SECTION 000110
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END OF SECTION

SECTION 011000

SUMMARY

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. Project information.
2. Work covered by Contract Documents.
3. Work by Owner.
4. Purchase contracts.
5. Access to site.
6. Work restrictions.
7. Specification and drawing conventions.

B. Related Section:

1. Division 01 Section 015000 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.3 PROJECT INFORMATION

A. Owner: Toms River Regional School District

1. Project Location: High School East, east Dover Elementary & Silver Bay Elementary

B. Construction Manager: Maser Consulting, 331 Newman Springs Road, Red Bank, NJ

1. Construction Manager has been engaged for this Project to serve as an advisor to Owner and to provide assistance in managing/oversight of the Contract for Construction between Owner and Contractor.

C. Architects: Netta Architects, 1084 Route 22 West, Mountainside, NJ & CDI LR Kimball, 615 West Highland Avenue, Ebensburg, PA

D. Project Web Site: Omitted

1.4 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of the Project is defined by the Contract Documents and consists of thefollowing:

HSE	EDE	SBE
Replace Chilled Water Piping	Plumbing Upgrades	Plumbing Upgrades
Plumbing Upgrades	Flooring Replacement	Flooring Replacement
Science Room upgrades	Interior Door Replacement	Interior Door Replacement
Roof Replacement	HVAC Upgrades	Ext Door Replacements
Interior Doors Replacement	Security vestibules	Elec Service Upgrade
Exterior Doors Replacement	Security Film	Air Conditioning
Electric Distribution Systems	Façade Restoration	Security vestibules
HVAC System Renovation	ADA Bathroom Upgrades	Security Film
Security vestibules	Hazardous Material Abatement	Façade Repairs
Security Film		Windows Replacement
Facade		Hazardous Material Abatement
ADA Bathroom Upgrades		
Window Replacements		
Kitchen Modernization		
Elevator Cab Replacement		

In accordance with the bid documents included.

B. Type of Contract

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

1.5 WORK BY OWNER (in conjunction with Contractor)

A. General: If applicable, cooperate fully with Owner so work may be carried out smoothly, without, without interfering with or delaying work under this Contract or work by Owner. Contractor is responsible to coordinate their Work of this Contract, through the Construction Manager, with the preceding work to be performed by Owner.

1.6 CONTRACTS

A. General: Omitted

1.7 ACCESS TO AREAS

A. General: Contractor shall have access to the areas for construction during the time periods as shown on the approved project schedule.

B. Use of Area:

1. Operations are to be within contract limits identified on plans.

1.8 WORK RESTRICTIONS

A. Work Restrictions, General: Comply with restrictions on construction operations.

1. Comply with limitations on use of public streets and other requirements of authorities having jurisdiction.

B. On-Site Work Hours: As allowed per the Districts requirements.

1. Weekend Hours: Per District's requirements and Subject to Review & Approval by Owner.
2. Early Morning / Late Night Hours: Per City Ordinance and Subject to Review & Approval by Owner.
3. Hours for Utility Shutdowns: Per City Ordinance and Subject to Review & Approval by Owner.

C. Shift Work (2^{nd} & 3^{rd} shifts)

1. Shift work is required (2^{nd} & 3^{rd} shifts), the Contractor will not be reimbursed for the labor differential and those costs shall be included in the Bid.

D. Existing Utility Interruptions: N/A

E. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.

1. Notify Construction Manager not less than three (3) days in advance of proposed disruptive operations.
2. Obtain Owner's written permission before proceeding with disruptive operations.
3. Contractor to comply with Toms River Township Ordinances.

F. Nonsmoking Building: Smoking is not permitted within the building site or building.

G. Controlled Substances: It shall be the Contractor's responsibility to prevent illegal drug use on the Project. Use of illegal drugs or substances on the Project site by any employee of the Contractor or any subcontractor, shall subject the employee to permanent removal from the site. Persistent use of illegal drugs or substances by employees of the Contractor or any of its subcontractors, shall be default under the construction contract.

