outside of each generator enclosure and provide power and contact closures on generator set to turn lights ON/OFF. Green indicates generator set in Auto-Standby mode and proper operation. Yellow indicates pre-alarm condition and red indicates a shutdown condition.
16) Report the below listed points to Generator Control Panel and to BMS via ModBus or BACnet protocol. Provide all required hardware and interfaces for communication with BMS system.

(a) Exhaust temperature-left
(b) Exhaust temperature-right
(c) Oil temperature
(d) Percent load
(e) Engine run time (hours)
(f) Engine speed (RPM)
(g) Kilowatts
(h) Amperes Phase A
(i) Amperes Phase B
(j) Amperes Phase C
(k) Amperes neutral
(l) Amperes ground
(m) Volts Phase A-B
(n) Volts Phase B-C
(o) Volts Phase C-A
(p) Power factor
(q) Frequency
(r) KVA
(s) KVARs
(t) Bearing vibration
(u) Over-excitation
(v) Stator temperature
(w) Bearings temperature
(x) Auto standby-Off (not in Auto)
(y) Generator running
(z) Lube oil low pressure
(aa) Low lube oil level
(bb) Lube oil high temperature
(cc) Coolant high temperature
(dd) Coolant low temperature
(ee) Aftercooler water temperature
(ff) Low coolant level
(gg) Generator approaching overload
(hh) Battery charger 1
(ii) Engine locked out
(jj) Overspeed
(kk) Overcrank (±10%)
(ll) Jacket water high temperature
(mm) Jacket water low temperature
(nn) Emergency stop (pullbox)
(oo) Loss of excitation
(pp) Loss of field
(qq) Underfrequency
(rr) Overfrequency
(ss) Undervoltage
(tt) Overvoltage
(uu) Negative sequence overcurrent
(vv) High-set phase overcurrent
 ww) Offline overcurrent
(xx) Voltage restrained phase overcurrent
i) Lube Oil System

1) The engine driven lubricating oil pump shall have sufficient capacity to ensure adequate lubrication of main bearings, crank pins, camshaft bearings, valve gear, rocker arms and all other wearing parts.

2) The system shall incorporate full-flow duplex filtration with a spring loaded, pressure calibrated bypass valve to allow lubrication to continue in the event of unusually high filter restriction. The bypass valve must be an integral part of the engine filters or filter housings. A local alarm shall be generated if bypass occurs.

3) Threaded spin-on or canister type full-flow lubricating oil filters, located for easy servicing, shall be provided.

4) A valved oil pan drain extended past the engine rail with braided stainless hose and reusable fittings shall be provided.

5) If required by the engine manufacturer for proper equipment operation, an automatic pre-lube oil system shall be provided to reduce engine wear and improve starting time.

6) A lubrication oil pressure sensor shall be provided to pre-alarm on low oil pressure or low oil level. A second sensor shall shut down the engine if the oil pressure falls below a manufacturer-determined safe level.

7) The engine shall be provided with an initial fill (including oil makeup tank) of manufacturer’s recommended multi-viscosity lubricating oil. Make up the lube oil automatically during engine operation.

j) Exhaust System
1) Exhaust silencer shall be mounted inside of the generator enclosure. The exhaust silencer(s) shall be suitable for continuous service. Exhaust silencer shall be selected such that the maximum allowable enclosure noise level is not exceeded. The silencer shall be properly coordinated with the engine characteristics. A condensate drain nozzle shall be provided. Mounting brackets with vibration isolators for suspension from the generator enclosure shall be included.

Exhaust silencer shall be interior enclosure mounted; exterior enclosure mounted exhaust silencer is not acceptable.

2) Stainless steel convoluted bellows type flexible couplings shall be furnished to isolate the exhaust piping from engine vibrations.

3) A fitting shall be provided on the engine manifold to permit back pressure measurements.

4) Provide sensors to monitor temperature of exhaust gases on each bank.

k) Jacket Water Heater

1) Duplex (two per engine) automatic thermostatically controlled tank-type or circulating pump type jacket water heater circulating systems shall be furnished for operation at 208 volts AC, single or three phase. The systems shall be rated to maintain 100°F to 120°F minimum coolant temperature at 30°F ambient. A cutout switch shall shut down the heaters during engine operation. The heaters shall be factory wired to panel within generator enclosure.

2) Hand shutoff valves shall be provided to facilitate service without draining cooling system.

l) Aftercooler Exchanger

1) Aftercooler exchanger shall be supported by and piped to split core radiator. Incoming water shall be 135°F maximum.

m) Radiator

1) Radiator shall be suitable for ¾” static pressure and 110°F entering ambient temperature (at room or enclosure, not fan) and 7°F rise across the engine.

   (a) Provide site glasses, visible from the generator end of the skid, to monitor coolant level for engine and after cooler.

   (b) Provide switches to monitor for low coolant levels.

2) The radiator fan shall be selected and coordinated in conjunction with the enclosure noise attenuating requirements. Tip speed shall be maintained at a minimum to minimize noise generation.

2. Generator
a) General

1) The generator shall meet all applicable requirements of the latest approved edition of NEMA in design, performance and factory test procedures. The generator and voltage regulator shall be UL listed. The voltage regulator shall be factory wired and tested with the generator. The manufacturer shall have a minimum of ten (10) years documented experience in manufacturing the specified generator.

2) The generator shall be synchronous-type, suitable for standby and prime service as previously specified.

3) Subtransient direct axis (X"D) shall be 12%, maximum.

4) Generator shall be Stamford Newage, Kato, Marathon or Electric Machinery.

5) The generator windings pitch shall be 2/3 pitch to enable the generator to deliver rated power with a load consisting of 12 pulse UPS rectifiers.

b) Construction and Bearings

1) The generator shall be drip-proof, two bearings, form wound construction, close coupled construction. Cast iron end brackets and fabricated steel frames shall be used. The unit shall be fully guarded per NEMA MG1-22.

2) Bearings shall be prelubricated, shielded, cartridge ball bearings with provisions for adding and/or changing grease through grease pipes extended to the generator exterior. Minimum B-10 bearing life shall be 40,000 hours.

3) Provide one three wire 100 ohm platinum resistance temperature detectors (RTD’s) on each bearing for remote temperature indication and overtemperature alarm. Wire RTD’s to control panel terminal blocks.

4) Provide sensors to monitor and detect abnormal vibration.

5) Provide thermostatically and humidistically controlled winding heaters. Heaters shall be automatically disconnected when generator is running.

c) Excitation System

1) The generator shall be rotating field brushless construction using a permanent magnet pilot excited generator to supply the voltage regulator. Volt regulator power supply at each generator shall be from a voltage transformer at the generator or the two 24 volt batteries via a best battery selector.
2) The voltage regulator shall be digital type, microprocessor based, using non-aging silicon controlled rectifiers. The voltage regulator shall be designed to work with the permanent magnet exciter to support a fault current of at least 300% of rated value for up to 10 seconds and prevent SCR induced interference to the voltage regulation system. The voltage regulator shall be three phase sensing and shall have volts-per-hertz operation, loss of sensing, over and under excitation protection, short circuit current limit and zero droop regulation. Adjustments for voltage droop and voltage gain shall be provided. The voltage regulator shall be mounted in the generator control panel.

3) The voltage regulator shall be equipped to shut down excitation upon opening of a customer’s remote contact.

4) The voltage regulator shall be capable of lowering excitation for 0.98 pf leading conditions so that nominal generator voltage does not exceed 1.05 PU.

5) The voltage regulator shall maintain the specified steady-state operational band with a non-linear load having a THD of not more than 15%.

6) KVAR/PF Controller – Can be operated in either mode. Provides KVAR or power factor control when generator is paralleled with utility and with other generators.

7) Reverse Power (Watt and Var) Relay Activation Point – Monitors generator output power and initiates a shutdown of the unit if a reverse power condition is detected.

8) Remote Communication Capability – RS422 port allows display and modification of parameters via link to a personal computer. Provide software.

9) Regulation: ±0.25% no load to full load.

10) Regulator temperature drift: Less than 0.5% for any 40°C change over the operating temperature range.

11) Programmable Volts/Hz characteristic: Two slope ranges adjustable form 1 to 10 V/Hz.

12) Regulator response time: Maximum of 10 milliseconds.

13) Regulator sensing: True RMS 3-phase sensing is standard. Variable sense range.

14) Regulator stability: Regulator responds to the fundamental component of the sensed voltage and remains stable for total harmonic distortion of the generator output voltage waveform up to 20%.

15) Regulator filtering: Telephone Influence Factor (TIF) less than 50 Complies with MIL STD 461B Part 9, EN 50081-2, and EN 50082-2.

16) Fine voltage adjust range: -10% to 10% of regular sensing voltage.
17) Regulator voltage gain (IR compensation): Adjustable 0-10%.

18) Fault detection and identification: Diagnostics identify operation outside of programmed limits and specific fault information is available even after the unit has been powered down.

19) Regulator start-up voltage: Meets ISO8325-3 class G2 specifications.

20) Harmonic tolerance: Shall maintain precise control of the generator output with up to 20% harmonic distortion in the generator output voltage.

21) Reactive droop adjustment: Adjustable 0-10%.

22) Over-excitation protection: Shuts off generator output when excitation current exceeds normal operating currents for 15 seconds or instantaneous shutoff if output is shorted.

23) Ambient operating temperature: -40°C to +70°C.

24) Storage temperature range: -40°C to +85°C.


26) Shock: Withstands up to 20 g’s.

27) Vibration: Withstands 4.5 g’s at frequencies between 18 and 2,000 Hz in three mutually perpendicular planes.


29) Sealing: Withstands up to 35 kPA (5.08 psi).

30) Adjustable over/undervoltage protection.

31) 24V DC, 0.5A power supply required.

d) Insulation System

1) The insulation system of both the rotor and stator windings shall be of NEMA Class H materials and shall be synthetic and non-hygroscopic. The stator winding shall be vacuum pressure impregnated with polyester resin, a dip and bake epoxy overcoat, and a final sealer coat. The rotor shall be wet layer wound with thermosetting epoxy between each layer and epoxy paint on the bare rotor. The rotor insulation shall be sealed and then oven cured.

e) Main Rotor
1) The main rotating field core shall be constructed of one piece four pole laminations. Dovetails, cross bolts and other core-to-shaft connection means are not acceptable. In addition, the amortisseur winding and field pole coil supports shall be integrally die-cast with the rotor laminations to form a single piece rotor core. Fabricated and welded or brazed amortisseur windings and coil supports are not acceptable. The rotor core shall be press fit and keyed to the shaft.

2) The rotor shall be directly coupled to the engine flywheel through a semi-flexible shear type coupling containing replaceable shear pins or approved equal.

3) The rotor windings shall be braced to withstand the forces resulting from operation at 125% overspeed and dynamically balanced.

f) Stator Windings

1) The stator windings shall be form wound design. The output terminals shall be properly designated to identify the proper sequence. The stator shall be heavy duty construction with solid bars, heavy bands, rings and welded foot assembly.

g) Winding Temperature

1) The temperature rise of both the rotor and the stator windings, as measured by the resistance method. Temperature rise shall not exceed 105°C over 40°C ambient.

2) Submit temperature data based on tests of the same or duplicate generators at full load, 0.80 power factor, rated voltage and frequency.

3) Six 100 ohm platinum RTD’s, two per phase, shall be provided in the stator windings to monitor and alarm for high temperature.

h) Ventilation

1) The generator shall be self-ventilated and shall have a one piece, cast aluminum alloy, single directional internal fan for high volume, low noise air delivery.

4. Generator Main Terminal Housing

a) A main generator circuit breaker(s) shall be installed as load circuit interrupting and protection device. It shall operate both manually for normal switching functions and automatically during overload and short circuit conditions. The breaker shall be factory wired to the generator output and installed in a NEMA-1 enclosure. The Terminal Housing shall permit load connections to enter through the bottom of top and shall be equipped to connect 2-hole compression lugs.

b) The circuit breakers shall meet standards established by Underwriter’s Laboratories, National Electrical Manufacturer’s Association and N.E.C.
c) Main circuit breaker shall be rated as follows: 400AF/300AT Amp frame/trip, 3 pole at 277/480V, 3 phase, 4 wire. Circuit breaker shall be 100% continuous trip rated. Circuit breaker shall have an electronic trip unit with adjustable long time, short time and instantaneous trip settings and ground fault alarm only.

d) Circuit breaker enclosure shall be equipped with a full rated neutral and ground bar factory wired to the neutral and ground terminals respectively of the generator winding.

5. Grounding

a) Weld two NEMA standard copper grounding pads at each diesel engine generator skid base. Extend ground wires from both ground pads to panels, cabinets, engine, generator, and enclosure.

6. Generator Support and Isolation System

a) The engine generator sets, including radiator shall be provided with a structural steel base. The base shall have sufficient rigidity for spring isolators in quantities as required between the generator enclosure structural floor framing and generator. Spring isolators shall provide a minimum static deflection of 1" and be similar to Mason Industries, Inc. Type SLR, or as approved. Neoprene pads shall be similar to Mason Industries, Inc. Type W, or as approved. Spring isolators shall be seismic rated as required by International Building Code.

7. Generator Weather Enclosure

a) Provide weatherproof emergency generator break-glass switches in NEMA 4 enclosures with plastic flip guard cover located at the exterior of each generator enclosure at strike side of each door. Provide phenolic screw type red nameplate with white lettering (1 inch high) to read “EMERGENCY STOP OF GENERATOR”. Operation of this switch shall immediately shut down the diesel engine-generator and open output circuit breaker. Provide BMS tie-in alarm on EPO operation.

b) Oil and water drains with ¾ inch bronze valves shall be provided and terminate at the floor of the unit, at the exterior wall with access from outside the enclosure. A crankcase fumes disposal line shall also be piped from the engine to the outside of the enclosure.

c) The enclosures shall be provided with a structural steel base. The base shall have sufficient rigidity to accept spring type isolators, furnished under this section, beneath the entire enclosure between it and building structural support steel. Outdoor spring isolators shall be provided in quantities determined by a qualified vibration isolation vendor to permit a minimum static deflection of 3 inches. Mountings shall incorporate a leveling device, vertical limit stops and single layer of ¾ inch Super “W” type pad. The mountings shall be installed directly under the structural steel base and shall be positioned to accept the weight and weight distribution for uniform mounting deflection. Spring isolators shall be similar to Mason Industries, Inc., Type SLR, or as approved. Pads shall be similar to Mason Industries, Inc., Super W, or as approved. Internal spring vibration isolators shall have one inch of static deflection minimum. All isolation devices shall satisfy Seismic Code, minimum 1.0g acceleration.
Any internal vibration shall be selected with due care and consideration to the main spring vibration isolators supporting the entire package enclosure (see section above for details). Internal spring vibration isolators shall have one inch of static deflection maximum.

Entire enclosure shall withstand a rigidity wind test equal to 115 mph and be capable of supporting a roof load of 50 lbs. per sq. ft. minimum, in addition to other roof mounted elements.

The enclosure exterior walls shall be factory prefinished in a color and texture to be selected by Owner. Color samples to be provided with submittal.

The silencer will be mounted inside the enclosures. It will be internally insulated. Silencer will be super-critical grade. GT Slimline – cool series or equal.

A minimum of four steel lifting rings shall be welded and bolted to assembly for the minimum combined lifting weight. Eyes are removable after setting.

Manufacturer is responsible to field assembly all components including heater, panelboard, muffler, silencer and etc.

c. Execution

1. Factory Testing

a) The factory tests must be performed at the factory where the diesel generator is assembled into the enclosure, not at the generator set manufacturing plant.

b) Include testing of equipment manufactured and fully assembled, specifically for this project.

c) Include exhaust silencers, radiators, heat exchangers, temperature regulators, voltage regulator and all accessories required for operation of the diesel generator. Provide temporary mounting connections and transfer pumps as needed.

d) Provide all resistive and reactive load banks and power cables to achieve full rated load at 0.80 power factor for the duration of the tests.

e) Use instruments calibrated within the previous twelve months and with accuracy directly traceable to the National Institute of Standards and Technology.

f) The scheduled factory tests will be witnessed by representatives of the Owner, the Architect/Engineer and the Electrical Contractor. Provide fourteen days advance notice of the witnessed factory tests and provide first class travel and hotel expenses for Engineer and two Owner’s representatives.

g) The Vendor shall submit to the Architect/Engineer for approval a detailed procedure of the proposed tests three weeks prior to the scheduled factory tests.

h) All equipment shall be ready for operation prior to start of the witnessed tests.

i) If equipment does not pass successfully and a second factory visit is required, Vendor shall pay travel expenses for Owner and Engineer to make additional factory visit(s).
2. Witnessed Factory Tests

   a) The factory tests shall be performed to demonstrate the capability of the diesel engine-generator to accept and continuously carry rated full load at rated voltage, frequency and 0.80 power factor. Operation of all safety and monitoring devices shall also be proven.

   b) The generator shall be given the transient tests described herein to demonstrate that the response of the diesel generator to load application meets the specified limits of voltage, frequency excursions and recovery time. A Dranetz or BMI disturbance analyzer with a waveform analyzer and strip chart recorder shall be used to record subcycle voltage and frequency transients. A hard copy of the results shall be forwarded to the Architect/Engineer.

   c) The generator shall then be operated at full rated load for twelve (12) hours using a factory load bank. During the full load tests, readings shall be recorded of the values listed below. The readings shall be made at 30 minute intervals, starting at the beginning of the test and including the values at the end of the cool-down period.