1.9 SPECIFICATION AND DRAWING CONVENTIONS

A. 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. Imperative mood and streamlined language are generally used in the Specifications. 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.
2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.

C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:

1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
2. Abbreviations: Materials and products are identified by abbreviations published as part of the U.S. National CAD Standard and scheduled on Drawings.
3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

PART 2 - PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

END OF SECTION 0110000

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.

1. Certain items are specified in the Contract Documents by allowances. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when direction will be provided to the Contractor. If necessary, additional requirements will be issued by Change Order.

B. Types of allowances include the following:

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

1.3 SELECTION AND PURCHASE

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

B. At Construction Manager'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 Construction Manager from the designated supplier.

1.4 ACTION SUBMITTALS

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

1.5 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.

1.6 COORDINATION

A. Coordinate allowance items with other portions of the Work. Furnish templates as required to coordinate installation.

1.7 CONTINGENCY ALLOWANCES

A. Use the contingency allowance only as directed by Construction Manager 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, 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 margins. Refer to Section 012900.

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

1.8 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. All unused allowance monies will revert back to Owner as a deduct change order at the completion of the project.

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 margins claimed.
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

A. Allowance No. 1 General Contingency $450,000.00
   1. Includes costs to perform additional work not included in the current bid documents.

3.2 EXAMINATION

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

3.3 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.

END OF SECTION 012100

SECTION 012200 - UNIT PRICES

GENERAL

SUMMARY

Section includes administrative and procedural requirements for unit prices.

Related Section:

Division 01 Section "Contract Modification Procedures" for procedures for submitting and handling Change Orders.

DEFINITIONS

Unit price is an amount incorporated in the Agreement, applicable during the duration of the Work as a price per unit of measurement for materials, equipment, or services, or a portion of the Work, added to or deducted from the Contract Sum by appropriate modification, if the scope of Work or estimated quantities of Work required by the Contract Documents are increased or decreased.

PROCEDURES

Unit prices include all necessary material, plus cost for delivery, installation, insurance, applicable taxes, overhead, and profit.

Measurement and Payment: Refer to individual Specification Sections for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.

Owner reserves the right to reject Contractor's measurement of work-in-place that involves use of established unit prices and to have this work measured, at Owner's expense, by an independent surveyor acceptable to Contractor.

List of Unit Prices: A schedule of unit prices is included in Part 3. Specification Sections referenced in the schedule contain requirements for materials described under each unit price.

PRODUCTS (Not Used)

EXECUTION

SCHEDULE OF UNIT PRICES

Unit Price No. 1a through 1f:

Description: This unit price shall include the replacement of additional interior doors with new doors and hardware. The replacement of doors is for doors beyond those doors shown of being replaced according to the plans.

Unit Price 1a	Type D1	$_____/Each
Unit Price 1b	Type D2	$_____/Each
Unit Price 1c	Type D3	$_____/Each
Unit Price 1d	Type D4	$_____/Each
Unit Price 1e	Type D5	$_____/Each
Unit Price 1f	Type D6	$_____/Each

Unit Price No. 2

Description: This unit price to include striping pain, prime and provide two coats of high performance coating for the metal fascia at High School East.

Unit Price Paint Metal Fascia $ _____/SF

Unit Price No. 3a through 3c

Description: These unit prices are to furnish and install various components in the High School East elevator.

Unit Price Furnish & install new circuit board to salvage control unit $_____/EA

Unit Price Furnish & install new software to salvage control unit $_____/EA

Unit Price Furnish & install a new solid state starter $_____/EA

END OF SECTION 012200

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 Owner decides to accept the Alternate as part of the awarded contract 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 alternate into the Work. No other adjustments are made to the Contract Sum.

1.4 PROCEDURES

A. Coordination: Modify 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. Notification: Immediately following award of the Contract, the Owner will notify the Contractor, in writing, whether each alternate has been accepted or rejected.