   1) Ambient temperature, barometric pressure and humidity.
   2) Generator three phase kilowatt load.
   3) Generator three phase kVA load.
   4) Generator currents in all three phases.
   5) Generator voltage across all three phases.
   6) Generator frequency.
   7) Engine coolant temperature.
   8) Engine lube oil pressure.
   9) Engine lube oil temperature.
  10) Engine fuel consumption.
  11) Exhaust gas temperature/each bank.
  12) Bearing temperatures from each RTD.
  13) Stator windings temperatures from each RTD.

   d) Measure harmonic content of output voltage under 25 percent and 100 percent of rated linear load. Verify that harmonic content is within specified limits.

   e) Generator rotor winding and stator winding temperature prior to the test and at the completion of the test shall be determined by the resistance method and recorded.

   f) If the equipment fails to meet Specification requirements during the witnessed factory tests, the Vendor shall correct the cause of the failure and repeat the tests to the satisfaction of the Owner prior to shipment.

   g) Six legible certified copies of the test results shall be provided to the Architect/Engineer. The test results shall include a log of all readings taken during the test run.

   h) Exhaust System Back-Pressure Test: Use a manometer with a scale exceeding 40 inches of water. Connect to exhaust line close to engine exhaust manifold. Verify that back pressure at full-rated load is within manufacturer's written allowable limits for the engine.

3. On-Site Tests of Emergency Generator

a) Manufacturer's Field Service: Provide services of a factory-authorized service representative to supervise installation, connection and on-site testing of units and to report results in writing.

b) Alignment: After installation is completed, check all related components to ensure alignments are within recommended tolerances.

c) Supervised Adjusting, Pretesting and Startup: The factory-authorized service representative shall supervise all system functions, operations and protective features for conformance with Specifications. Startup shall include all time required to achieve proper operation of each piece of equipment provided.

d) Commissioning: The Vendor shall provide on-site support for the duration of equipment commissioning. A minimum of eight man days shall be included. Support shall be dedicated to this project and assigned to work continuously until successful commissioning completion.

e) Integrated System Testing: The Vendor shall provide on-site support for the duration of equipment integrated system testing. A minimum of five man days for each engine system shall be included. Support shall be dedicated to this project and assigned to work continuously until successful integrated system testing completion.

f) On-Site Tests: The factory authorized service representative shall supervise and provide instrumentation for the following tests:

1) Step Load Tests plus four hours at full load using resistive load bank provided at the site. A combination of the radiator mounted load bank and portable load banks to achieve nameplate nominal rating of 200kW is required.

2) Load Tests: Conduct all tests and record readings as specified under witnessed factory testing.

3) Battery-Charger Tests: Verify specified rates of charge for both equalizing and float-charging conditions.

4) System Integrity Tests: Methodically verify proper installation, connection and integrity of each element of engine generator system before and during system operation. Check for air, exhaust and liquid leaks.

5) Exhaust System Back-Pressure Test: Use a manometer with a scale exceeding 40 inches of water. Connect to exhaust line close to engine exhaust manifold. Verify that back pressure at full-rated load is within manufacturer's written allowable limits for the diesel engine.
6) Exhaust Emissions Test: Conform to applicable government test criteria. In lieu of field measuring emissions, factory prototype emissions data can be submitted.

7) Simulate power undervoltage and overvoltage, start of generator, unloading, cooldown and shutdown.

8) Replace all filters and lubrication oils at completion of site tests.

9) Take oil and coolant sample following completion of site test and perform laboratory evaluation to determine presence of unwanted metals and liquids. Submit report to Owner.

3. Services
   a) Start-up supervision and testing shall be provided at no cost to the Owner for required period to get engine-generator to properly operate and complete all on-site tests.

   b) The engine-generator manufacturer must demonstrate the experienced factory personnel are available on a 24 hour basis for service. Rates shall be specified in the proposal for additional time, if required.

   c) The use of authorized repair agencies or "dealers" for service responsibilities shall not be considered as a responsible field service organization for purposes of warranty, undivided responsibility and emergency service.

4. Training
   a) Provide the services of a factory authorized service representative to train the Owner's On-Site Work Force (OSWF) on procedures and schedules for programming, setting of relays, startup, shutdown, troubleshooting, servicing and preventive maintenance of all equipment. The instruction shall include:

      1) The instruction shall be dedicated and intensive and shall be provided by competent instructors fully familiar with the equipment.

      2) The instructions shall be presented in three sessions. Each session for each of the three shifts shall be one eight hour day. Two sessions shall be conducted at substantial completion of the project. One session shall be conducted at 90 to 120 days after move-in.

      3) The Owner will provide a suitable classroom environment on site for the instruction sessions.

      4) Include three day eight hour instruction sessions.

      5) Record the instruction procedures on two copies of CD's, which shall be labeled and protected from erasure.

      6) Schedule training with the Owner with at least seven working days advance notice and provide advance copies of training program to Owner.
7) Provide both classroom training and hands-on equipment operation covering the following:

(a) Safety precautions.
(b) Features and construction of engine generators and accessories.
(c) Routine inspection, test and maintenance procedures.
(d) Routine cleaning.
(e) Features, operation, and maintenance of protective devices.
(f) Interpretation of readings of indicating and alarm devices.
(g) Review operating and maintenance manuals.
(h) Review troubleshooting operations.

5. Installation, Operation, Maintenance and Service Repair Instructions

a) The Vendor shall submit for approval to the Owner, five sets of installation, operating maintenance, service and repair instructions, in bound form, no later than 10 business days after the equipment has been shipped. Wiring diagrams shall be shipped with equipment. Modifications to diagrams made during factor testing shall be shipped with equipment. Additionally, one electronic copy of the approved documents, with text in Word for Windows 2007 format and Drawings in AutoCAD Rel. 2017, shall be delivered to the Owner on CD disk.

b) Each manual shall include, but not be limited to, the following items:

1) All approved shop drawing information as called for above in “SHOP DRAWINGS”.
2) Typical sectional views showing mounting details of equipment, methods of securing power and control wiring, connection of fuel lines, combustion exhaust, etc.
3) Service and repair instructions.
4) Recommend spare parts list.
5) Power and control wiring diagrams with all terminal markings and connections in point-to-point format.
6) List of all pre-alarm and alarm shutdown protective devices with appropriate settings cross-referenced to the appropriate pressure or temperature characteristic curves.
7) Complete parts list with all principal parts identified as to manufacturer, performance data and model number. This list shall include sectional and/or outline prints or illustrations identifying each numbered part and location in relation to the equipment as a whole.
8) Preventive maintenance schedule with detailed instructions.

E-42 SHORT-CIRCUIT STUDIES
a. Summary

1. Section includes a computer-based, fault-current study to determine the minimum interrupting capacity of circuit protective devices.

b. Definitions

1. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed and salvaged, or removed and reinstalled. Existing to remain items shall remain functional throughout the construction period.

2. Field Adjusting Agency: An independent electrical testing agency with full-time employees and the capability to adjust devices and conduct testing indicated and that is a member company of NETA.

3. One-Line Diagram: A diagram that shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used therein.

4. Power System Analysis Software Developer: An entity that commercially develops, maintains, and distributes computer software used for power system studies.

5. Power Systems Analysis Specialist: Professional engineer in charge of performing the study and documenting recommendations, licensed in the state where Project is located.

6. Protective Device: A device that senses when an abnormal current flow exists and then removes the affected portion of the circuit from the system.

7. SCCR: Short-circuit current rating.

8. Service: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.


c. Action Submittals

1. Product Data:

   a) For computer software program to be used for studies.

   b) Submit the following after the approval of system protective devices submittals. Submittals may be in digital form.

      1) Short-circuit study input data, including completed computer program input data sheets.

      2) Short-circuit study and equipment evaluation report; signed, dated, and sealed by a qualified professional engineer.
(a) Submit study report for action prior to receiving final approval of distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Architect for preliminary submittal of sufficient study data to ensure that selection of devices and associated characteristics is satisfactory.

(b) Revised one-line diagram, reflecting field investigation results and results of short-circuit study.

d. Informational Submittals
   1. Qualification Data:
      a) For Power Systems Analysis Software Developer.
      b) For Power System Analysis Specialist.
      c) For Field Adjusting Agency.


e. Closeout Submittals
   1. Operation and Maintenance Data:
      a) For overcurrent protective devices to include in emergency, operation, and maintenance manuals.
      b) The following are from the Short-Circuit Study Report:
         1) Final one-line diagram.
         2) Final Short-Circuit Study Report.
         3) Short-circuit study data files.
         4) Power system data.

f. Quality Assurance
   1. Study shall be performed using commercially developed and distributed software designed specifically for power system analysis.
   2. Software algorithms shall comply with requirements of standards and guides specified in this Section.
   3. Manual calculations are unacceptable.
      a) Power System Analysis Software Qualifications: Computer program shall be designed to perform short-circuit studies or have a function, component, or add-on module designed to perform short-circuit studies.
      b) Computer program shall be developed under the charge of a licensed professional engineer who holds IEEE Computer Society's Certified Software Development Professional certification.
4. Power Systems Analysis Specialist Qualifications: Professional engineer licensed in the state where Project is located. All elements of the study shall be performed under the direct supervision and control of this professional engineer.

5. Short-Circuit Study Certification: Short-Circuit Study Report shall be signed and sealed by Power Systems Analysis Specialist.

6. Field Adjusting Agency Qualifications:
   a) Employer of a NETA ETT-Certified Technician Level III or NICET Electrical Power Testing Level III certification responsible for all field adjusting of the Work.
   b) A member company of NETA.
   c) Acceptable to authorities having jurisdiction.

7. Products

   1. Power System Analysis Software Developers
      a) Comply with IEEE 399 and IEEE 551.
         1) Analytical features of power systems analysis software program shall have capability to calculate "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.
         b) Computer software program shall be capable of plotting and diagramming time-current-characteristic curves as part of its output.

h. Short-Circuit Study Report Contents

   1. Executive summary of study findings.
   2. Study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpretation of results.
   3. One-line diagram of modeled power system, showing the following:
      a) Protective device designations and ampere ratings.
      b) Conductor types, sizes, and lengths.
      c) Transformer kilovolt ampere (kVA) and voltage ratings.
      d) Motor and generator designations and kVA ratings.
      e) Switchgear, switchboard, motor-control center, and panelboard designations and ratings.
      f) Derating factors and environmental conditions.
      g) Any revisions to electrical equipment required by the study.

4. Comments and recommendations for system improvements or revisions in a written document, separate from one-line diagram.

5. Protective Device Evaluation:
a) Evaluate equipment and protective devices and compare to available short-circuit currents. Verify that equipment withstand ratings exceed available short-circuit current at equipment installation locations.

b) Tabulations of circuit breaker, fuse, and other protective device ratings versus calculated short-circuit duties.

c) For 600-V overcurrent protective devices, ensure that interrupting ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.

d) For devices and equipment rated for asymmetrical fault current, apply multiplication factors listed in standards to 1/2-cycle symmetrical fault current.

e) Verify adequacy of phase conductors at maximum three-phase bolted fault currents; verify adequacy of equipment grounding conductors and grounding electrode conductors at maximum ground-fault currents. Ensure that short-circuit withstand ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.

6. Short-Circuit Study Input Data:

a) One-line diagram of system being studied.

b) Power sources available.

c) Manufacturer, model, and interrupting rating of protective devices.

d) Conductors.

e) Transformer data.

7. Short-Circuit Study Output Reports:

a) Low-Voltage Fault Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:

1) Voltage.
2) Calculated fault-current magnitude and angle.
3) Fault-point X/R ratio.
4) Equivalent impedance.

b) Momentary Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:

1) Voltage.
2) Calculated symmetrical fault-current magnitude and angle.
3) Fault-point X/R ratio.
4) Calculated asymmetrical fault currents:
   (a) Based on fault-point X/R ratio.
   (b) Based on calculated symmetrical value multiplied by 1.6.
   (c) Based on calculated symmetrical value multiplied by 2.7.

c) Interrupting Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:

1) Voltage.
2) Calculated symmetrical fault-current magnitude and angle.
3) Fault-point X/R ratio.
4) No AC Decrement (NACD) ratio.
5) Equivalent impedance.
6) Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a symmetrical basis.
7) Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a total basis.

i. Power System Data

1. Obtain all data necessary for conduct of the study.
   a) Verify completeness of data supplied on one-line diagram. Call any discrepancies to Architect's attention.
   b) For equipment included as Work of this Project, use characteristics submitted under provisions of action submittals and information submittals for this Project.
   c) For equipment that is existing to remain, obtain required electrical distribution system data by field investigation and surveys, conducted by qualified technicians and engineers. Qualifications of technicians and engineers shall be as defined by NFPA 70E.

2. Gather and tabulate the required input data to support the short-circuit study. Comply with requirements in Section 017839 "Project Record Documents" for recording circuit protective device characteristics. Record data on a Record Document copy of one-line diagram. Comply with recommendations in IEEE 551 as to the amount of detail that is required to be acquired in the field. Field data gathering shall be under direct supervision and control of the engineer in charge of performing the study, and shall be by the engineer or its representative who holds NETA ETT-Certified Technician Level III or NICET Electrical Power Testing Level III certification. Data include, but are not limited to, the following:
   a) Product Data for Project's overcurrent protective devices involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
   b) Obtain electrical power utility impedance at the service.
   c) Power sources and ties.
   d) For transformers, include kVA, primary and secondary voltages, connection type, impedance, X/R ratio, taps measured in percent, and phase shift.
   e) For reactors, provide manufacturer and model designation, voltage rating, and impedance.
   f) For circuit breakers and fuses, provide manufacturer and model designation. List type of breaker, type of trip, SCCR, current rating, and breaker settings.
   g) Generator short-circuit current contribution data, including short-circuit reactance, rated kVA, rated voltage, and X/R ratio.
   h) Busway manufacturer and model designation, current rating, impedance, lengths, and conductor material.
   i) Motor horsepower and NEMA MG 1 code letter designation.
   j) Conductor sizes, lengths, number, conductor material and conduit material (magnetic or nonmagnetic).
   k) Derating factors.

j. Short-Circuit Study
1. Perform study following the general study procedures contained in IEEE 399.

2. Calculate short-circuit currents according to IEEE 551.

3. Base study on device characteristics supplied by device manufacturer.

4. Extent of electrical power system to be studied is indicated on Drawings.

5. Begin short-circuit current analysis at the service, extending down to system overcurrent protective devices as follows:
   a) To normal system low-voltage load buses where fault current is 10 kA or less.
   b) Exclude equipment rated 240 V ac or less when supplied by a single transformer rated less than 125 kVA.

6. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for Project. Study all cases of system-switching configurations and alternate operations that could result in maximum fault conditions.

7. Include the ac fault-current decay from induction motors, synchronous motors, and asynchronous generators and apply to low- and medium-voltage, three-phase ac systems. Also account for the fault-current dc decrement to address asymmetrical requirements of interrupting equipment.

8. Calculate short-circuit momentary and interrupting duties for a three-phase bolted fault and a single line-to-ground fault at each equipment indicated on one-line diagram.
   a) For grounded systems, provide a bolted line-to-ground fault-current study for areas as defined for the three-phase bolted fault short-circuit study.

9. Include in the report identification of any protective device applied outside its capacity.

E-43 COORDINATION STUDIES

a. Summary

1. Section includes computer-based, overcurrent protective device coordination studies to determine overcurrent protective devices and to determine overcurrent protective device settings for selective tripping.
   a) Study results shall be used to determine coordination of series-rated devices.

2. Definitions
   a) Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled. Existing to remain items shall remain functional throughout the construction period.
   b) Field Adjusting Agency: An independent electrical testing agency with full-time employees and the capability to adjust devices and conduct testing indicated and that is a member company of NETA.
c) One-Line Diagram: A diagram that shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used therein.

d) Power System Analysis Software Developer: An entity that commercially develops, maintains, and distributes computer software used for power system studies.

e) Power System Analysis Specialist: Professional engineer in charge of performing the study and documenting recommendations, licensed in the state where Project is located.

f) Protective Device: A device that senses when an abnormal current flow exists and then removes the affected portion of the circuit from the system.

g) SCCR: Short-circuit current rating.

h) Service: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.


3. Action Submittals

a) Product Data:

1) For computer software program to be used for studies.

2) Submit the following after the approval of system protective devices submittals. Submittals [shall] [may] be in digital form.

   (a) Coordination-study input data, including completed computer program input data sheets.

   (b) Study and equipment evaluation reports.

3) Overcurrent protective device coordination study report; signed, dated, and sealed by a qualified professional engineer.

   (a) Submit study report for action prior to receiving final approval of distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Architect for preliminary submittal of sufficient study data to ensure that selection of devices and associated characteristics is satisfactory.

4. Informational Submittals

a) Qualification Data:

1) For Power System Analysis Software Developer.

2) For Power Systems Analysis Specialist.

3) For Field Adjusting Agency.
b) Product Certificates: For overcurrent protective device coordination study software, certifying compliance with IEEE 399.

5. Closeout Submittals

a) Operation and Maintenance Data: For overcurrent protective devices to include in emergency, operation, and maintenance manuals.

1) The following are from the Coordination Study Report:
   (a) Final one-line diagram.
   (b) Final protective device coordination study.
   (c) Coordination study data files.
   (d) List of all protective device settings.
   (e) Time-current coordination curves.
   (f) Power system data.

6. Quality Assurance

a) Studies shall be performed using commercially developed and distributed software designed specifically for power system analysis.

b) Software algorithms shall comply with requirements of standards and guides specified in this Section.

c) Manual calculations are unacceptable.

d) Power System Analysis Software Qualifications:

1) Computer program shall be designed to perform coordination studies or have a function, component, or add-on module designed to perform coordination studies.

2) Computer program shall be developed under the charge of a licensed professional engineer who holds IEEE Computer Society's Certified Software Development Professional certification.

e) Power Systems Analysis Specialist Qualifications: Professional engineer licensed in the state where Project is located. All elements of the study shall be performed under the direct supervision and control of this professional engineer.

f) Field Adjusting Agency Qualifications:

1) Employer of a NETA ETT-Certified Technician Level III responsible for all field adjusting of the Work.

2) A member company of NETA.

3) Acceptable to authorities having jurisdiction.

b. Products

1. Power System Analysis Software Developers

a) Comply with IEEE 242 and IEEE 399.
b) Analytical features of device coordination study computer software program shall have the capability to calculate "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.

c) Computer software program shall be capable of plotting and diagramming time-current-characteristic curves as part of its output. Computer software program shall report device settings and ratings of all overcurrent protective devices and shall demonstrate selective coordination by computer-generated, time-current coordination plots.

1) Optional Features:
   (a) Arcing faults.
   (b) Simultaneous faults.
   (c) Explicit negative sequence.
   (d) Mutual coupling in zero sequence.

2. COORDINATION STUDY REPORT CONTENTS

a) Executive summary of study findings.

b) Study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpretation of results.

c) One-line diagram of modeled power system, showing the following:

1) Protective device designations and ampere ratings.
2) Conductor types, sizes, and lengths.
3) Transformer kilovolt ampere (kVA) and voltage ratings.
4) Motor and generator designations and kVA ratings.
5) Switchgear, switchboard, motor-control center, and panelboard designations.
6) Any revisions to electrical equipment required by the study.
7) Study Input Data: As described in "Power System Data" Article.

   (a) Short-Circuit Study Output: As specified in "Short-Circuit Study Output Reports" Paragraph in "Short-Circuit Study Report Contents" Article in Section 260573.13 "Short-Circuit Studies."

d) Protective Device Coordination Study:

1) Report recommended settings of protective devices, ready to be applied in the field. Use manufacturer's data sheets for recording the recommended setting of overcurrent protective devices when available.

   (a) Phase and Ground Relays:

   (1) Device tag.
   (2) Relay current transformer ratio and tap, time dial, and instantaneous pickup value.
   (3) Recommendations on improved relaying systems, if applicable.

   (b) Circuit Breakers:
Adjustable pickups and time delays (long time, short time, and ground).

2) Adjustable time-current characteristic.

3) Adjustable instantaneous pickup.

4) Recommendations on improved trip systems, if applicable.

(c) Fuses: Show current rating, voltage, and class.

e) Time-Current Coordination Curves: Determine settings of overcurrent protective devices to achieve selective coordination. Graphically illustrate that adequate time separation exists between devices installed in series, including power utility company's upstream devices. Prepare separate sets of curves for the switching schemes and for emergency periods where the power source is local generation. Show the following information:

1) Device tag and title, one-line diagram with legend identifying the portion of the system covered.

2) Terminate device characteristic curves at a point reflecting maximum symmetrical or asymmetrical fault current to which the device is exposed.

3) Identify the device associated with each curve by manufacturer type, function, and, if applicable, tap, time delay, and instantaneous settings recommended.

4) Plot the following listed characteristic curves, as applicable:

(a) Power utility's overcurrent protective device.
(b) Medium-voltage equipment overcurrent relays.
(c) Medium- and low-voltage fuses including manufacturer's minimum melt, total clearing, tolerance, and damage bands.
(d) Low-voltage equipment circuit-breaker trip devices, including manufacturer's tolerance bands.
(e) Transformer full-load current, magnetizing inrush current, and ANSI through-fault protection curves.
(f) Cables and conductors damage curves.
(g) Ground-fault protective devices.
(h) Motor-starting characteristics and motor damage points.
(i) Generator short-circuit decrement curve and generator damage point.
(j) The largest feeder circuit breaker in each motor-control center and panelboard.

5) Maintain selectivity for tripping currents caused by overloads.

6) Maintain maximum achievable selectivity for tripping currents caused by overloads on series-rated devices.

7) Provide adequate time margins between device characteristics such that selective operation is achieved.

8) Comments and recommendations for system improvements.
c. Execution

1. Examination

   a) Examine Project overcurrent protective device submittals for compliance with electrical distribution system coordination requirements and other conditions affecting performance of the Work. Devices to be coordinated are indicated on Drawings.

      1) Proceed with coordination study only after relevant equipment submittals have been assembled. Overcurrent protective devices that have not been submitted and approved prior to coordination study may not be used in study.

2. Power System Data

   a) Obtain all data necessary for conduct of the overcurrent protective device study.

      1) Verify completeness of data supplied in one-line diagram on Drawings. Call any discrepancies to Architect's attention.

      2) For equipment included as Work of this Project, use characteristics submitted under provisions of action submittals and information submittals for this Project.

      3) For [equipment that] [relocated equipment and that which] is existing to remain, obtain required electrical distribution system data by field investigation and surveys, conducted by qualified technicians and engineers. Qualifications of technicians and engineers shall be as defined by NFPA 70E.

   b) Gather and tabulate all required input data to support the coordination study. List below is a guide. Comply with recommendations in IEEE 551 for the amount of detail required to be acquired in the field. Field data gathering shall be under direct supervision and control of the engineer in charge of performing the study, and shall be by the engineer or its representative who holds NETA ETT-Certified Technician Level III or NICET Electrical Power Testing Level III certification. Data include, but are not limited to, the following:

      1) Product Data for overcurrent protective devices specified in other Sections and involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.

      2) Electrical power utility impedance at the service.

      3) Power sources and ties.

      4) Short-circuit current at each system bus (three phase and line to ground).

      5) Full-load current of all loads.

      6) Voltage level at each bus.
7) For transformers, include kVA, primary and secondary voltages, connection type, impedance, X/R ratio, taps measured in percent, and phase shift.

8) For reactors, provide manufacturer and model designation, voltage rating, and impedance.

9) For circuit breakers and fuses, provide manufacturer and model designation. List type of breaker, type of trip and available range of settings, SCCR, current rating, and breaker settings.

10) Generator short-circuit current contribution data, including short-circuit reactance, rated kVA, rated voltage, and X/R ratio.

11) For relays, provide manufacturer and model designation, current transformer ratios, potential transformer ratios, and relay settings.

12) Maximum demands from service meters.

13) Busway manufacturer and model designation, current rating, impedance, lengths, size, and conductor material.

14) Motor horsepower and NEMA MG 1 code letter designation.

15) Low-voltage cable sizes, lengths, number, conductor material, and conduit material (magnetic or nonmagnetic).

16) Medium-voltage cable sizes, lengths, conductor material, cable construction, metallic shield performance parameters, and conduit material (magnetic or nonmagnetic).

17) Data sheets to supplement electrical distribution system one-line diagram, cross-referenced with tag numbers on diagram, showing the following:

(a) Special load considerations, including starting inrush currents and frequent starting and stopping.

(b) Transformer characteristics, including primary protective device, magnetic inrush current, and overload capability.

(c) Motor full-load current, locked rotor current, service factor, starting time, type of start, and thermal-damage curve.

(d) Generator thermal-damage curve.

(e) Ratings, types, and settings of utility company's overcurrent protective devices.

(f) Special overcurrent protective device settings or types stipulated by utility company.

(g) Time-current-characteristic curves of devices indicated to be coordinated.
(h) Manufacturer, frame size, interrupting rating in amperes root mean square (rms) symmetrical, ampere or current sensor rating, long-time adjustment range, short-time adjustment range, and instantaneous adjustment range for circuit breakers.

(i) Manufacturer and type, ampere-tap adjustment range, time-delay adjustment range, instantaneous attachment adjustment range, and current transformer ratio for overcurrent relays.

(j) Switchgear, switchboards, motor-control centers, and panelboards ampacity, and SCCR in amperes rms symmetrical.

(k) Identify series-rated interrupting devices for a condition where the available fault current is greater than the interrupting rating of downstream equipment. Obtain device data details to allow verification that series application of these devices complies with NFPA 70 and UL 489 requirements.

3. Coordination Study

a) Comply with IEEE 242 for calculating short-circuit currents and determining coordination time intervals.

b) Comply with IEEE 399 for general study procedures.

c) Base study on device characteristics supplied by device manufacturer.

d) Extent of electrical power system to be studied is indicated on Drawings.

e) Begin analysis at the service, extending down to system overcurrent protective devices as follows:

1) To normal system low-voltage load buses where fault current is 10 kA or less.

2) Exclude equipment rated 240 V ac or less when supplied by a single transformer rated less than 125 kVA.

f) Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for Project. Study all cases of system-switching configurations and alternate operations that could result in maximum fault conditions.

g) Transformer Primary Overcurrent Protective Devices:

1) Device shall not operate in response to the following:

   (a) Inrush current when first energized.

   (b) Self-cooled, full-load current or forced-air-cooled, full-load current, whichever is specified for that transformer.

   (c) Permissible transformer overloads according to IEEE C57.96 if required by unusual loading or emergency conditions.
2) Device settings shall protect transformers according to IEEE C57.12.00, for fault currents.

h) Motor Protection:
   1) Select protection for low-voltage motors according to IEEE 242 and NFPA 70.
   2) Select protection for motors served at voltages more than 600 V according to IEEE 620.

i) Conductor Protection: Protect cables against damage from fault currents according to ICEA P-32-382, ICEA P-45-482, and protection recommendations in IEEE 242. Demonstrate that equipment withstands the maximum short-circuit current for a time equivalent to the tripping time of the primary relay protection or total clearing time of the fuse. To determine temperatures that damage insulation, use curves from cable manufacturers or from listed standards indicating conductor size and short-circuit current.

j) Generator Protection: Select protection according to manufacturer's written instructions and to IEEE 242.

k) Include the ac fault-current decay from induction motors, synchronous motors, and asynchronous generators and apply to low- and medium-voltage, three-phase ac systems. Also account for fault-current dc decrement, to address asymmetrical requirements of interrupting equipment.

l) Calculate short-circuit momentary and interrupting duties for a three-phase bolted fault and a single line-to-ground fault at each equipment indicated on one-line diagram.
   1) For grounded systems, provide a bolted line-to-ground fault-current study for areas as defined for the three-phase bolted fault short-circuit study.

m) Protective Device Evaluation:
   1) Evaluate equipment and protective devices and compare to short-circuit ratings.
   2) Adequacy of switchgear, motor-control centers, and panelboard bus bars to withstand short-circuit stresses.
   3) Any application of series-rated devices shall be recertified, complying with requirements in NFPA 70.
   4) Include in the report identification of any protective device applied outside its capacity.

4. Load-Flow And Voltage-Drop Study
   a) Perform a load-flow and voltage-drop study to determine the steady-state loading profile of the system. Analyze power system performance two times as follows:
1) Determine load flow and voltage drop based on full-load currents obtained in "Power System Data" Article.

2) Determine load flow and voltage drop based on 80 percent of the design capacity of load buses.

3) Prepare load-flow and voltage-drop analysis and report to show power system components that are overloaded, or might become overloaded; show bus voltages that are less than as prescribed by NFPA 70.

5. Motor-Starting Study
   a) Perform a motor-starting study to analyze the transient effect of system's voltage profile during motor starting. Calculate significant motor-starting voltage profiles and analyze the effects of motor starting on the power system stability.

   b) Prepare the motor-starting study report, noting light flicker for limits proposed by IEEE 141, and <Insert applicable standards>, and voltage sags so as not to affect operation of other utilization equipment on system supplying the motor.

6. Field Adjusting
   a) Adjust relay and protective device settings according to recommended settings provided by the coordination study. Field adjustments shall be completed by the engineering service division of equipment manufacturer under the "Startup and Acceptance Testing" contract portion.

   b) Make minor modifications to equipment as required to accomplish compliance with [short-circuit and ]protective device coordination studies.

   c) Testing and adjusting shall be by a full-time employee of the Field Adjusting Agency, who holds NETA ETT-Certified Technician Level III or NICET Electrical Power Testing Level III certification.

   d) Perform each visual and mechanical inspection and electrical test stated in NETA ATS. Certify compliance with test parameters. Perform NETA tests and inspections for all adjustable overcurrent protective devices.

7. Demonstration
   a) Engage Power Systems Analysis Specialist to train Owner's maintenance personnel in the following:

      1) Acquaint personnel in fundamentals of operating the power system in normal and emergency modes.

      2) Hand-out and explain the coordination study objectives, study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpreting time-current coordination curves.

      3) For Owner's maintenance staff certified as NETA ETT-Certified Technicians Level III or NICET Electrical Power Testing Level III Technicians, teach how to adjust, operate, and maintain overcurrent protective device settings.
a. Summary

1. Section includes a computer-based, arc-flash study to determine the arc-flash hazard distance and the incident energy to which personnel could be exposed during work on or near electrical equipment.

b. Definitions

1. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

2. Field Adjusting Agency: An independent electrical testing agency with full-time employees and the capability to adjust devices and conduct testing indicated and that is a member company of NETA.

3. One-Line Diagram: A diagram that shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used therein.

4. Power System Analysis Software Developer: An entity that commercially develops, maintains, and distributes computer software used for power system studies.

5. Power Systems Analysis Specialist: Professional engineer in charge of performing the study and documenting recommendations, licensed in the state where Project is located.

6. Protective Device: A device that senses when an abnormal current flow exists and then removes the affected portion from the system.

7. SCCR: Short-circuit current rating.

8. Service: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.


c. Action Submittals

1. Product Data: For computer software program to be used for studies.

2. Study Submittals: Submit the following submittals after the approval of system protective devices submittals. Submittals shall be in digital form:

   a) Arc-flash study input data, including completed computer program input data sheets.

   b) Arc-flash study report; signed, dated, and sealed by Power Systems Analysis Specialist.
c) Submit study report for action prior to receiving final approval of distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Architect for preliminary submittal of sufficient study data to ensure that selection of devices and associated characteristics is satisfactory.

d. Informational Submittals

1. Qualification Data:
   a) For Power Systems Analysis Software Developer.
   b) For Power System Analysis Specialist.
   c) For Field Adjusting Agency.

2. Product Certificates: For arc-flash hazard analysis software, certifying compliance with IEEE 1584 and NFPA 70E.

e. Closeout Submittals

1. Operation and Maintenance Data:
   a) Provide maintenance procedures in equipment manuals according to requirements in NFPA 70E.

   b) Operation and Maintenance Procedures: In addition to items specified in Section 017823 "Operation and Maintenance Data," provide maintenance procedures for use by Owner's personnel that comply with requirements in NFPA 70E.

f. Quality Assurance

1. Study shall be performed using commercially developed and distributed software designed specifically for power system analysis.

2. Software algorithms shall comply with requirements of standards and guides specified in this Section.

3. Manual calculations are unacceptable.

4. Power System Analysis Software Qualifications: An entity that owns and markets computer software used for studies, having performed successful studies of similar magnitude on electrical distribution systems using similar devices.

   a) Computer program shall be designed to perform arc-flash analysis or have a function, component, or add-on module designed to perform arc-flash analysis.

   b) Computer program shall be developed under the charge of a licensed professional engineer who holds IEEE Computer Society's Certified Software Development Professional certification.

5. Power Systems Analysis Specialist Qualifications: Professional engineer in charge of performing the arc-flash study, analyzing the arc flash, and documenting recommendations, licensed in the state where Project is located. All elements of the study shall be performed under the direct supervision and control of this professional engineer.

7. Field Adjusting Agency Qualifications:
   a) Employer of a NETA ETT-Certified Technician Level III or NICET Electrical Power Testing Level III certification responsible for all field adjusting of the Work.
   b) A member company of NETA.
   c) Acceptable to authorities having jurisdiction.

8. Products
   1. Computer Software Developers
      a) Comply with IEEE 1584 and NFPA 70E.
      b) Analytical features of device coordination study computer software program shall have the capability to calculate "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.

9. Arc-Flash Study Report Content
   1. Executive summary of study findings.
   2. Study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpretation of results.
   3. One-line diagram, showing the following:
      a) Protective device designations and ampere ratings.
      b) Conductor types, sizes, and lengths.
      c) Transformer kilovolt ampere (kVA) and voltage ratings, including derating factors and environmental conditions.
      d) Motor and generator designations and kVA ratings.
      e) Switchgear, switchboard, motor-control center, panelboard designations, and ratings.
   5. Short-Circuit Study Output Data: As specified in "Short-Circuit Study Output Reports" Paragraph in "Short-Circuit Study Report Contents" Article in Section 260573.13 "Short-Circuit Studies."
   6. Protective Device Coordination Study Report Contents: As specified in "Coordination Study Report Contents" Article in Section 260573.16 "Coordination Studies."
   7. Arc-Flash Study Output Reports:
a) Interrupting Duty Report: Three-phase and unbalanced fault calculations, showing the following for each equipment location included in the report:

1) Voltage.
2) Calculated symmetrical fault-current magnitude and angle.
3) Fault-point X/R ratio.
4) No AC Decrement (NACD) ratio.
5) Equivalent impedance.
6) Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a symmetrical basis.
7) Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a total basis.

8. Incident Energy and Flash Protection Boundary Calculations:

a) Arcing fault magnitude.
b) Protective device clearing time.
c) Duration of arc.
d) Arc-flash boundary.
e) Restricted approach boundary.
f) Limited approach boundary.
g) Working distance.
h) Incident energy.
i) Hazard risk category.
j) Recommendations for arc-flash energy reduction.

9. Fault study input data, case descriptions, and fault-current calculations including a definition of terms and guide for interpretation of computer printout.

i. ARC-Flash Warning Labels

1. Comply with requirements in Section 260553 "Identification for Electrical Systems" for self-adhesive equipment labels. Produce a 3.5-by-5-inch (76-by-127-mm) self-adhesive equipment label for each work location included in the analysis.

2. Label shall have an orange header with the wording, "WARNING, ARC-FLASH HAZARD," and shall include the following information taken directly from the arc-flash hazard analysis:

a) Location designation.
b) Nominal voltage.
c) Protection boundaries.
   1) Arc-flash boundary.
   2) Restricted approach boundary.
   3) Limited approach boundary.

d) Arc flash PPE category.
e) Required minimum arc rating of PPE in Cal/cm squared.
f) Available incident energy.
g) Working distance.
h) Engineering report number, revision number, and issue date.
3. Labels shall be machine printed, with no field-applied markings.

j. Execution

1. Examination

   a) Examine Project overcurrent protective device submittals. Proceed with arc-flash study only after relevant equipment submittals have been assembled. Overcurrent protective devices that have not been submitted and approved prior to arc-flash study may not be used in study.