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

D. Schedule: A schedule of alternates is included at the end of this Section. 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

A. Alternates

OPTION 1 – WITH PROJECT LABOR AGREEMENT
ALTERNATE NO. 1
HIGH SCHOOL EAST – High School East School Electrical Panels
Work associated with the retrofit of electrical panels in Pine Beach Elementary School as shown on the drawings. Under base bid, the existing panels shall remain.

OPTION 1 – WITH PROJECT LABOR AGREEMENT
ALTERNATE NO. 2
EAST DOVER – East Dover Elementary School Electrical Panels
Work associated with the retrofit of electrical panels in Washington Street Elementary School as shown on the drawings. Under base bid, the existing panels shall remain.

OPTION 1 – WITH PROJECT LABOR AGREEMENT
ALTERNATE NO. 3
SILVER BAY – Silver Bay Elementary Schools Electrical Panels
Work associated with the retrofit of electrical panels in High School South as shown on the drawings. Under base bid, the existing panels shall remain.

OPTION 1 – WITH PROJECT LABOR AGREEMENT
ALTERNATE NO. 4
EAST DOVER – Removal and replacement of all flooring.
All work associated with the replacement of the flooring shown on the drawings and specifications.

OPTION 1 – WITH PROJECT LABOR AGREEMENT
ALTERNATE NO. 5
SILVER BAY – Removal and replacement of all flooring.
All work associated with the replacement of the flooring shown on the drawings and specifications.

OPTION 1 – WITH PROJECT LABOR AGREEMENT
ALTERNATE NO. 6
HIGH SCHOOL EAST – High School Chiller Replacement
Provide all work in the mechanical penthouse at HSE for the reconfiguration and replacement of a water-cooled chiller, associated piping, accessories and controls per plans and specifications.

OPTION 1 – WITH PROJECT LABOR AGREEMENT
ALTERNATE NO. 7
SILVER BAY – Silver Bay Remove & Replacement of Windows on the 2nd Floor that is not part of the base bid.
All work associated with the replacement of the windows shown on the drawings and specifications.

OPTION 1 – WITH PROJECT LABOR AGREEMENT
ALTERNATE NO. 8
SILVER BAY – Silver Bay Remove & Replacement of Windows on the 1st Floor that is not part of the

base bid.
All work associated with the replacement of the windows shown on the drawings and specifications.

OPTION 1 – WITH PROJECT LABOR AGREEMENT
ALTERNATE NO. 9
HIGH SCHOOL EAST – High School East provide and install a new elevator control unit.
All work associated with the replacement of the control unit shown on the drawings and specifications.

OPTION 2 – WITHOUT PROJECT LABOR AGREEMENT
ALTERNATE NO. 1
HIGH SCHOOL EAST – High School East School Electrical Panels
Work associated with the retrofit of electrical panels in Pine Beach Elementary School as shown on the drawings. Under base bid, the existing panels shall remain.

OPTION 2 – WITHOUT PROJECT LABOR AGREEMENT
ALTERNATE NO. 2
EAST DOVER – East Dover Elementary School Electrical Panels
Work associated with the retrofit of electrical panels in Washington Street Elementary School as shown on the drawings. Under base bid, the existing panels shall remain.

OPTION 2 – WITHOUT PROJECT LABOR AGREEMENT
ALTERNATE NO. 3
SILVER BAY – Silver Bay Elementary Schools Electrical Panels
Work associated with the retrofit of electrical panels in High School South as shown on the drawings. Under base bid, the existing panels shall remain.

OPTION 2 – WITHOUT PROJECT LABOR AGREEMENT
ALTERNATE NO. 4
EAST DOVER – Removal and replacement of all flooring.
All work associated with the replacement of the flooring shown on the drawings and specifications.