2. ARC-Flash Hazard Analysis

   a) Comply with NFPA 70E and its Annex D for hazard analysis study.

   b) Preparatory Studies: Perform the Short-Circuit and Protective Device Coordination studies prior to starting the Arc-Flash Hazard Analysis.

      1) Short-Circuit Study Output: As specified in "Short-Circuit Study Output Reports" Paragraph in "Short-Circuit Study Report Contents" Article in Section 260573.13 "Short-Circuit Studies."

      2) Coordination Study Report Contents: As specified in "Coordination Study Report Contents" Article in Section 260573.16 "Coordination Studies."

   c) Calculate maximum and minimum contributions of fault-current size.

      1) Maximum calculation shall assume a maximum contribution from the utility and shall assume motors to be operating under full-load conditions.

      2) Calculate arc-flash energy at 85 percent of maximum short-circuit current according to IEEE 1584 recommendations.

      3) Calculate arc-flash energy at 38 percent of maximum short-circuit current according to NFPA 70E recommendations.

      4) Calculate arc-flash energy with the utility contribution at a minimum and assume no motor contribution.

   d) Calculate the arc-flash protection boundary and incident energy at locations in electrical distribution system where personnel could perform work on energized parts.

   e) Include medium- and low-voltage equipment locations, except equipment rated 240 V ac or less fed from transformers less than 125 kVA.

   f) Calculate the limited, restricted, and prohibited approach boundaries for each location.

   g) Incident energy calculations shall consider the accumulation of energy over time when performing arc-flash calculations on buses with multiple sources. Iterative calculations shall take into account the changing current contributions, as the sources are interrupted or decremented with time. Fault contribution from motors and generators shall be decremented as follows:
1) Fault contribution from induction motors shall not be considered beyond three to five cycles.

2) Fault contribution from synchronous motors and generators shall be decayed to match the actual decrement of each as closely as possible (for example, contributions from permanent magnet generators will typically decay from 10 per unit to three per unit after 10 cycles).

h) Arc-flash energy shall generally be reported for the maximum of line or load side of a circuit breaker. However, arc-flash computation shall be performed and reported for both line and load side of a circuit breaker as follows:

1) When the circuit breaker is in a separate enclosure.

2) When the line terminals of the circuit breaker are separate from the work location.

i) Base arc-flash calculations on actual overcurrent protective device clearing time. Cap maximum clearing time at two seconds based on IEEE 1584, Section B.1.2.

3. Power System Data

a) Obtain all data necessary for conduct of the arc-flash hazard analysis.

1) Verify completeness of data supplied on one-line diagram on Drawings. Call discrepancies to Architect's attention.

2) For new equipment, use characteristics from approved submittals under provisions of action submittals and information submittals for this Project.

3) For existing equipment, whether or not relocated, obtain required electrical distribution system data by field investigation and surveys conducted by qualified technicians and engineers.

b) Electrical Survey Data: Gather and tabulate the following input data to support study. Comply with recommendations in IEEE 1584 and NFPA 70E as to the amount of detail that is required to be acquired in the field. Field data gathering shall be under the direct supervision and control of the engineer in charge of performing the study, and shall be by the engineer or its representative who holds NETA ETT-Certified Technician Level III or NICET Electrical Power Testing Level III certification.

Data include, but are not limited to, the following:

1) Product Data for overcurrent protective devices specified in other Sections and involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.

2) Obtain electrical power utility impedance or available short circuit current at the service.

3) Power sources and ties.
4) Short-circuit current at each system bus (three phase and line to ground).

5) Full-load current of all loads.

6) Voltage level at each bus.

7) For transformers, include kVA, primary and secondary voltages, connection type, impedance, X/R ratio, taps measured in percent, and phase shift.

8) For reactors, provide manufacturer and model designation, voltage rating and impedance.

9) For circuit breakers and fuses, provide manufacturer and model designation. List type of breaker, type of trip and available range of settings, SCCR, current rating, and breaker settings.

10) Generator short-circuit current contribution data, including short-circuit reactance, rated kVA, rated voltage, and X/R ratio.

11) For relays, provide manufacturer and model designation, current transformer ratios, potential transformer ratios, and relay settings.

12) Busway manufacturer and model designation, current rating, impedance, lengths, size, and conductor material.

13) Motor horsepower and NEMA MG 1 code letter designation.

14) Low-voltage conductor sizes, lengths, number, conductor material and conduit material (magnetic or nonmagnetic).

15) Medium-voltage conductor sizes, lengths, conductor material, conductor construction and metallic shield performance parameters, and conduit material (magnetic or nonmagnetic).

4. Labeling

a) Apply one arc-flash label on the front cover of each section of the equipment for each equipment included in the study. Base arc-flash label data on highest values calculated at each location.

b) Each piece of equipment listed below shall have an arc-flash label applied to it:

1) Motor-control center.
2) Low-voltage switchboard.
3) Switchgear.
4) Low voltage transformers.
5) Panelboard and safety switch over 250 V.
6) Applicable panelboard and safety switch under 250 V.
7) Control panel.

c) Note on record Drawings the location of equipment where the personnel could be exposed to arc-flash hazard during their work.
1) Indicate arc-flash energy.
2) Indicate protection level required.

5. Application Of Warning Labels

1) Install arc-flash warning labels under the direct supervision and control of Power System Analysis Specialist.

6. Demonstration

a) Engage Power Systems Analysis Specialist to train Owner's maintenance personnel in potential arc-flash hazards associated with working on energized equipment and the significance of arc-flash warning labels.

END OF SECTION 16000
SECTION 311000 - SITE CLEARING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract, including General Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Removing above- and below-grade site improvements.
   2. Disconnecting, capping or sealing, and removing site utilities.

B. Additional Information
   1. Explosives: The use of explosives will not be permitted for this Work.

C. General Requirements:
   1. Site Clearing shall be performed in accordance with Section 201 of the New Jersey Department of Transportation Standard Specifications for Road and Bridge Construction, latest edition.

1.3 MATERIAL OWNERSHIP

A. All materials indicated to remain on the OWNER’s property shall be transported by the Contractor to stockpiles on site, as directed by the ARCHITECT.

1.4 SUBMITTALS

A. Photographs or videotape, sufficiently detailed, of existing conditions of trees and plantings, adjoining construction, and site improvements that might be misconstrued as damage caused by site clearing. The preconstruction videos and/or photographs shall be submitted at the preconstruction meeting.

1.5 PROJECT CONDITIONS

A. Traffic: Minimize interference with walks and other adjacent occupied or used facilities during site-clearing operations.

B. Salvageable Improvements: Carefully remove items indicated to be salvaged and store on OWNER’s premises where indicated.

C. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing.

D. Do not commence site clearing operations until temporary erosion and sedimentation control measures are in place.
PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PREPARATION

A. The CONTRACTOR shall be responsible for obtaining all permits unless noted otherwise. All expenses, including but not limited to, permit fees and associated cost for inspection, sampling, filing, monitoring, validation, handling, transportation, disposal shall be paid by the CONTRACTOR.

B. All work shall be performed in accordance with current Federal, State and local rules and regulations, Standard Engineering Practices and Principles, Safety and Health Requirements Manual, and Contract Plans and Specifications.

C. The amount of dust resulting from demolition shall be controlled to prevent the spread of dust to occupied portions of the construction site and to avoid creation of a nuisance in the surrounding area.

D. Before beginning any clearing work, the CONTRACTOR shall survey the site and examine the drawings and specifications to determine the extent of the work.

E. The use of burning at the project site for the disposal of refuse and debris will not be permitted.

F. Use of explosives will not be permitted.

G. Protect and maintain benchmarks and survey control points from disturbance during construction.

H. Protect existing site improvements to remain from damage during construction.

1. Restore damaged improvements to their original condition, as acceptable to OWNER.

3.2 UTILITIES

A. Locate, identify, disconnect, and seal or cap off utilities indicated to be removed.

1. Arrange with utility companies to shut off indicated utilities.

B. Existing Utilities: Do not interrupt utilities serving facilities occupied by OWNER or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify ENGINEER not less than three days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without ARCHITECT’s written permission.

C. Excavate for and remove underground utilities indicated to be removed.

3.3 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and as necessary to facilitate new construction.

B. Protect existing above- and below-grade improvements not indicated to be removed and or not necessary to facilitate new construction.
3.4 DISPOSAL

A. Disposal: Remove obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off OWNER's property.

1. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities.

END OF SECTION 311000
SECTION 312000 – EARTH MOVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Earthwork shall be performed in accordance with Division 200 of the New Jersey Department of Transportation Standard Specifications for Road and Bridge Construction, latest edition.

1.2 SUMMARY

A. This Section includes the following:

1. Preparing subgrades for slabs-on-grade, walks, pavements and lawns and grasses.
2. Excavating and backfilling for buildings and structures.
3. Drainage course for slabs-on-grade.
4. Subbase course for concrete pavements.
5. Excavating and backfilling for utility trenches.
6. Excavation for proposed pavement and slabs.
7. Excavating and backfilling for drainage basin.

B. Related Sections include the following:

1. Division 3 Section "Cast-in-Place Concrete" for concrete slabs, pads and foundations.
2. Division 31 Section "Site Clearing" for temporary erosion and sedimentation control measures, site stripping, grubbing, stripping and stockpiling topsoil, and removal of above- and below-grade improvements.
3. Division 31 Section "Dewatering" for lowering and disposing of ground water during construction.
4. Division 31 Section "Excavation Support and Protection" for shoring, bracing, and sheet piling of excavations.
5. Division 32 Section "Turf and Grasses" for finish grading, including preparing and placing topsoil and planting soil for lawns.
6. Division 33 Section "Storm Utility Drainage Piping" for storm drains and structures.
7. Division 26 Section “Underground Ducts and Raceways for Electrical Systems” for electrical conduits.

1.3 DEFINITIONS

A. Backfill: Soil material used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Backfill Excavation: Material meeting the requirements for Dense-Graded Aggregate Base Course, as defined in Section 32 11 33, which is installed if & where directed by the Architect, to fill voids created by the Excavation & Offsite Removal of Unclassified Material or Excavation & Offsite Removal of Unsuitable Material directed by the Architect.
C. Base Course: Course placed between the subbase course and paving.

D. Bedding Course: Course placed over the excavated subgrade in a trench before laying pipe.

E. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

F. Drainage Course: Course supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

G. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
   1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect. This may also be used if, during earthwork operations, the Architect determines that there are unsuitable materials on site and they must be removed above and beyond the initial contract. This excavation and replacement material required will be paid for according to Contract provisions for unit prices.
   2. Bulk Excavation: Excavation more than 10 feet in width and more than 30 feet in length.
   3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.

H. Fill: Soil materials used to raise existing grades.

I. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

J. Subbase Course: Course placed between the subgrade and base course for hot-mix asphalt pavement, or course placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.

K. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.

L. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

M. Unsuitable Material: All material that cannot be compacted as directed by the Architect.

N. Unclassified Material: All materials above the subgrade elevations that includes brick and concrete debris, boulders (rocks over 3’ in diameter), other obstructions including metals, piping, trash, etc.

1.4 SUBMITTALS

A. Product Data: For the following:
   1. Structural Fill

B. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated:
   1. Classification according to ASTM D 2487 of each on-site and borrow soil material proposed for fill and backfill.
   2. Laboratory compaction curve according to ASTM D 1557 for each on-site and borrow soil material proposed for fill and backfill.
C. Pre-exavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by earthwork operations. Submit before earthwork begins.

1.5 QUALITY ASSURANCE

A. Geotechnical Testing Agency Qualifications: An independent testing agency qualified according to ASTM E 329 to conduct soil materials and rock-definition testing, as documented according to ASTM D 3740 and ASTM E 548.

1.6 PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing and then only after arranging to provide temporary utility services according to requirements indicated.

1. Notify Architect not less than three days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Architect’s written permission.
3. Contact utility-locator service for area where Project is located before excavating.

B. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies to shut off services if lines are active.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Satisfactory Structural Soils: ASTM D 2487 Soil Classification Groups GW, GP, GM, SW, SP, and SM, or a combination of these groups; free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter, or fill as described in attached soils report.

C. Unsatisfactory Soils for Import: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D 2487, or a combination of these groups.

1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction. No payment will be made for the removal and disposal of unsatisfactory soil imported by the contractor.

D. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.

E. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 95 percent passing a 1-1/2-inch sieve and not more than 8 percent passing a No. 200 sieve.

F. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.
G. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.

H. Drainage Course: Narrowly graded mixture of crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.

I. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch sieve and 0 to 5 percent passing a No. 4 sieve.

J. Sand: ASTM C 33; fine aggregate, natural, or manufactured sand.

K. Backfill Excavation: Material meeting the requirements for Dense-Graded Aggregate Base Course, as defined in Section 32 11 33.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

B. Preparation of subgrade for earthwork operations including removal of vegetation, topsoil, debris, obstructions, and deleterious materials from ground surface is specified in Division 31 Section "Site Clearing."

C. Protect and maintain erosion and sedimentation controls, which are specified in Division 31 Section "Site Clearing," during earthwork operations.

3.2 DEWATERING

A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.

1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

2. Install a dewatering system, specified in Division 31 Section "Dewatering," to keep subgrades dry and convey ground water away from excavations. Maintain until dewatering is no longer required.

3.3 EXPLOSIVES

A. Explosives: Do not use explosives.

3.4 EXCAVATION, GENERAL

A. Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Project Lump Sum includes excavation to all subgrade elevations including the removal of excess fill if required.
3.5 EXCAVATION FOR WALKS AND PAVEMENTS
   A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and
      subgrades.

3.6 EXCAVATION FOR UTILITY TRENCHES
   A. Excavate trenches to indicated gradients, lines, depths, and elevations.
   B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit.
      Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit,
      unless otherwise indicated.
      1. Clearance: As indicated.
   C. Trench Bottoms: Excavate trenches 4 inches deeper than bottom of pipe elevation to allow for bedding
      course. Hand excavate for bell of pipe.

3.7 EXCAVATION & OFFSITE REMOVAL OF UNCLASSIFIED MATERIAL (IF & WHERE DIRECTED)
   A. Excavation: Excavate material regardless of the character of surface and subsurface conditions
      encountered, if & where directed by the Architect. The quantity of this pay item in the bid will be
      utilized only at the direction of the Architect, if field conditions differ substantially from those shown on
      the plans and specified herein.
   B. Disposal: Dispose of Unclassified Material in accordance with Subsection 3.21.

3.8 EXCAVATION & OFFSITE REMOVAL OF UNSUITABLE MATERIAL (IF & WHERE DIRECTED)
   A. Excavation: Excavate unsuitable material regardless of the character of surface and subsurface conditions
      encountered, if & where directed by the Architect. The quantity of this pay item in the bid will be
      utilized only at the direction of the Architect, if field conditions differ substantially from those shown on
      the plans and specified herein.
   B. Disposal: Dispose of Unsuitable Material in accordance with Subsection 3.21.

3.9 SUBGRADE INSPECTION
   A. Notify Architect when excavations have reached required subgrade.
   B. If Testing Agency determines that unsatisfactory soil is present, continue excavation and replace with fill
      material as directed by the Owner.
   C. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and
      areas of excess yielding. Do not proof-roll wet or saturated subgrades.
      1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular
         to first direction. Limit vehicle speed to 3 mph.
      2. Proof-roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
      3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined
         by Architect, and replace with compacted backfill or fill as directed.
D. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices.

E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.

3.10 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation by extending bottom elevation of concrete to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi, may be used when approved by Architect.

1. Fill unauthorized excavations under other construction or utility pipe as directed by Architect.

3.11 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.12 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:

1. Surveying locations of underground utilities for Record Documents.
2. Testing and inspecting underground utilities.
3. Removing concrete formwork.
4. Removing trash and debris.
5. Removing temporary shoring and bracing, and sheeting.

B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.13 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

C. Backfill trenches excavated under footings and within 18 inches of bottom of footings with dense-graded aggregate; fill with concrete to elevation of bottom of footings. Concrete is specified in Division 3 Section "Cast-in-Place Concrete."

D. Place and compact initial backfill of, free of particles larger than 1 inch in any dimension, to a height of 12 inches over the utility pipe or conduit.

1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

E. Backfill voids with dense-graded aggregate while installing and removing shoring and bracing.
F. Place and compact final backfill of dense-graded aggregate to final subgrade elevation.

3.14 SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B. Place and compact fill material in layers to required elevations as follows:
   1. Under grass and planted areas, use satisfactory soil material.
   2. Under walks and pavements, use satisfactory soil material.

C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.15 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.
   1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
   2. Remove and replace, or scarify and air dry otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.16 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 1557:
   1. Under pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 95 percent.
   2. Under lawn or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 90 percent.
   3. For utility trenches, compact each layer of initial and final backfill dense-graded aggregate material at 90 percent.

3.17 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
   1. Provide a smooth transition between adjacent existing grades and new grades.
   2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Grading: Slope grades to direct water away from pavement and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
1. Lawn or Unpaved Areas: Plus or minus 1 inch.
2. Walks: Plus or minus 1/4 inch.
3. Pavements: Plus or minus 1/2 inch.

3.18 SUBBASE AND BASE COURSES

A. Place subbase and base course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place subbase and base course under pavements as follows:
   1. Place base course material over subbase course under pavement.
   2. Shape subbase and base course to required elevations and grades.
   3. Place subbase and base course 6 inches or less in compacted thickness in a single layer.
   4. Place subbase and base course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
   5. Compact subbase and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.

3.19 DRAINAGE COURSE

A. Place drainage course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:
   1. Place drainage course 6 inches or less in compacted thickness in a single layer.
   2. Place drainage course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
   3. Compact each layer of drainage course to required cross sections and thicknesses to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

3.20 FIELD QUALITY CONTROL

A. Testing Agency: Contractor will engage a qualified 3rd party geotechnical engineering testing agency to perform field quality-control testing.

B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.

C. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:
   1. Paved Areas: At subgrade and at each compacted fill and backfill layer, at least 1 test for every 2000 sq. ft. or less of paved area or building slab, but in no case fewer than 3 tests.
   2. Trench Backfill: At each compacted initial and final backfill layer, at least 1 test for each 150 feet or less of trench length, but no fewer than 2 tests.

D. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained.
3.21 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace soil material to depth as directed by Architect; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.22 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

END OF SECTION 312000
SECTION 312319 – DEWATERING

PART 1 - GENERAL

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

1.2 SUMMARY
A. This Section includes construction dewatering.
B. Related Sections include the following:
   1. Division 3 Section "Cast-in-Place Concrete" for concrete slabs, pads and foundations
   2. Division 31 Section "Earth Moving" for excavating, backfilling, site grading and for site utilities.
   3. Division 31 Section "Excavation Support and Protection".
   4. Division 33 Section "Storm Utility Drainage Piping" for storm drains and structures.
   5. Division 26 Section “Underground Ducts and Raceways for Electrical Systems” for electrical conduits.

1.3 PERFORMANCE REQUIREMENTS
A. Dewatering Performance: Design, furnish, install, test, operate, monitor, and maintain dewatering system of sufficient scope, size, and capacity to control ground-water flow into excavations and permit construction to proceed on dry, stable subgrades.
   1. Maintain dewatering operations to ensure erosion control, stability of excavations and constructed slopes, that excavation does not flood, and that damage to subgrades and permanent structures is prevented.
   2. Prevent surface water from entering excavations by grading, dikes, or other means.
   3. Accomplish dewatering without damaging existing improvements adjacent to excavation.
   4. Remove dewatering system if no longer needed.

1.4 SUBMITTALS
A. Field Test Reports: Before starting excavation, submit test results and computations demonstrating that dewatering system is capable of meeting performance requirements. Contractor shall submit a dewatering plan which shall include the disposal of water, for review and approval by the Architect.

1.5 QUALITY ASSURANCE
A. Regulatory Requirements: Comply with water disposal requirements of the New Jersey Department of Environmental Protection and the Freehold Soil Conservation District.
1.6 PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing and then only after arranging to provide temporary utility services according to requirements indicated.

B. Project-Site Information:

1. The Contractor shall make test borings and conduct other exploratory operations necessary for dewatering.

C. Survey adjacent structures and improvements, employing a qualified professional engineer or land surveyor, establishing exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.

1. During dewatering, regularly resurvey benchmarks, maintaining an accurate log of surveyed elevations for comparison with original elevations. Promptly notify Architect if changes in elevations occur or if cracks, sags, or other damage is evident in adjacent construction.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by dewatering operations.

1. Prevent surface water and subsurface or ground water from entering excavations, from ponding on prepared subgrades, and from flooding site and surrounding area.

2. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.

B. Install dewatering system to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

3.2 INSTALLATION

A. Install dewatering system utilizing wells, well points, or similar methods complete with pump equipment, standby power and pumps, filter material gradation, valves, appurtenances, water disposal, and surface-water controls.

B. Before excavating below ground-water level, place system into operation to lower water to specified levels. Operate system continuously until drains, sewers, and structures have been constructed and fill materials have been placed, or until dewatering is no longer required.

C. Provide an adequate system to lower and control ground water to permit excavation, construction of structures, and placement of fill materials on dry subgrades. Install sufficient dewatering equipment to drain water-bearing strata above and below bottom of foundations, drains, sewers, and other excavations.
1. Do not permit open-sump pumping that leads to loss of fines, soil piping, subgrade softening, and slope instability.

D. Reduce hydrostatic head in water-bearing strata below subgrade elevations of foundations, drains, sewers, and other excavations.
   1. Maintain piezometric water level a minimum of 24 inches below surface of excavation.

E. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of work under construction or completed. Dispose of water in a manner that avoids inconvenience to others. Provide sumps, sedimentation tanks, and other flow-control devices as required by authorities having jurisdiction.

F. Provide standby equipment on-site, installed and available for immediate operation, to maintain dewatering on continuous basis if any part of system becomes inadequate or fails. If dewatering requirements are not satisfied due to inadequacy or failure of dewatering system, restore damaged structures and foundation soils at no additional expense to Owner.
   1. Remove dewatering system from Project site on completion of dewatering. Plug or fill well holes with sand or cut off and cap wells a minimum of 36 inches below overlying construction.

G. Damages: Promptly repair damages to adjacent facilities caused by dewatering operations.

END OF SECTION 312319
SECTION 315000 - EXCAVATION SUPPORT AND PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Excavation Support and Protection shall be performed in accordance with Section 202 of the New Jersey Department of Transportation Standard Specifications for Road and Bridge Construction, 2007 edition.

1.2 SUMMARY

A. This Section includes temporary excavation support and protection systems.

B. Related Sections include the following:
   1. Division 31 Section "Dewatering" for dewatering excavations.
   2. Division 31 Section "Earth Moving" for excavating and backfilling and for existing utilities.
   3. Division 33 Section "Storm Utility Drainage Piping" for storm drains and structures.
   4. Division 03 Section "Cast-in-Place Concrete" for concrete slabs, pads and foundations.

1.3 PERFORMANCE REQUIREMENTS

A. Design, furnish, install, monitor, and maintain excavation support and protection system capable of supporting excavation sidewalls and of resisting soil and hydrostatic pressure and superimposed and construction loads.

   1. Provide professional engineering services needed to assume engineering responsibility, including preparation of Shop Drawings and a comprehensive engineering analysis by a qualified professional engineer.
   2. Prevent surface water from entering excavations by grading, dikes, or other means.
   3. Install excavation support and protection systems without damaging existing buildings, pavements, and other improvements adjacent to excavation.

1.4 SUBMITTALS

A. Shop Drawings for Information: Prepared by or under the supervision of a qualified professional engineer for excavation support and protection systems.

   1. Include Shop Drawings signed and sealed by the qualified professional engineer responsible for their preparation.

B. Qualification Data: For Installer and professional engineer.

C. Photographs or videotape, sufficiently detailed, of existing conditions of adjoining construction and site improvements that might be misconstrued as damage caused by the absence of, the installation of, or the performance of excavation support and protection systems.
1.5 PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing and then only after arranging to provide temporary utility services according to requirements indicated.

B. Project-Site Information: Seasonal high water elevations will fluctuate and the Contractor shall be responsible for all dewatering required.

1. The Contractor shall make test borings and conduct other exploratory operations necessary for dewatering.

C. Survey adjacent structures and improvements, employing a qualified professional engineer or land surveyor; establish exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.

1. During installation of excavation support and protection systems, regularly resurvey benchmarks, maintaining an accurate log of surveyed elevations and positions for comparison with original elevations and positions. Promptly notify Architect if changes in elevations or positions occur or if cracks, sags, or other damage is evident in adjacent construction.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards that could develop during excavation support and protection system operations.

1. Shore, support, and protect utilities encountered.

B. Install excavation support and protection systems to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

C. Locate excavation support and protection systems clear of permanent construction so that forming and finishing of concrete surfaces is not impeded.

D. Monitor excavation support and protection systems daily during excavation progress and for as long as excavation remains open. Promptly correct bulges, breakage, or other evidence of movement to ensure that excavation support and protection systems remain stable.

E. Promptly repair damages to adjacent facilities caused by installing excavation support and protection systems.

END OF SECTION 315000
SECTION 321133 - AGGREGATE BASE COURSE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Aggregate Base Course shall be constructed in accordance with Section 302 of the “NJDOT Standard Specifications for Road and Bridge Construction, 2007” as amended herein.

1.2 SUMMARY

C. This work shall consist of the construction of base courses of soil aggregate or dense graded aggregate for pavement and pavement repair.

D. Related Sections include the following:
   1. Division 31 Section "Earth Moving" for excavating, backfilling, site grading and for site utilities.
   2. Division 31 Section "Site Clearing" for temporary erosion and sedimentation control measures, site stripping, grubbing, stripping and stockpiling topsoil, and removal of above- and below-grade improvements.
   3. Division 31 Section "Earth Moving" for excavating, backfilling, site grading and for site utilities.
   4. Division 32 Section “Asphalt Paving” for Hot Mix Asphalt Paving.

1.3 STANDARDS

A. All work to be performed under this section shall comply with the provisions of Section 302 of the “NJDOT Standard Specification for Road and Bridge Construction, 2007,” and as amended herein.

1.4 SUBMITTALS

B. Product Data: Certified material statements from Suppliers.

PART 2 - MATERIALS

2.1 SOIL AGGREGATE BASE COURSE

C. The following is added to Subsection 301.02:

   1. Soil aggregate for base course shall be NJDOT Designation I-5, conforming to NJDOT Subsection 901.11.
   2. Soil aggregate for base course may also be Dense Graded Aggregate conforming to NJDOT Subsection 901.11.

2.2 DENSE-GRADED AGGREGATE BASE COURSE

A. Dense-graded aggregate base course shall be as specified in NJDOT Section 901.

PART 3 - EXECUTION

3.1 CONSTRUCTION
A. Prior to placing base course material the subgrade shall be shaped and compacted to grade and contour in accordance with Section 31 23 00 “Earth Moving”.

B. Material shall not be placed when the subgrade is frozen, or when it is unstable because of excessive moisture. The material shall be spread with mechanical spreaders, except in limited or restricted areas. If approved, the material may be dumped in windrows or end dumped. Material dumped in windrows or end dumped shall be spread so as to eliminate segregation and all ruts and ridges caused by dumping or hauling over the material.

C. The base course shall be constructed in layers not exceeding a compacted thickness of 8 inches. If the required compacted depth of the base course is greater than 8 inches, the base course shall be constructed in layers of approximate equal thickness. Each layer shall be compacted as specified.

D. Compaction of each layer shall achieve an in-place minimum average ASTM dry density of 95 percent of maximum. Compaction methods shall be as specified under Section 31 23 00.

E. The base course shall be maintained, by the Contractor, smooth and uniform until covered by the following stage of construction.

END OF SECTION 321133
SECTION 320190
SITE RESTORATION

DESCRIPTION

A. Restoration shall include spreading of topsoil layer, fine grading, fertilizing, seeding and mulching.

B. The Contractor shall furnish all necessary material and equipment required to landscape disturbed areas within the contract limits and where otherwise noted on the Plans, except such areas occupied by structures, pavements and walks. For the purposes of this Section, landscaping shall mean grading, seeding and mulching.

MATERIALS

A. Topsoil - Shall be fertile, friable, well drained and have a pH between 6.0 and 6.5. Topsoil shall be clean and free of clay lumps, stones, roots and debris more than 1” diameter and shall contain at least 2.75 percent organic matter.

B. Fertilizer – NPK 10-20-10 shall be applied in all areas to be seeded.

C. Lime – Agricultural limestone will be spread on all areas of topsoil to bring pH to 6.0 to 6.5.

D. Seed – “Black Beauty Ultra” as produced by Jonathan Green or approved equal. The Contractor shall submit tag analysis prior to seeding.

Permanent Seeding Specifications:

- 30% Dakota Tall Fescue
- 30% Taos Tall Fescue
- 20% Tombstone Tall Fescue
- 10% Blue-Tastic Kentucky Bluegrass
- 10% Frontier Perennial Ryegrass

The seed shall be applied at a rate of 4 lbs. PLS per 1,000 s.f.

E. Mulch - Straw for mulch shall be approved by the Park System and shall not be rotted. Mulch shall be used in its natural length. Chopped or ground straw shall not be used.

METHODS OF CONSTRUCTION

A. Following construction and prior to distribution of topsoil, the area shall be cleared of all debris including tree stumps, logs and all building materials. (i.e. concrete, blocks, bricks, tar, paper, wood shingles, etc.).

B. Topsoil shall be spread evenly by hand or other approved method. Topsoil shall not be delivered or spread on frozen or muddy conditions.
C. If sufficient topsoil is not stockpiled on site, the Contractor shall furnish and place suitable imported topsoil.

D. Imported topsoil shall consist of a fertile, friable, natural topsoil with no mixture of subsoil refuse or other foreign material. Topsoil shall have a normal amount of organic matter and be reasonably free from chlorides, stumps, roots, hard dirt, heavy or stiff clay, stones larger than 1” in diameter, lumps, course sand, noxious weeds, sticks, brush or other litter. A certificate if the topsoil shall be provided including a pH test.

E. The topsoil shall not be placed until all fills, embankments and backfilled trenches have approximately reached their final condition of settlement, or until satisfactory allowance has been made for possible future settlement. The subgrade upon which the topsoil is to be placed shall be loosened by deep raking or rototilling to a minimum depth of 6”.

F. On all areas to be seeded, the finished surface of the topsoil shall conform to the finished grade and be free from hollows or other inequalities which may hold water or be subject to scalping by mowing. Stone over 1” in every dimension, sticks, clods and other extraneous matter shall be removed with a hand rake or other acceptable means.

G. After placing the topsoil, the Contractor shall spread sufficient ground agricultural limestone to bring the soil pH to 6.0 to 6.5.

H. 10-20-10 fertilizer shall be applied at 20 lbs. per 1,000 s.f. over the area as the final preparation.

I. Seeding shall be done when the weather and soil conditions are suitable for work.

J. Seeding shall be done on a calm day. The seed shall be applied at the rates listed under the Materials Section of the this Specifications.

K. If there will be any delay in seeding during which weeds grow on the surface or the soil is washed out, the Contractor shall remove the weeds or replace the soil before sowing the seed without any additional compensation.

L. Upon completion of the seeding operation, all seeded areas shall be mulched with salt hay at a rate of 70 to 90 pounds per 1,000 s.f. immediately after seeding so that seed will not be washed or blown away. The Contractor will be held responsible for maintaining all areas that have been seeded until a self-sustained growth has developed.

M. The Contractor is responsible for irrigation of all restored, seeded areas until grass is established.

END OF SECTION 320190
SECTION 321216 - ASPHALT PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Hot-Mix Asphalt Paving shall be performed in accordance with Divisions 300, 400 and 900 of the New Jersey Department of Transportation Standard Specifications for Road and Bridge Construction, latest edition. Sawcutting shall be performed in accordance with Division 200 of the NJDOT Standard Specifications, latest edition.

C. Line Striping and Markings shall be performed in accordance with Section 610 of the New Jersey Department of Transportation Standard Specifications for Road and Bridge Construction, latest edition.

1.2 SUMMARY

A. Section Includes:
   1. Hot-mix asphalt paving.
   2. Traffic Stripes, long-life epoxy resin.
   3. Traffic Markings, thermoplastic

B. Related Sections:
   1. Division 31 Section "Earth Moving" for aggregate subbase and base courses.

1.3 DEFINITION

A. Hot-Mix Asphalt Paving Terminology: Refer to ASTM D 8 for definitions of terms.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include technical data and tested physical and performance properties.
   1. Job-Mix Designs: For each job mix proposed for the Work.

B. Shop Drawings: Indicate pavement markings, lane separations, and defined parking spaces. Indicate, with international symbol of accessibility, spaces allocated for people with disabilities.

C. Qualification Data: For qualified manufacturer and Installer.

D. Material Certificates: For each paving material.

E. Material Test Reports: For each paving material.

F. Load Tickets: The load ticket for each load of material that arrives on site specifying all requirements as set forth in NJDOT Division 400.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: A paving-mix manufacturer registered with and approved by the NJDOT.

B. Testing Agency Qualifications: The Contractor shall provide a qualified according to ASTM D 3666 for testing indicated.

C. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of NJDOT for asphalt paving work.

1. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver pavement-marking materials to Project site in original packages with seals unbroken and bearing manufacturer's labels containing brand name and type of material, date of manufacture, and directions for storage.

B. Store pavement-marking materials in a clean, dry, protected location within temperature range required by manufacturer. Protect stored materials from direct sunlight.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp, if rain is imminent or expected before time required for adequate cure, or if the following conditions are not met:

1. Prime Coat: Minimum surface temperature of 60 deg F.
2. Tack Coat: Minimum surface temperature of 60 deg F.
3. Asphalt Base Course: Minimum surface temperature of 40 deg F and rising at time of placement.
4. Asphalt Surface Course: Minimum surface temperature of 60 deg F at time of placement.

B. Pavement-Markings: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F for oil-based materials, 55 deg F for water-based materials, and not exceeding 95 deg F. Comply with manufacturer's recommended application temperatures and humidity levels.

PART 2 - PRODUCTS

2.1 AGGREGATES

A. All aggregates shall comply with Section 901 of the New Jersey Department of Transportation Specifications.

2.2 ASPHALT MATERIALS AND PAVING MIX

A. All asphalt materials shall comply with Section 902 of the New Jersey Department of Transportation Specifications.

B. All pavement markings shall comply with Section 912 of the New Jersey Department of Transportation Specifications.
2.3 PAVEMENT MARKINGS

A. Epoxy Pavement Markings: Epoxy pavement markings shall comply with NJDOT Specifications Section 912.
   1. Color: As indicated.

B. Thermoplastic Pavement Markings: Thermoplastic pavement markings shall comply with NJDOT Specifications Section 912.
   1. Color: As indicated.

C. Glass Beads: AASHTO M 247, Type 1.

2.4 MIXES

A. Hot-Mix Asphalt: Dense, hot-laid, hot-mix asphalt plant mixes approved by the NJDOT and complying with the following requirements:
   1. Provide mixes with a history of satisfactory performance in geographical area where Project is located.
   2. Base Course: Hot-Mix Asphalt 19M64 Base Course.
   3. Surface Course: Hot-Mix Asphalt 9.5M64 Surface Course.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that subgrade is dry and in suitable condition to begin paving.

B. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
   1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.
   2. Proof-roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
   3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.

C. Place DGA Base Course on suitable sub-base only in accordance with Division 31.

D. Proceed with paving only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.

B. Prime Coat: Apply uniformly over surface of compacted unbound-aggregate base course at a rate of 0.15 to 0.50 gal./sq. yd. Apply enough material to penetrate and seal but not flood surface. Allow prime coat to cure.
   1. If prime coat is not entirely absorbed within 24 hours after application, spread sand over surface to blot excess asphalt. Use enough sand to prevent pickup under traffic. Remove loose sand by sweeping before pavement is placed and after volatiles have evaporated.
2. Protect primed substrate from damage until ready to receive paving.

C. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd.
   1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
   2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3.3 HOT-MIX ASPHALT PLACING

A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.
   1. Place hot-mix asphalt base course in number of lifts and thicknesses indicated.
   2. Place hot-mix asphalt surface course in single lift.
   3. Spread mix at minimum temperature of 250 deg F.
   4. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes unless otherwise indicated.
   5. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.

B. Place paving in consecutive strips not less than 12 feet wide unless infill edge strips of a lesser width are required.
   1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Complete a section of asphalt base course before placing asphalt surface course.

C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.4 JOINTS

A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions, with same texture and smoothness as other sections of hot-mix asphalt course.
   1. Clean contact surfaces and apply tack coat to joints.
   2. Offset longitudinal joints, in successive courses, a minimum of 6 inches.
   3. Offset transverse joints, in successive courses, a minimum of 24 inches.
   4. Construct transverse joints at each point where paver ends a day's work and resumes work at a subsequent time. Construct these joints using either "bulkhead" or "papered" method according to A I MS-22, for both "Ending a Lane" and "Resumption of Paving Operations".
   5. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.
   6. Compact asphalt at joints to a density within 2 percent of specified course density.

3.5 COMPACTION

A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or with vibratory-plate compactors in areas inaccessible to rollers.
   1. Complete compaction before mix temperature cools to 185 deg F.
B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.

C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:

1. Average Density: 96 percent of reference laboratory density according to ASTM D 6927, but not less than 94 percent nor greater than 100 percent.
2. Average Density: 92 percent of reference maximum theoretical density according to ASTM D 2041, but not less than 90 percent nor greater than 96 percent.

D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.

E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.

F. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.

G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.6 INSTALLATION TOLERANCES

A. Pavement Thickness: Compact each course to produce the thickness indicated within the following tolerances:

1. Base Course: Plus or minus 1/2 inch.
2. Surface Course: Plus 1/4 inch, no minus.

B. Pavement Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:

1. Base Course: 1/4 inch.
2. Surface Course: 1/8 inch. Ensure no ponding on final surface course.
3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch.

3.7 PAVEMENT MARKING

A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.

B. Allow paving to age for 30 days before starting pavement marking.

C. Sweep and clean surface to eliminate loose material and dust.

D. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.
3.8 FIELD QUALITY CONTROL

A. Testing Agency: The Contractor shall provide qualified 3rd party testing agency to perform tests and inspections.

B. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D 3549.

C. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.

D. In-Place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement according to ASTM D 979.
   1. Reference maximum theoretical density will be determined by averaging results from four samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D 2041, and compacted according to job-mix specifications.
   2. In-place density of compacted pavement will be determined by testing core samples according to ASTM D 1188 or ASTM D 2726.
      a. One core sample will be taken for every 1,000 sq. yd. or less of installed pavement, with no fewer than 3 cores taken.
      b. Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D 2950 and correlated with ASTM D 1188 or ASTM D 2726.

E. Replace and compact hot-mix asphalt where core tests were taken.

F. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.9 DISPOSAL

A. Except for material indicated to be recycled, remove excavated materials from Project site and legally dispose of them in an EPA-approved landfill.

B. Do not allow milled materials to accumulate on-site.

END OF SECTION 321216
SECTION 321313 – CONCRETE PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Cement Concrete Pavement shall be performed in accordance with Sections 405 and 606 of the New Jersey Department of Transportation Standard Specifications for Road and Bridge Construction, latest edition.

1.2 SUMMARY

A. This Section includes exterior cement concrete pavement for the following:
   1. Concrete Sidewalks
   2. Concrete Foundations for equipment
   3. Concrete Curb

B. Related Sections include the following:
   1. Division 31 Section "Earth Moving" for subgrade preparation, grading, and subbase course.
   2. Division 3 Section "Cast-in-Place Concrete" for general building applications of concrete.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, and ground granulated blast-furnace slag.

1.4 SUBMITTALS

A. Product Data: For each type of manufactured material and product indicated.

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

C. Qualification Data: For manufacturer.

D. Material Test Reports: The Contractor shall provide from a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated, based on comprehensive testing of current materials:
   1. Aggregates.

E. Material Certificates: Signed by manufacturers certifying that each of the following materials complies with requirements:
   1. Cementitious materials.
   2. Steel reinforcement and reinforcement accessories.
   3. Admixtures.
4. Curing compounds.
5. Applied finish materials.
6. Bonding agent or epoxy adhesive.
7. Joint fillers.

F. Field quality-control test reports.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer of ready-mixed concrete products who complies with ASTM C 94/C 94M requirements for production facilities and equipment.

B. Testing Agency Qualifications: An independent agency qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.


D. Concrete Testing Service: The Contractor shall engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

1.6 PROJECT CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

PART 2 - PRODUCTS

2.1 FORMS

A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, smooth exposed surfaces.

1. Use flexible or curved forms for curves with a radius 100 feet or less.

B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

2.2 STEEL REINFORCEMENT

A. Plain-Steel Welded Wire Reinforcement: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.

B. Reinforcing Bars: ASTM A 615/A 615M, Grade 60; deformed.

2.3 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source throughout the Project:

1. Portland Cement: ASTM C 150, Type I/II,
B. Normal-Weight Aggregates: Aggregate shall be provided as per Section 901.06 of the New Jersey Department of Transportation Specifications.

C. Water: ASTM C 94/C 94M.


E. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.

2.4 CURING MATERIALS

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

B. Water: Potable.

2.5 RELATED MATERIALS


B. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

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

2.6 CONCRETE MIXTURES

A. Prepare design mixtures, proportioned according to ACI 301, for each type and strength of normal-weight concrete determined by either laboratory trial mixes or field experience.
   1. Use a qualified independent testing agency for preparing and reporting proposed concrete mixture designs for the trial batch method.

B. Proportion mixtures to provide normal-weight concrete with the following properties:
   1. Compressive Strength (28 Days): NJDOT class B concrete, as per NJDOT Specification Section 903 and as per plans.
   2. Maximum Water-Cementitious Materials Ratio at Point of Placement: As per NJDOT Specification Section 903

C. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:

D. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.
2.7 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Furnish batch certificates for each batch discharged and used in the Work.

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

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.

B. Proof-roll prepared subbase surface below concrete pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding.

1. Completely proof-roll subbase in one direction and repeat in perpendicular direction. Limit vehicle speed to 3 mph.
2. Proof-roll with a loaded 10-wheel tandem-axle dump truck weighing not less than 15 tons.
3. Subbase with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch require correction according to requirements in Division 31 Section "Earth Moving."

C. Proceed with concrete pavement operations only after nonconforming conditions have been corrected and subgrade is ready to receive pavement.

3.2 PREPARATION

A. Remove loose material from compacted subbase surface immediately before placing concrete.

3.3 EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for pavement to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.

B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.4 STEEL REINFORCEMENT

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

B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.

C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.
D. Install welded wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

E. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities, or replace units as required before placement. Set mats for a minimum 2-inch overlap of adjacent mats.

F. Dowel concrete repair sections per NJDOT Standard Specifications for Road and Bridge Construction 2007 Section 454 – Retrofit Dowel Bars.

3.5 JOINTS

A. General: Form construction, isolation, and contraction joints and tool edgings true to line with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline, unless otherwise indicated.

1. When joining existing pavement, place transverse joints to align with previously placed joints, unless otherwise indicated.

B. Construction Joints: Set construction joints at side and end terminations of pavement and at locations where pavement operations are stopped for more than one-half hour unless pavement terminates at isolation joints.

1. Continue steel reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of pavement strips, unless otherwise indicated.
2. Provide tie bars at sides of pavement strips where indicated.
3. Butt Joints: Use epoxy bonding adhesive at joint locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
4. Keyed Joints: Provide preformed keyway-section forms or bulkhead forms with keys, unless otherwise indicated. Embed keys at least 1-1/2 inches into concrete.
5. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt-coat one-half of dowel length to prevent concrete bonding to one side of joint.

C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, walks, other fixed objects, and where indicated.

1. Locate expansion joints at intervals of 50 feet, unless otherwise indicated.
2. Extend joint fillers full width and depth of joint.
3. Terminate joint filler not less than 1/2 inch or more than 1 inch below finished surface if joint sealant is indicated.
4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
6. Protect top edge of joint filler during concrete placement with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.

D. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows to match jointing of existing adjacent concrete pavement:

E. Edging: Tool edges of pavement, gutters, curbs, and joints in concrete after initial floating with an edging tool to a 1/4-inch radius. Repeat tooling of edges after applying surface finishes. Eliminate tool marks on concrete surfaces.
3.6 CONCRETE PLACEMENT

A. Inspection: Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast in. Notify other trades to permit installation of their work.

B. Remove snow, ice, or frost from subbase surface and reinforcement before placing concrete. Do not place concrete on frozen surfaces.

C. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.

D. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.

E. Do not add water to concrete during delivery or at Project site.

F. Do not add water to fresh concrete after testing.

G. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.

H. Consolidate concrete according to ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.
   1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement, dowels, and joint devices.

I. Screed pavement surfaces with a straightedge and strike off.

J. Commence initial floating using bull floats or darbies to impart an open textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

K. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
   1. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.
   2. Do not use frozen materials or materials containing ice or snow.
   3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mix designs.

L. Hot-Weather Placement: Comply with ACI 301 and as follows when hot-weather conditions exist:
   1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
   2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
   3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.
3.7 FLOAT FINISHING

A. General: Do not add water to concrete surfaces during finishing operations.

B. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats, or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.

   1. Medium-to-Coarse-Textured Broom Finish: Provide a coarse finish by striating float-finished concrete surface 1/16 to 1/8 inch deep with a stiff-bristled broom, perpendicular to line of traffic.

3.8 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

B. Comply with ACI 306.1 for cold-weather protection.

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

D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

E. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound, or a combination of these as follows:

   1. Moist Curing: Keep surfaces continuously moist for not less than seven days with the following materials:

      a. Water.
      b. Continuous water-fog spray.
      c. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.

3.9 PAVEMENT TOLERANCES

A. Comply with tolerances of ACI 117 and as follows:

   1. Elevation: 1/4 inch.
   3. Surface: Gap below 10-foot-long, unlevelled straightedge not to exceed 1/4 inch.
   4. Lateral Alignment and Spacing of Tie Bars and Dowels: 1 inch.
   5. Vertical Alignment of Tie Bars and Dowels: 1/4 inch.
   6. Alignment of Tie-Bar End Relative to Line Perpendicular to Pavement Edge: 1/2 inch.
   7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Pavement Edge: Length of dowel 1/4 inch per 12 inches.
   8. Joint Spacing: 3 inches.

3.10 FIELD QUALITY CONTROL

A. Testing Agency: The Contractor shall provide qualified 3rd party testing and inspecting agency to perform field tests and inspections and prepare test reports.
B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

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

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

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

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

5. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.

6. Compressive-Strength Tests: ASTM C 39/C 39M; test 1 specimen at 7 days and 2 specimens at 28 days.
   a. A compressive-strength test shall be the average compressive strength from 2 specimens obtained from same composite sample and tested at 28 days.

C. Strength of each concrete mix will be satisfactory if average of any 3 consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.

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

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

F. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.

G. Remove and replace concrete pavement where test results indicate that it does not comply with specified requirements.

H. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.11 REPAIRS AND PROTECTION

A. Remove and replace concrete pavement that is broken, damaged, or defective or that does not comply with requirements in this Section.

B. Drill test cores, where directed by Architect, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with portland cement concrete bonded to pavement with epoxy adhesive.
C. Protect concrete from damage. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur.

D. Maintain concrete pavement free of stains, discoloration, dirt, and other foreign material. Sweep concrete pavement not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 321313
SECTION 321316
DECORATIVE CONCRETE PAVING

SECTION INCLUDES

A. Integrally colored Portland cement concrete paving with imprinted pattern, stain and cure/sealer.

B. Integrally colored and color-hardened Portland cement concrete paving with imprinted pattern and stain/sealer treatments.

REFERENCES

A. ACI 301 - Specifications for Structural Concrete for Buildings.

B. ACI 302 - Guide for Concrete Floor and Slab Construction.

C. ACI 303 - Guide to Cast-in-Place Architectural Concrete Practice.

D. ACI 305R - Hot Weather Concreting.

E. ACI 306R - Cold Weather Concreting.

F. ACI 308 - Standard Practice for Curing Concrete.

G. ACI 309 - Standard Practice for Consolidation of Concrete.

H. ACI 347 - Guide to Formwork for Concrete.

I. ACI 503 - Standard Specification for Bonding Plastic Concrete to Hardened Concrete with a Multi-Component Epoxy Adhesive.

J. ASTM C33 - Standard Specifications for Concrete Aggregates.


N. ASTM C494 - Standard Specifications for Chemical Admixtures for Concrete.

O. ASTM C618 - Standard Specifications for Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete.


R. ASTM A615 - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.


X. ASTM C1059 - Standard Specification for Latex Agents for Bonding Fresh To Hardened Concrete.


SUBMITTALS

A. 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.

B. Testing:
1. Submit proposed mix design for each class of concrete for review prior to commencement of work.
2. Testing firm will take cylinders and perform slump and air entrainment tests in accordance with ACI 301.
3. Two concrete test cylinders will be taken for each class of concrete placed each day.
4. One slump test will be taken for each set of test cylinders taken.
5. Testing to be coordinated and paid for by contractor.

QUALITY ASSURANCE

A. Manufacturer Qualifications:

B. Installer Qualifications:
   1. The Installer shall provide a qualified foreman or supervisor who has a minimum of three years experience with imprinted and textured concrete, and who has successfully completed at least five Bomanite imprinted concrete installations of high quality and similar in scope to that required.
   2. The concrete is cast in place, on the job site, by trained and experienced workmen who shall be employed by a firm that is a licensed and certified Bomanite Imprint Licensed Contractor
   3. Perform work in accordance with ACI 301, 302, 303.
   4. Obtain materials from same source throughout.
   5. Conform to applicable codes and regulations for paving work performed within the public right of way.

C. Ready-Mixed Supplier Qualifications: Supplier of ready-mixed concrete products shall comply with ASTM C 94 requirements for production facilities and equipment. Supplier shall be certified according to NCRMA’s “Certification of Ready Mixed Concrete Production Facilities Quality Control Manuals.”

D. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 to conduct the testing indicated, as documented according to ASTM E 548.

E. Mock-Up: Provide field samples of surface colors textures and patterns specified for architect approval prior to beginning work, 48 inches by 48 inches (1219 mm by 1219 mm) in size illustrating paving finishes.
   1. Finish areas designated by Architect.
   2. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.
   3. Refinish mock-up area as required to produce acceptable work.

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.

PROJECT CONDITIONS

A. Do not place pavement when base surface or ambient temperature is less than 40 degrees F (4 degrees C) or if base surface is wet or frozen.

B. 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.

WARRANTY

A. All materials manufactured by The Bomanite Company are warranted to be of uniform quality within manufacturing tolerances.

B. Since control is not exercised over their use, no warranty, expressed or implied, is made as to the effects of such use. The Bomanite Company's obligation under this warranty shall be limited to refunding the purchase price of that portion of the material proven to be defective.

MANUFACTURERS


SYSTEM

A. Supporting Structure:

1. Mix Design:
   a. Mix and deliver concrete in accordance with ASTM C94, Alternate 2.
   b. Use accelerating admixtures containing no calcium chloride in cold weather only when approved by testing laboratory. Use of admixtures will not relax cold weather placement requirements.
   c. Use set retarding admixtures during hot weather only when approved by testing laboratory.
   d. Add air entraining agent to concrete mix for concrete work exposed to exterior, in amounts of 4 to 7 percent of total concrete volume or as otherwise recommended by testing laboratory.
   e. Add coloring admixture where scheduled in quantities recommended by coloring admixture manufacturer to achieve selected color.
f. Add polypropylene fiber reinforcement at point of concrete batching at rate scheduled.
g. Maintain water cement ratio to produce a minimum of 3 to maximum of 5 inch slump.
h. Use of calcium chloride is strictly prohibited.

2. Subgrade:
a. Refer to Section 02300 for subgrade preparation.
b. Refer to drawings for scope of subgrade preparation.

3. Reinforcement:
a. Fiber Reinforcement: ASTM C948, collated, fibrillated, 3/4 inch (19 mm) long virgin polypropylene fibers, equal to BOMANITE Fibers by The Bomanite Company.
b. Reinforcing Steel: ASTM A615; Grade 60; deformed billet steel bars, uncoated finish.
c. Welded Steel Wire Fabric: Plain type, ANSI/ASTM A185; in flat sheets; uncoated finish.

B. Color:
1. Integral Color:
   1) Type A, cement dispersing/water reducing.
   2) Type D, set retarding/water reducing.
   3) Color to match Architect's sample.

2. Color Hardener:
a. Bomanite Color Hardener: The concrete shall be colored with Bomanite Color Hardener. Color(s) as scheduled. Refer to Drawings.

C. Tools Selection:
1. Imprinting Tools:
a. Mat type imprinting tools for texturing freshly placed concrete, in pattern/texture as selected by Architect or as scheduled.
b. Imprinting tools used in the execution of this project shall be manufactured by The Bomanite Company.
2. Bomanite Patterns: Design(s) as scheduled. Refer to Drawings.
3. Bomacron Textures and Patterns: Design(s) as scheduled. Refer to Drawings.

D. Release Agent Selection:

E. Secondary Antique or Coloration:
1. Topical Stain: Color(s) as scheduled. Refer to Drawings.
a. Bomanite Topical Stain.
2. Chemical Stain: Color(s) as scheduled. Refer to Drawings.
a. Bomanite Chemical Stain.