OPTION 2 – WITHOUT PROJECT LABOR AGREEMENT
ALTERNATE NO. 5
SILVER BAY – Removal and replacement of all flooring.
All work associated with the replacement of the flooring shown on the drawings and specifications.

OPTION 2 – WITHOUT PROJECT LABOR AGREEMENT
ALTERNATE NO. 6
HIGH SCHOOL EAST – High School Chiller Replacement
Provide all work in the mechanical penthouse at HSE for the reconfiguration and replacement of a water-cooled chiller, associated piping, accessories and controls per plans and specifications.

OPTION 2 – WITHOUT PROJECT LABOR AGREEMENT
ALTERNATE NO. 7
SILVER BAY – Silver Bay Remove & Replacement of Windows on the 2nd Floor that is not part of the base bid.
All work associated with the replacement of the windows shown on the drawings and specifications.

OPTION 2 – WITHOUT PROJECT LABOR AGREEMENT
ALTERNATE NO. 8

SILVER BAY – Silver Bay Remove & Replacement of Windows on the 1st Floor that is not part of the base bid.
All work associated with the replacement of the windows shown on the drawings and specifications.

OPTION 2 – WITHOUT PROJECT LABOR AGREEMENT
ALTERNATE NO. 9
HIGH SCHOOL EAST – High School East provide and install a new elevator control unit.
All work associated with the replacement of the control unit shown on the drawings and specifications.

END OF SECTION 012300

SECTION
012600

CONTRACT MODIFICATION 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 handling and processing Contract modifications.

B. Related Requirements:

1. Omit

1.3 MINOR CHANGES IN THE WORK

A. CM 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, "Construction Manager's Supplemental Instructions."

1.4 PROPOSAL REQUESTS

A. Owner-Initiated Proposal Requests: Construction Manager 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. Work Change Proposal Requests issued by Construction Manager are not instructions either to stop work in progress or to execute the proposed change.
2. Within time specified in Proposal Request 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.

e. Quotation Form: Use forms acceptable to Construction Manager.

B. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract Documents, Contractor may initiate a claim by submitting a request for a change to Construction Manager.

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 Section 012500 "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.
7. Proposal Request Form: Use CSI Form 13.6A, "Change Order Request (Proposal)," with attachments CSI Form 13.6D, "Proposal Worksheet Summary," and Form 13.6C, "Proposal Worksheet Detail."
8. Refer to section 012900 Payment Procedures for permissible markups on changes.

1.5 ADMINISTRATIVE CHANGE ORDERS

A. Allowance Adjustment: See Section 012100 "Allowances" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect actual costs of allowances.

1.6 CHANGE ORDER PROCEDURES

A. Contractor is obliged to notify Construction Manager five (5) days from the date a changed condition is identified. Failure to comply will result in denial of change order and/or claim.

B. All Change Order requests shall be in accordance with NJAC 6A:23A-21.1

1.7 CONSTRUCTION CHANGE DIRECTIVE

A. Construction Change Directive: Construction Manager may issue a Construction Change

Directive on AIA Document G714/CMa-1992. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.

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.

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. Section 012100 "Allowances" for procedural requirements governing the handling and processing of allowances.
2. Section 012600 "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
3. Section 013200 "Construction Progress Documentation" for administrative requirements governing the preparation and submittal of the Contractor's construction schedule.

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 Construction Manager at earliest possible date, but no later than seven days before the date scheduled for submittal of initial Applications for Payment for review & approval
3. Subschedules for Phased Work: Where the Work is separated into phases requiring separately phased payments, provide subschedules showing values coordinated with each phase of payment.
4. Subschedules for Separate Elements of Work: Where the Contractor's construction schedule defines separate elements of the Work, provide subschedules showing values coordinated with each element.
5. Subschedules for Separate Design Contracts: Where the Owner has retained design professionals under separate contracts who will each provide certification of payment requests, provide subschedules showing values coordinated with the scope of each design services contract as described in Section 011000"Summary."