F. Cure Agent:
   1. Membrane Color Cure: Color(s) as scheduled. Refer to Drawings.
         1) BOMANITE Color Cure by The Bomanite Company.
         2) BOMANITE Clear Cure by The Bomanite Company.
         3) BOMANITE Clear Cure Matte Finish by The Bomanite Company.
   2. Silicate Cure & Densifier:
      a. The concrete shall receive a cure treatment utilizing Bomanite ConShield.

G. Sealing and Finish Coatings:
   1. Colorwax by The Bomanite Company.
   2. Hydrolock by The Bomanite Company.
   3. VOC II by The Bomanite Company.

RELATED MATERIALS

A. Cement: ASTM C150, type 1, Portland cement, gray color.


C. Water: Clean and not detrimental to concrete.

D. Form Material: Conform to ACI 301. If using metal, material shall be free from deformities. If using wood, use construction grade lumber, sound and free of warp, minimum 2 inches (51 mm) nominal thickness, except where short radii of curves require thinner forms.

E. Contraction Joint Devices: Galvanized sheet metal, keyed profile, with knock-outs for reinforcing and dowel steel.

F. Tie Wire: Annealed steel, minimum 16 gage (1.519 mm) size.

G. Dowels: ASTM A615; Grade 40, plain steel, uncoated finish.

H. Miscellaneous Reinforcing Accessories: Spacers, chairs, ties, and other devices necessary for properly placing, spacing, supporting, and fastening reinforcement in place.

I. Form release agent: As acceptable to concrete colorant manufacturer, non-staining, dissipative type.

J. Vapor Retarding Membrane: 10 mil (.2540 mm) reinforced polyethylene.
K. Air-Entraining Admixture: ASTM C 206. Air Entrained Concrete shall be used wherever concrete is exposed to the freezing weather. Proportions of entrained air, as determined by ASTM C233, and C260, shall be as follows:
   1. Aggregate: 3/8 inch (9.5 mm) maximum size aggregate 6-8 percent entrained air.
   2. Aggregate: 3/4 inch (19 mm) maximum size aggregate 5-7 percent entrained air.

L. Joint Fillers:
   1. Redwood Boards: Construction heart grade redwood, sound and free of checks, splits or other defects, 3/4 inch (19 mm) thick.
   2. Asphaltic Joint Filler: Asphalt impregnated fiberboard, ASTM D1751, 1/2 inch (12 mm) thick.
   3. Non-Asphaltic Joint Fillers: ASTM D1752, Type I.

M. Sealants: Two part polyurethane sealants, of grade as required to suit application, meeting ASTM C920, in manufacturer's custom colors.
   1. Urethane, SL grade, as specified in Section 07920.
   2. Urethane, SL-TB grade as specified in Section 07920.

N. Bonding-Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene rubber.

O. Epoxy-Bonding Adhesive: ASTM C 881, two component epoxy resin, capable of humid curing and bonding to damp surface, of class and grade to suit requirements if required, and as follows: Types I and II, non-load bearing, for bonding hardened of freshly mixed concrete to hardened concrete.

INSPECTION

A. Verify compacted subgrade is ready to support paving and imposed loads, free of frost, smooth and properly compacted.

B. Verify gradients and elevations of base are correct, and proper drainage has been provided so water does not stand in the area to receive paving.

C. Beginning of installation means acceptance of existing conditions.

PREPARATION

A. If vapor retarding membrane is not used, moisten base to minimize absorption of water from fresh concrete.

B. Notify Architect and testing laboratory, minimum 24 hours prior to commencement of concreting operations.

FORMING
A. Construct and remove forms in accordance with ACI 347.

B. Place and secure forms to correct location, dimension, and profile. Adequately brace to withstand loads applied during concrete placement.

C. Assemble formwork to permit easy stripping and dismantling without damaging concrete.

D. Place joint fillers vertical in position, in straight lines. Secure to formwork during concrete placement.

**INSERTS AND ACCESSORIES**

A. Make provisions for installation of inserts, accessories, anchors, and sleeves.

B. Place vapor retarder continuously over subgrade. Overlap joints a minimum of 12 inches (305 mm) and seal with a joint tape of same permeance as sheeting material.

**REINFORCEMENT**

A. Accurately place reinforcement in middle of slabs-on-grade.

B. Discontinue every other bar of reinforcement at control and expansion joints.

C. Place reinforcement to achieve slab and curb alignment as detailed.

D. Steel shall be free of rust, mill scale, dirt and oil.

E. Provide doweled joints at interruptions of concrete with one end of dowel set in capped sleeve to allow longitudinal movement. Provide support at both ends of dowels.

F. Support reinforcing on bar chairs. Securely saddle tie at intersections. Rigidly secure in place to minimize displacement during concrete pour.

**JOINTS**

A. Intentional stoppage of concrete placing shall be at planned location of either an expansion joint or contraction joint.

B. When stoppage occurs at an expansion joint, install joint assembly with a bulkhead of sufficient section drilled to accommodate required dowels. Provide expansion joints at maximum 40 feet (12 m) o.c.e.w. in parking lots, 40 feet (12 m) o.c. for curbs and maximum 20 feet (6 m) o.c.e.w. at pedestrian paving.
C. When stoppage occurs at a contraction joint, install sheet metal joint assembly of sufficient section to prevent deflection, shaped to concrete section. Drill bulkhead to permit continuation of longitudinal reinforcing steel through construction joint.

D. Stoppage at Unintentional Location:
   1. Immediately upon unintended stoppage of concrete placing, place available concrete to a line and install bulkhead perpendicular to surface of pavement and at required elevation. Place and finish concrete to this bulkhead. Remove and dispose of concrete remaining on subgrade ahead of bulkhead.
   2. When placing of concrete is resumed before concrete has set to extent that concrete will stand on removal of bulkhead, new concrete shall be rodded with the first; otherwise, carefully preserve joint face.
   3. Provide a joint seal space at edges created by a construction joint of this type shall have a joint seal space as detailed on Drawings.

E. Provide sawed contraction joints in vehicular paving and curbs spaced as detailed on Drawings, but in no case greater than 20 feet (6 m) o.c. spacing.
   1. Saw joints after completion of finishing operations as soon as concrete has hardened to extent necessary to prevent revealing of joint or damage to adjacent concrete surfaces.
   2. Saw joints same day that concrete is placed except that sawing of joints in concrete placed late in day may be delayed until morning of following day.
   3. In any event, saw joints within 18 hours after placing concrete.
   4. Use a power-driven concrete saw made especially for sawing concrete and maintain in good operating condition.
   5. Saw cut shall be to a depth equal to 1/4 of slab thickness, minimum one inch (25 mm) depth.
   6. Align joints in vehicular paving with joints in adjacent pedestrian paving.
   7. Cut joints through curbs at right angles to back of curb.

F. Place joint filler between paving components and building or other appurtenances.

G. Provide scored joints in sidewalks and plazas to a depth of 1/4 the slab thickness, and at intervals as indicated, but in no case spaced greater than width of walk.

**PLACING CONCRETE**

A. Place concrete in accordance with ACI 301, 302, and 304. Deposit concrete so that specified slab thickness will be obtained after vibrating and finishing operations. Minimize handling to prevent segregation. Consolidate concrete by suitable means to prevent formation of voids or honeycombs. Exercise care to prevent disturbance of forms and reinforcing and damage to vapor retarder. Place concrete to lines and levels shown, properly sloped to drain as designed.
   3. Ensure reinforcement, inserts, embedded parts, and formed joints are not disturbed during concrete placement.
4. Place concrete continuously between predetermined construction joints. Do not break or interrupt successive pours such that cold joints occur.

B. After consolidating and screeding, float concrete to gradients indicated. Use a straight edge to level and test surface in longitudinal direction to required grade. Finish edges to provide a smooth dense surface with 1/8 inch (3 mm) radius.

C. Apply Bomanite Color Hardener prior to application of pattern. Apply at rate recommended by manufacturer, evenly to the surface of the fresh concrete by the dry-shake method. Applied in two or more shakes, floated after each shake and troweled only after the final floating.

D. While concrete is still in its plastic state, apply the tool/texture pattern to the surface of the concrete. Properly tamp tools into the surface to achieve the required texture, with uniformity of pattern and depth of stamping. Utilize bond breaker to keep tools from sticking to fresh concrete.
   1. Release material shall be applied to the troweled surface prior to imprinting.

E. Place curing compound on exposed concrete surfaces immediately after finishing. Apply in accordance with manufacturer's instructions.

F. Apply secondary stain treatment per approved mock-up or as scheduled to achieve design.

G. Apply finish sealer per approved mock-up or as specified to achieve design required.

PROTECTION

A. Immediately after placement, protect concrete under provisions of Section 01500 from premature drying, excessive hot or cold temperatures, and mechanical injury.

END OF SECTION 321316
SECTION 321317 THIN-SET CEMENTITIOUS OVERLAY

RELATED DOCUMENTS

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

SUMMARY

A. Related Sections include the following:

1. Cast-in-Place Concrete for concrete slabs.

DEFINITIONS

A. Thin-Set II:

1. A trowel applied cementitious topping modified with specialized resins applied in multiple layers to achieve a final thickness of approximately 5/16” – ¾”. The product is applied for decorative applications with the ultimate appearance to resemble slate, stone or other texture created through imprinting with polyurethane tools.

SUBMITTALS

B. Product Data:

1. Submit special concrete finishes manufacturer’s specifications, test data and other data required for each type of manufactured material and product indicated.

2. Submit special concrete finishes technical bulletins listing manufacturer’s name, product name, descriptive data, curing time and application requirements.

3. Submit special concrete finishes manufacturer’s Material Safety Data Sheet (MSDS) and other safety requirements.

QUALITY ASSURANCE

A. Installer Qualifications: The contractor for this work shall be a Bomanite Toppings Licensee and Certified Applicator approved by The Bomanite Company (303) 369-1115.
1. Provide letter of certification from The Bomanite Company stating that installer is a certified applicator of special concrete finishes and is familiar with proper procedures/installation requirements required by the manufacturer.

2. Use an authorized Bomanite Toppings Licensee and adequate number of skilled workmen who are thoroughly trained and experienced in the necessary craft.

3. Applicator shall be familiar with the specified requirements and the methods needed for proper performance of work of this section.

4. Applicator shall be familiar with the previously approved mock-ups that demonstrated standard of workmanship.

5. Authorized installers limited to the following:
   a. www.bomanite.com/locate

B. Manufacturer Qualifications: A firm experienced in the support and training of a national installer network and manufacturing products required/listed to complete the work.

C. Source Limitations: Obtain all materials required for the installation through The Bomanite Company or Bomanite approved vendors.

D. Mock-ups:
   1. Apply finish to mock-ups constructed by concrete contractor, using each type of finish to demonstrate finished appearance and standard of workmanship.
      a. Mock-up shall include entire system, including primers, toppings, decorative finishes and clear coatings.
      b. Obtain from Architect approval of mock-ups before starting construction.
      c. If the Architect determines that the mock-ups do not meet requirements, General Contractor will demolish and remove them from the site and arrange to assemble more until approved.
      d. Maintain mock-ups during construction in an undisturbed condition as a standard for judging the completed work.

DELIVERY, STORAGE AND HANDLING

A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer labels indicating brand name and directions for storage, mixing with other components and application.
B. Store materials to comply with manufacturer’s written instructions to prevent deterioration from moisture or other detrimental effects.

C. Dispense special concrete finish material from factory numbered and sealed containers. Maintain record of container numbers.

PROJECT CONDITIONS

A. Environmental Limitations:

1. Comply with manufacturer’s written instructions for ambient temperature and other conditions affecting installation performance.

2. The topping must be cured a minimum of 2 days or as directed by the manufacturer before foot trafficking can begin with an additional 2 days for vehicular traffic.

MANUFACTURERS

A. In other Part 2 articles where titles below introduce products, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturer listed. For other manufacturers to be considered, submit according to the specifications in “Product Requirements.”

   a. The Bomanite Company (303) 369-1115

PERFORMANCE REQUIREMENTS

A. The product is required to resist common pool chemicals.

B. The product is required to have a compressive value greater than 4500 psi.

MATERIALS

A. Bomanite Thin-Set II Powder and Liquid: Color selected from manufacturer’s standard color charts or from samples provided.

C. Bomanite XP Primer: Water based epoxy primer for use under the topping products to enhance bond to the prepared substrate.

D. Bomanite Repair Mortar: Polymer modified cementitious repair product for correcting elevations between topping systems, transitions at doors or general-purpose patching requirements under the topping products.
E. Bomanite Florthane WB: Water based clear urethane coating with superior chemical resistance designed to protect and enhance the topping products.
   1. Available in Matte and Gloss Finish

F. Bomanite Extra Sure Trac: A polymer bead designed to improve the Co-Efficient of Friction of clear topcoat coatings to in areas subject to water exposure.

G. No substitutions or alternates to the above will be accepted.

EXAMINATION

A. Examine the areas and conditions where the Bomanite Topping System is to be installed and notify the Architect and General Contractor of conditions detrimental to the proper and timely completion of work. Do not proceed with the work until the General Contractor in a manner acceptable to both the Architect and Bomanite installer has corrected all unsatisfactory conditions.

B. Verify that the slab meets a minimum of 3000 psi in compressive strength.

PREPARATION

A. Shot blast, scarify or diamond grind the concrete surface prior to installing the Bomanite Topping System. Meet an ICRI CSP 3 or greater.

B. Verify that the substrate meets Project Conditions above.

C. Layout all control joints or saw cuts required in the finished toppings prior to installation.

D. Determine if there are any cracks or structural issues that need to be repaired or isolated prior to topping installation.

E. Prior to topping installation, verify that the substrate or any repairs to the substrate are free of construction damage and contaminants.

INSTALLATION

A. Construction Process:

   1. Apply the XP Primer in accordance to the Bomanite XP Primer Application Guidelines.

   2. Correct any elevations in accordance to the Bomanite Repair Mortar Application Guideline.

   3. Install the Thin-Set II in accordance with the Bomanite Application Guidelines.
4. Proceed with any coloring applications and clear coating in accordance with the Bomanite Application Guidelines.

5. Honor any and all control joints, expansion joints or isolation joints in the substrate by cutting and filling with an appropriate polyurethane sealant.

PROTECTION

A. General: Protect finished work from traffic until fully cured in accordance with manufacturer’s recommendations.

END OF SECTION 321317
SECTION 329200 - TURF AND GRASSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Turf and Grasses shall be performed in accordance with Sections 804, 806, 809 and 810 of the New Jersey Department of Transportation Standard Specifications for Road and Bridge Construction, latest edition.

1.2 SUMMARY

A. This Section includes the following:
   1. Seeding.
   2. Topsoil.
   3. Straw Mulch.
   4. Mowing.

B. Related Sections include the following:
   1. Division 2 Section "Site Clearing" for topsoil stripping and stockpiling.
   2. Division 2 Section "Earth Moving" for excavation, filling and backfilling, and rough grading.

C. All areas disturbed and all areas within the property boundaries are to be restored with topsoil, fertilizer and seed if no other material is defined. The Contractor shall topsoil, fertilize and seed and straw mulch grass areas disturbed during construction.

1.3 DEFINITIONS

A. Finish Grade: Elevation of finished surface of planting soil.

B. Manufactured Soil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.

C. Planting Soil: Native or imported topsoil, manufactured topsoil, or surface soil modified to become topsoil; mixed with soil amendments.

D. Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill immediately beneath planting soil.

1.4 SUBMITTALS

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

B. Certification of Grass Seed: From seed vendor for each grass-seed monostand or mixture stating the botanical and common name and percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging.
1. Certification of each seed mixture, identifying source, including name and telephone number of supplier.

C. Product Certificates: For soil amendments and fertilizers, signed by product manufacturer.

D. Qualification Data: For landscape Installer.

E. Material Test Reports: For existing surface soil and imported topsoil.

F. Planting Schedule: Indicating anticipated planting dates for each type of planting.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful lawn establishment.

1. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when planting is in progress.

B. Soil-Testing Laboratory Qualifications: An independent laboratory, recognized by the State Department of Agriculture, with the experience and capability to conduct the testing indicated and that specializes in types of tests to be performed.

C. Topsoil Analysis: Furnish soil analysis by a qualified soil-testing laboratory stating percentages of organic matter; gradation of sand, silt, and clay content; cation exchange capacity; deleterious material; pH; and mineral and plant-nutrient content of topsoil.

1. Report suitability of topsoil for lawn growth. State recommended quantities of nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce a satisfactory topsoil.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Seed: Deliver seed in original sealed, labeled, and undamaged containers.

1.7 SCHEDULING

A. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with maintenance periods to provide required maintenance from date of Substantial Completion.

1. Spring Planting: 3/1-4/30
2. Fall Planting: 8/15-11/15

B. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit.

1.8 LAWN MAINTENANCE

A. Begin maintenance immediately after each area is planted and continue until acceptable lawn is established, but for not less than the following periods:

1. Lawns: 3 months from date of Substantial Completion.
When full maintenance period has not elapsed before end of planting season, or if lawn is not fully established, continue maintenance during next planting season.

Maintain and establish lawn by watering, fertilizing, weeding, mowing, trimming, replanting, and other operations. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth lawn.

1. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch. Anchor as required to prevent displacement.

Watering: Provide and maintain temporary piping, hoses, and lawn-watering equipment to convey water from sources and to keep lawn uniformly moist to a depth of 4 inches.

1. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly planted areas.
2. Water lawn at a minimum rate of 1 inch per week.

Mow lawn as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than 40 percent of grass height. Remove no more than 40 percent of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet. Schedule initial and subsequent mowings to maintain the following grass height:
1. Mow grass 1 to 2 inches high.

Lawn Post fertilization: Apply fertilizer after initial mowing and when grass is dry.
1. Use fertilizer that will provide actual nitrogen of at least 1 lb/1000 sq. ft. to lawn area.