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 ofvalues:

   a. Project name and location.
   b. Name of Construction Manager.
   c. Construction Manager's project number.
   d. Contractor's name and address.
   e. 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. Related Specification Section or Division.
   b. Description of the Work.
   c. Name of subcontractor.
   d. Name of manufacturer or fabricator.
   e. Name of supplier.
   f. Change Orders (numbers) that affect value.
   g. Dollar value of the following, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.

      1) Labor.
      2) Materials.
      3) Equipment.

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

5. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
6. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.

a. Differentiate between items stored on-site and items stored off-site. If required, include evidence of insurance.

7. Provide separate line items in the schedule of values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
8. Allowances: Provide a separate line item in the schedule of values for each allowance. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.
9. Purchase Contracts: Provide a separate line item in the schedule of values for each purchase contract. Show line-item value of purchase contract. Indicate owner payments or deposits, if any, and balance to be paid by Contractor.
10. 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.

11. Schedule Updating: Update and resubmit the schedule of values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.5 CHANGES IN THE WORK

A. When a change in the Work includes a category or categories of Work both added to and deducted from the Contract, the total quantities of added Work and of deleted Work shall be determined separately for each category and the appropriate unit price or net cost of the Work shall be applied to the difference between the two total quantities.

B. Unit prices shall be inclusive of all costs and shall be applied to units of measure as defined in the Specifications for each category of Work.

C. For all extra Work performed by Contractor, the gross cost to the Owner shall include the net cost of the Work to the Contractor plus an allowance for overhead and profit (inclusive of Bond / Insurance) not to exceed 15% of the net cost.

D. For all extra Work performed by a Subcontractor, the gross cost to the Owner shall include the net cost of the Work to the Subcontractor plus an allowance for overhead and profit not to exceed 10% of the net cost, plus the Contractor's overhead and profit (inclusive of Bond / Insurance) not to exceed 10% of the Subcontractor's cost.

E. Net cost of extra Work shall be the actual or pro-rated cost of:

1. Labor, including foreman, at the prevailing rate of wages, contributions and taxes.
2. Materials entering permanently into the Work, including delivery to the site.
3. The ownership or rental cost of construction equipment and expendable tools, pro-rated for the time necessary for the Work.
4. Power and consumable supplies for the operation of power equipment, pro-rated for the necessary Work. Contractor to provide detailed breakdown & back up for Items 1-3 when

submitting their change order request.

F. Gross costs shall be net costs plus the allowances described above, such allowances being inclusive, of all cost of superintendence, supervision, engineering, overhead, profit, administrative and site office expenses and all other general expenses.

1.6 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 and paid for by Owner. All payments shall be in compliance with the Prompt Payment Act NJSA 2A:30A-1 et seq.

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. Payment Application Times: Submit Application for Payment to Construction Manager monthly, date to be agreed with Owner. The period covered by each Application for Payment is one month.

1. Submit draft copy of Application for Payment seven days prior to due date for review by Construction Manager.

D. Application for Payment Forms: Use AIA Document G732-2009 and AIA Document G703 as form for Applications for Payment.

E. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Construction Manager 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.

F. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed which is stored on-site.

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 Applications for Payment.
    b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
    c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.

G. Transmittal: Submit three signed and notarized original copies of each Application for Payment to Construction Manager by a method ensuring receipt within 24 hours.

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

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

I. Application for Payment at Substantial Completion: After Construction Manager 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.
2. Insurance certificates for products and completed operations where required and proof

that taxes, fees, and similar obligations were paid.

3. Updated final statement, accounting for final changes to the Contract Sum.
4. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
5. AIA Document G706A, "Contractor's Affidavit of Release of Liens."
6. AIA Document G707, "Consent of Surety to Final Payment."
7. Evidence that claims have been settled.
8. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
9. Final liquidated damages settlement statement.

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. Coordination drawings. (if required)
3. Requests for Information (RFIs).
4. Project meetings.