PART 2 - PRODUCTS

2.1 SEED

A. Grass Seed: Fresh, clean, dry, new-crop seed complying with AOSA's "Journal of Seed Technology; Rules for Testing Seeds" for purity and germination tolerances.
1. Seed Species: 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. Seed shall be NJDOT type A as per section 917.05 of the NJDOT Standard Specifications.

2.2 TOPSOIL

A. Topsoil: ASTM D 5268, pH range of 5.5 to 7, a minimum of 5 percent organic material content; free of stones 1 inch or larger in any dimension and other extraneous materials harmful to plant growth.
1. Topsoil Source: Reuse surface soil stockpiled on-site. Verify suitability of stockpiled surface soil to produce topsoil. Clean surface soil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful to plant growth.
   a. Supplement with imported or manufactured topsoil from off-site sources when quantities are insufficient. Obtain topsoil displaced from naturally well-drained construction or mining sites where topsoil occurs at least 4 inches deep; do not obtain from bogs or marshes.
2. Topsoil Source: Import topsoil or manufactured topsoil from off-site sources. Obtain topsoil displaced from naturally well-drained construction or mining sites where topsoil occurs at least 4 inches deep; do not obtain from bogs or marshes.
3. Topsoil Source: Amend existing in-place surface soil to produce topsoil. Verify suitability of surface soil to produce topsoil. Clean surface soil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful to plant growth.
   
   a. Surface soil may be supplemented with imported or manufactured topsoil from off-site sources. Obtain topsoil displaced from naturally well-drained construction or mining sites where topsoil occurs at least 4 inches deep; do not obtain from bogs or marshes.

2.3 INORGANIC SOIL AMENDMENTS

A. Lime: ASTM C 602, agricultural limestone containing a minimum 80 percent calcium carbonate equivalent and as follows:
   
   1. Class: Class T, with a minimum 99 percent passing through No. 8 sieve and a minimum 75 percent passing through No. 60 sieve.

2.4 ORGANIC SOIL AMENDMENTS

A. Compost: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1/2-inch sieve; soluble salt content of 5 to 10 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:
   
   1. Organic Matter Content: 50 to 60 percent of dry weight.

2.5 FERTILIZER

A. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:
   
   1. Composition: 1 lb/1000 sq. ft. of actual nitrogen, 4 percent phosphorous, and 2 percent potassium, by weight.
   2. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing agency.

B. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:
   
   1. Composition: 20 percent nitrogen, 10 percent phosphorous, and 10 percent potassium, by weight.
   2. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing agency.

2.6 STRAW MULCH

A. Straw Mulch: Provide air-dry, clean, mildew- and seed-free, salt hay or threshed straw of wheat, rye, oats, or barley.

B. Asphalt Emulsion: ASTM D 977, Grade SS-1; nontoxic and free of plant-growth or germination inhibitors.
PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive lawns and grass for compliance with requirements and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities, trees, shrubs, and plantings from damage caused by planting operations.
   1. Protect adjacent and adjoining areas from hydro seeding overspray.

B. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.3 LAWN PREPARATION

A. Limit lawn subgrade preparation to areas to be planted.

B. Newly Graded Subgrades: Loosen subgrade to a minimum depth of 4 inches. Remove stones larger than 2 inches in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.
   1. Apply fertilizer directly to subgrade before loosening.
   2. Thoroughly blend planting soil mix off-site before spreading or spread topsoil, apply soil amendments and fertilizer on surface, and thoroughly blend planting soil mix.
      a. Delay mixing fertilizer with planting soil if planting will not proceed within a few days.
      b. Mix lime with dry soil before mixing fertilizer.
   3. Spread planting soil mix to a depth of 6 inches but not less than required to meet finish grades after light rolling and natural settlement. Do not spread if planting soil or subgrade is frozen, muddy, or excessively wet.

C. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus 1/2 inch of finish elevation. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit fine grading to areas that can be planted in the immediate future.

D. Moisten prepared lawn areas before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

E. Restore areas if eroded or otherwise disturbed after finish grading and before planting.

3.4 SEEDING

A. Sow seed with spreader or seeding machine. Do not broadcast or drop seed when wind velocity exceeds 5 mph. Evenly distribute seed by sowing equal quantities in two directions at right angles to each other.
   1. Do not use wet seed or seed that is moldy or otherwise damaged.

B. Sow seed at the rate of 3 to 4 lb/1000 sq. ft.
C. Rake seed lightly into top 1/8 inch of topsoil, roll lightly, and water with fine spray.

D. Protect seeded areas by spreading straw mulch. Spread uniformly at a minimum rate of 2 tons/acre to form a continuous blanket 1-1/2 inches in loose depth over seeded areas. Spread by hand, blower, or other suitable equipment.
   1. Bond straw mulch by spraying with asphalt emulsion at the rate of 10 to 13 gal./1000 sq. ft. Take precautions to prevent damage or staining of structures or other plantings adjacent to mulched areas. Immediately clean damaged or stained areas.

3.5 SATISFACTORY LAWNS

A. Satisfactory Seeded Lawn: At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding 90 percent over any 10 sq. ft. (0.92 sq. m) and bare spots not exceeding 5 by 5 inches.

3.6 CLEANUP AND PROTECTION

A. Promptly remove soil and debris created by lawn work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

B. Erect barricades and warning signs as required to protect newly planted areas from traffic. Maintain barricades throughout maintenance period and remove after lawn is established.

C. Remove erosion-control measures after grass establishment period.

END OF SECTION 329200
SECTION 323123 - VINYL FENCES AND GATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Privacy fences.
   2. Swing gates.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:
      a. Fence and gate posts, rails, and fittings.
      b. Gates and hardware.
   2. Manufacturer Warranty

B. Shop Drawings: For each type of fence and gate assembly.
   1. Include plans, elevations, sections, details, and attachments to other work.
   2. Include accessories, hardware, gate operation, and operational clearances.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the Project site in manufacturer's original wrappings and containers, labeled with manufacturer's name, material or product brand name.

B. Store materials in their original, undamaged packages and containers, inside a well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

1.5 FIELD CONDITIONS

A. Field Measurements: Verify layout information for vinyl fences and gates shown on Drawings in relation to property survey and existing structures. Verify dimensions by field measurements.
PART 2 - PRODUCTS

2.1 FENCE FRAMEWORK

A. Posts and Rails: ASTM D 1784 for framework, including rails, braces, and line; terminal; and corner posts. Provide members with minimum dimensions and wall thickness based on the following:

1. Fence Height: 60-inches, unless otherwise indicated.
2. Section Width: 6 foot.
3. Tongue and Groove Panels: 7/8 inch by 8-1/2 inch with 4 inch appearance.
4. Posts and Post Caps: 5 inch by 5 inch.

2.2 SWING GATES

A. General: ASTM D 1784 for gate posts and single swing gate types.


B. Hardware: Stainless steel with aluminum latch clappers.

2. Latch: Permitting operation from both sides of gate.
3. Lock: Manufacturer's standard internal device.
4. Aluminum Handle: Manufacturer’s standard; powder coated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, pavement work, and other conditions affecting performance of the Work.

1. Do not begin installation before final grading is completed unless otherwise permitted by Architect.

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

3.2 PREPARATION

A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet or line of sight between stakes. Indicate locations of utilities, underground structures, benchmarks, and property monuments.

3.3 VINYL FENCE INSTALLATION

A. Install fencing in accordance with manufacturer's instructions.
B. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings indicated, in firm, undisturbed soil.

C. Post Setting: Set posts by mechanically driving into soil at indicated spacing into firm, undisturbed soil.
   1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
   2. Mechanically Driven Posts: Drive into soil to depth of 36 inches. Protect post top to prevent distortion.

D. Terminal Posts: Install terminal end, corner, and gate posts according to ASTM F 567 and terminal pull posts at changes in horizontal or vertical alignment of 15 degrees or more. For runs exceeding 500 feet, space pull posts an equal distance between corner or end posts.

E. Post Bracing and Intermediate Rails: Install according to ASTM F 567, maintaining plumb position and alignment of fence posts. Install braces at end and gate posts and at both sides of corner and pull posts.

3.4 GATE INSTALLATION

A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach hardware using tamper-resistant or concealed means. Adjust hardware for smooth operation.

3.5 ADJUSTING

A. Clean the work according to manufacturer's written instructions. Post hole excavations shall be scattered uniformly away from the posts. Clean fence with mild household detergent and rinse well with clean water.

B. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

C. Lubricate hardware and other moving parts.

D. Touch-up, repair or replace damaged products prior to Substantial Completion

END OF SECTION 323123
SECTION 334100 – STORM UTILITY DRAINAGE PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Storm Drainage shall be performed in accordance with Sections 601 and 602 of the New Jersey Department of Transportation Standard Specifications for Road and Bridge Construction, latest edition.

1.2 SUMMARY

A. This Section includes gravity-flow, nonpressure storm drainage with the following components:
   1. Drainage pipe.
   2. Catch Basins and Inlets.
   3. Drainage Manholes

B. Related Sections include the following:
   1. Division 31 Section "Earth Moving" for excavation and backfill.
   2. Division 31 Section "Dewatering" for dewatering.
   3. Division 31 Section "Excavation Support and Protection" for excavation support and protection.
   4. Division 03 Section "Cast-in-Place Concrete" for cast-in-place concrete structures.

C. All pipe outlets, manholes, and inlets shall be constructed as per the project plans and details.

1.3 DEFINITIONS

A. RCP: Reinforced concrete pipe

B. PVC: Polyvinyl chloride

C. HDPE: High density polyethylene pipe

1.4 PERFORMANCE REQUIREMENTS

A. Gravity-Flow, Nonpressure, Drainage-Piping Pressure Rating: 10-foot head of water. Pipe joints shall be at least silt tight, unless otherwise indicated.

B. Construction of roof drainage shall conform to the “National Standard Plumbing Code,” latest edition, and local codes, as applicable

C. All other work to be performed under this Section shall comply with the provisions of Sections 601 and 602 of the “NJDOT Standard Specification for Road and Bridge Construction, 2007,” as amended herein.

1.5 SUBMITTALS

A. Product Data: For the following:
1. Reinforced Concrete Pipe.
2. High Density Polyethylene Pipe.
3. Concrete Structures.

B. Shop Drawings: For the following:
   1. Catch Basins and Manholes: Include plans, elevations, sections, details, and frames and covers. Include design calculations, and concrete design-mix report for cast-in-place structures.
   2. Pipe, pipe coupling, connections, transitions.

C. Field quality-control test reports.

1.6 DELIVERY, STORAGE, AND HANDLING
   A. Protect pipe, pipe fittings, and seals from dirt and damage.
   B. Do not store plastic pipe and fittings in direct sunlight.
   C. Handle manholes according to manufacturer's written rigging instructions.
   D. Handle stormwater inlets according to manufacturer’s written rigging instructions.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS
   A. Refer to Part 3 "Piping Applications" Article for applications of pipe, fitting, and joining materials.

2.2 CONCRETE PIPE AND FITTINGS
   A. Reinforced-Concrete Sewer Pipe and Fittings: ASTM C 76, with straight wall ends and gasketed joints with ASTM C 443, rubber gaskets.

2.3 HDPE PIPE AND FITTINGS
   A. HDPE pipe and fittings: smooth interior wall conforming to ASTM F2648. Joints shall be bell and spigot conforming to ASTM F2648.
   B. Fittings shall conform to ASTM F2306.
   C. Manufacturers, HDPE Piping:
      1. Advanced Drainage Systems, Inc.
      2. Hancor, Inc.
      4. Or Approved Equal

2.4 NONPRESSURE-TYPE PIPE COUPLINGS
   A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.

   B. Sleeve Materials:
1. For Concrete Pipes: ASTM C 443, rubber.

C. Unshielded Flexible Couplings: Elastomeric sleeve with corrosion-resistant-metal tension band and tightening mechanism on each end.

2.5 MANHOLES

A. Standard Precast Concrete Manholes: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.

1. Diameter: 48 inches minimum, unless otherwise indicated.
2. Ballast: Increase thickness of precast concrete sections or add concrete to base section, as required to prevent flotation.
3. Base Section: 6-inch minimum thickness for floor slab and 6-inch minimum thickness for walls and base riser section, and having separate base slab or base section with integral floor.
4. Riser Sections: 6-inch minimum thickness, and lengths to provide depth indicated.
5. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.
7. Resilient Pipe Connectors: ASTM C 923, cast or fitted into manhole walls, for each pipe connection.
8. Steps: Individual FRP steps or FRP ladder, wide enough to allow worker to place both feet on 1 step and designed to prevent lateral slippage off of step. Cast or anchor steps into sidewalls at 12- to 16-inch intervals.
9. Grade Rings: Reinforced-concrete rings, 6- to 9-inch total thickness, to match diameter of manhole frame and cover.
10. Manhole Frames and Covers: Ferrous; 24-inch ID by 7- to 9-inch riser with 4-inch minimum width flange and 26-inch diameter cover. Include indented top design with lettering cast into cover, using wording equivalent to "STORM SEWER."

a. Material: ASTM A 48, Class 35 gray iron, unless otherwise indicated.

b. Protective Coating: Foundry-applied, SSPC-Paint 16, coal-tar, epoxy-polyamide paint; 10-mil minimum thickness applied to all surfaces, unless otherwise indicated.

2.6 CONCRETE

A. General: Cast-in-place concrete according to ACI 318/318R, ACI 350R, and the following:

1. Cement: ASTM C 150, Type II.

B. Portland Cement Design Mix: 4000 psi minimum, with 0.45 maximum water-cementitious materials ratio.

2. Reinforcement Bars: ASTM A 615/A 615M, Grade 60, deformed steel.

C. Ballast and Pipe Supports: Portland cement design mix, 3000 psi minimum, with 0.58 maximum water-cementitious materials ratio.

2. Reinforcement Bars: ASTM A 615/A 615M, Grade 60, deformed steel.
2.7 CATCH BASINS

A. Standard Precast Concrete Catch Basins: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
   1. Base Section: 6-inch minimum thickness for floor slab and 6-inch minimum thickness for walls and base riser section, and having separate base slab or base section with integral floor.
   2. Riser Sections: 6-inch minimum thickness, 48-inch diameter, and lengths to provide depth indicated.
   3. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.
   5. Steps: Individual FRP steps or FRP ladder, wide enough to allow worker to place both feet on 1 step and designed to prevent lateral slippage off of step. Cast or anchor steps into sidewalls at 12 to 16-inch intervals.
   6. Pipe Connectors: ASTM C 923, resilient, of size required, for each pipe connecting to base section.

B. Frames and Grates: ASTM A 536, Grade 60-40-18, ductile iron designed for A-16, structural loading. Include flat grate with small square or short-slotted drainage openings.
   1. Size: 24 by 24 inches minimum, unless otherwise indicated.
   2. Grate Free Area: Approximately 50 percent, unless otherwise indicated.

C. Frames and Grates: ASTM A 48, Class 35 gray iron designed for A-16, structural loading. Include 24-inch ID by 7 to 9-inch riser with 4-inch minimum width flange, and 26-inch diameter flat grate with small square or short-slotted drainage openings.
   1. Grate Free Area: Approximately 50 percent, unless otherwise indicated.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavation, trenching, and backfilling are specified in Division 31 Section "Earth Moving."

3.2 PIPING APPLICATIONS

A. Pipe couplings and special pipe fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.

3.3 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take design considerations into account. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.

C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.
D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

E. Tunneling: Install pipe under streets or other obstructions that cannot be disturbed by tunneling, jacking, or a combination of both.

F. Install gravity-flow, nonpressure drainage piping according to the following:
   1. Install piping pitched down in direction of flow.

G. Connection to existing manholes shall be done via the method of core drilling. After drilling, a flexible boot and proper sealant shall be used to insure a watertight seal between the proposed pipe and the existing inlet.

3.4 MANHOLE INSTALLATION
   A. General: Install manholes, complete with appurtenances and accessories indicated.
   B. Install precast concrete manhole sections according to ASTM C 891.
   C. Set tops of frames and covers flush with finished surface of manholes that occur in pavements.

3.5 CATCH BASIN INSTALLATION
   A. Construct catch basins to sizes and shapes indicated.
   B. Set frames and grates to elevations indicated.

3.6 PIPE JOINT CONSTRUCTION
   A. Basic pipe joint construction is specified in NJDOT Section 601. Where specific joint construction is not indicated, follow piping manufacturer's written instructions.
   B. Join gravity-flow, nonpressure drainage piping according to the following:
      b. Join HDPE sewer piping according to NJDOT Section 601.

3.7 CONCRETE PLACEMENT
   A. Place cast-in-place concrete according to ACI 318/318R.

3.8 FIELD QUALITY CONTROL
   A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.
      1. Submit separate reports for each system inspection.
      2. Defects requiring correction include the following:
         a. Alignment: Less than full diameter of inside of pipe is visible between structures.
b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
c. Crushed, broken, cracked, or otherwise damaged piping.
d. Infiltration: Water leakage into piping.
e. Exfiltration: Water leakage from or around piping.

3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
4. Reinspect and repeat procedure until results are satisfactory.

B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.

1. Do not enclose, cover, or put into service before inspection and approval.
2. Test completed piping systems according to authorities having jurisdiction.
3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
4. Submit separate report for each test.
5. Gravity-Flow Storm Drainage Piping: Test according to requirements of authorities having jurisdiction, UNI-B-6, and the following:
   a. Exception: Piping with soil tight joints unless required by authorities having jurisdiction.
   b. Option: Test plastic piping according to ASTM F 1417.
   c. Option: Test concrete piping according to ASTM C 924.

C. Leaks constitute defects that must be repaired.

D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

3.9 CLEANING

A. Clean interior of piping of dirt and superfluous materials. Flush with potable water.

3.10 AS-BUILT DRAWINGS

A. CONTRACTOR shall submit as-built drawings to the OWNER of all storm drainage installed.

END OF SECTION 334100