B. WEB BASED PROJECT MANAGEMENT – all parties will use the construction manager's on line software.

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

D. Related Requirements:
1. Section 013200 "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
2. Section 017300 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
3. Section 017700 "Closeout Procedures" for coordinating closeout of the Contract.

1.3 DEFINITIONS

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

1.4 INFORMATIONAL SUBMITTALS

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. Coordination: Each contractor shall coordinate its construction operations with those of other contractors and entities to ensure efficient and orderly installation of each part of the Work. Each contractor shall coordinate its operations with 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 with other contractors to ensure maximum performance and accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.

C. 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.

D. 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. Pre-installation conferences.
7. Project closeout activities.

8. Startup and adjustment of systems.

E. 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. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. See other Sections for disposition of salvaged materials that are designated as Owner's property.

1.6 COORDINATION DRAWINGS

A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely shown 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. Coordinate the addition of trade-specific information to the coordination drawings by multiple contractors in a sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.
c. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
d. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
e. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
f. Indicate required installation sequences.
g. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Construction Manager 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 ceiling plenum

to accommodate layout of light fixtures 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 in diameter and larger.
    b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire-alarm locations.
    c. Panel board, switch board, 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 will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Construction Manager determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Construction Manager will so inform Contractor, who shall make changes as directed and resubmit.
10. Coordination Drawing Prints: Prepare coordination drawing prints according to requirements in Section 013300 "Submittal Procedures."

C. Coordination Digital Data Files: Prepare coordination digital data files according to the following requirements:

1. File Preparation Format: Same digital data software program, version, and operating system as original Drawings.
2. File Preparation Format: DWG, Version, operating in Microsoft Windows operating system.
3. File Submittal Format: Submit or post coordination drawing files using format same as file preparation format and Portable Data File (PDF) format.

1.7 REQUESTS FOR INFORMATION (RFIs)

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

1. Construction Manager will return RFIs submitted to Construction Manager 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.
6. RFI number, numbered sequentially.
7. RFI subject.
8. Specification Section number and title and related paragraphs, asappropriate.
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.

C. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketch RFI Forms: RFI's will be submitted through the construction manager's on line software.

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

D. Construction Manager's Action: Construction Manager will review each RFI, determine action required, and respond. Allow seven (7) working days for Construction Manager's response for each RFI. RFIs received by Construction Manager after 1:00 p.m. will be considered as received the following workingday.

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 Construction Manager's actions on submittals.
    g. Incomplete RFIs or inaccurately prepared RFIs.
2. Construction Manager's action may include a request for additional information, in which case Construction Manager's time for response will date from time of receipt of additional

information.

3. Construction Manager'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 Section 012600 "Contract Modification Procedures."

    a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Construction Manager 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.

1. Project name.
2. Name and address of Contractor.
3. Name and address of Construction Manager.
4. RFI number including RFIs that were returned without action or withdrawn.
5. RFI description.
6. Date the RFI was submitted.
7. Date Construction Manager's response was received.

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

1. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
2. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.

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 of scheduled meeting dates and times.
2. Agenda: 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, within three days of the meeting.

B. Preconstruction Conference: Construction Manager will schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Construction Manager, 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, 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. Phasing.
   c. Critical work sequencing and long-lead items.
   d. Designation of key personnel and their duties.
   e. Lines of communications.
   f. Procedures for processing field decisions and Change Orders.
   g. Procedures for RFIs.
   h. Procedures for testing and inspecting.
   i. Procedures for processing Applications for Payment.
   j. Distribution of the Contract Documents.
   k. Submittal procedures.
   l. Omitted
   m. Preparation of record documents.
   n. Use of the premises.
   o. Work restrictions.
   p. Working hours.
   q. Owner's occupancy requirements.
   r. Responsibility for temporary facilities and controls.
   s. Procedures for moisture and mold control.
   t. Procedures for disruptions and shutdowns.
   u. Construction waste management and recycling.
   v. Parking availability.
   w. Office, work, and storage areas.
   x. Equipment deliveries and priorities.
   y. First aid.
   z. Security.
   aa. Progress cleaning.

4. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.

C. Pre-installation Conferences: Conduct a pre-installation conference at Project site before each construction activity that requires coordination with other construction.

1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Construction Manager of scheduled meeting dates.
2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:

   a. Contract Documents.
   b. Options.
   c. Related RFIs.
   d. Related Change Orders.
   e. Purchases.
   f. Deliveries.
   g. Submittals.

h. Review of mockups.
i. Possible conflicts.
j. Compatibility requirements.
k. Time schedules.
l. Weather limitations.
m. Manufacturer's written instructions.
n. Warranty requirements.
o. Compatibility of materials.
p. Acceptability of substrates.
q. Temporary facilities and controls.
r. Space and access limitations.
s. Regulations of authorities having jurisdiction.
t. Testing and inspecting requirements.
u. Installation procedures.
v. Coordination with other work.
w. Required performance results.
x. Protection of adjacent work.
y. Protection of construction and personnel.

3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

D. Project Closeout Conference: Schedule and conduct a project closeout conference, at a time convenient to Owner and Construction Manager, but no later than 90 days prior to the scheduled date of Substantial Completion.

1. Conduct the conference to review requirements and responsibilities related to Project closeout.
2. Attendees: Authorized representatives of Owner, Construction Manager, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Discuss items of significance that could affect or delay Project closeout, including, but not limited to, all items in Section 017700 Closeout Procedures, and the following:

a. Preparation of record documents.
b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
c. Submittal of written warranties.
d. Omitted
e. Requirements for preparing operations and maintenance data.
f. Requirements for delivery of material samples, attic stock, and spare parts.
g. Requirements for demonstration and training.
h. Preparation of Contractor's punch list.
i. Procedures for processing Applications for Payment at Substantial Completion and for final payment.

j. Submittal procedures.
k. Coordination of separate contracts.
l. Owner's partial occupancy requirements.
m. Installation of Owner's furniture, fixtures, and equipment.
n. Responsibility for removing temporary facilities and controls.

4. Minutes: Entity conducting meeting will record and distribute meeting minutes.

E. Progress Meetings: Conduct progress meetings at weekly intervals.

1. Coordinate dates of meetings with preparation of payment requests.
2. Attendees: In addition to representatives of Owner and Construction Manager, 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) Interface requirements.
2) Sequence of operations.
3) Resolution of BIM component conflicts.
4) Status of submittals.
5) Omitted
6) Deliveries.
7) Off-site fabrication.
8) Access.
9) Site utilization.
10) Temporary facilities and controls.
11) Progress cleaning.
12) Quality and work standards.
13) Status of correction of deficient items.
14) Field observations.
15) Status of RFIs.
16) Status of proposal requests.
17) Pending changes.
18) Status of Change Orders.
19) Pending claims and disputes.
20) Documentation of information for payment requests.

4. Minutes: Entity responsible for conducting the meeting 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.

F. Coordination Meetings: Conduct Project coordination meetings at regular intervals as required. Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and pre-installation conferences.

1. Attendees: In addition to representatives of Owner and Construction Manager, 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 meetings shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Review and correct or approve minutes of the previous coordination meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

    a. Combined Contractor's Construction Schedule: Review progress since the last coordination meeting. Determine whether each contract is on time, ahead of schedule, or behind schedule, in relation to combined 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.
    b. Schedule Updating: Revise combined Contractor's construction schedule after each coordination meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with report of each meeting.
    c. Review present and future needs of each contractor present, including the following:

        1) Interface requirements.
        2) Sequence of operations.
        3) Resolution of BIM component conflicts.
        4) Status of submittals.
        5) Deliveries.
        6) Off-site fabrication.
        7) Access.
        8) Site utilization.
        9) Temporary facilities and controls.
        10) Work hours.
        11) Hazards and risks.
        12) Progress cleaning.
        13) Quality and work standards.
        14) Change Orders.

3. Reporting: Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013100

SECTION 013200 CONSTRUCTION PROGRESS 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 documenting the progress of construction during performance of the Work, including the following:

1. Contractor's construction schedule.
2. Construction schedule updating reports.
3. Daily construction reports.
4. Material location reports.
5. Site condition reports.
6. Special reports.

B. WEB BASED PROJECT MANAGEMENT – all parties will use the web based construction managers on line system.

C. Related Requirements:
1. Section 013300 "Submittal Procedures" for submitting schedules and reports.
2. Section 014000 "Quality Requirements" for submitting a schedule of tests and inspections.

1.3 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. Predecessor Activity: An activity that precedes another activity in the network.
3. 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 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. Event: The starting or ending point of an activity.

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

1. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.
2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.

1.4 INFORMATIONAL SUBMITTALS

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

1. Working electronic copy of schedule file, where indicated.
2. PDF electronic file.
3. Two paper copies.

B. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.

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.

C. CPM Reports: Concurrent with CPM schedule, submit each of the following reports. Format for each activity in reports shall contain activity number, activity description, cost and resource loading, 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.

D. Construction Schedule Updating Reports: Submit with Applications for Payment.

E. Daily Construction Reports: Submit at monthly intervals.

F. Material Location Reports: Submit at monthly intervals.

G. Site Condition Reports: Submit at time of discovery of differing conditions.

H. Special Reports: Submit at time of unusual event.

1.5 QUALITY ASSURANCE

A. Prescheduling Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination." Review methods and procedures related to the preliminary construction schedule and Contractor's construction schedule, including, but not limited to, the following:

1. Review software limitations and content and format for reports.
2. Verify availability of qualified personnel needed to develop and update schedule.
3. Discuss constraints, including interim milestones.
4. Review delivery dates for Owner-furnished products.
5. Review schedule for work of Owner's separate contracts.
6. Review submittal requirements and procedures.
7. Review time required for review of submittals and resubmittals.
8. Review requirements for tests and inspections by independent testing and inspecting agencies.
9. Review time required for Project closeout and Owner startup procedures, including commissioning activities.
10. Review and finalize list of construction activities to be included in schedule.
11. Review procedures for updating schedule.

1.6 COORDINATION

A. 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 - PRODUCTS

2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

A. Time Frame: Extend schedule from date established for the Notice of Award to date of final completion.

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 main 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 Construction Manager.
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 resubmittal times indicated in Section 013300 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's construction schedule with submittal schedule.
4. Startup and Testing Time: Include no fewer than 15 days for startup and testing.
5. Substantial Completion: Indicate completion in advance of date established for Substantial Completion and allow time for Construction Manager's administrative procedures necessary for certification of Substantial Completion.
6. Punch List and Final Completion: Include not more than 30 days for completion of punch list items 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. Products Ordered in Advance: Include a separate activity for each product. Include delivery date indicated in Section 011000 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
5. Owner-Furnished Products: Include a separate activity for each product. Include delivery date indicated in Section 011000 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
6. 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.
    f. Provisions for future construction.
    g. Seasonal variations.
    h. Environmental control.

7. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:

    a. Subcontract awards.
    b. Submittals.
    c. Purchases.
    d. Mockups.
    e. Fabrication.
    f. Sample testing.
    g. Deliveries.
    h. Installation.
    i. Tests and inspections.
    j. Adjusting.
    k. Curing.
    l. Building flush-out.
    m. Startup and placement into final use and operation.

8. Construction Areas: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:

    a. Structural completion.
    b. Temporary enclosure and space conditioning.
    c. Permanent space enclosure.
    d. Completion of mechanical installation.
    e. Completion of electrical installation.
    f. Substantial Completion.

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. Cost Correlation: Superimpose a cost correlation timeline, indicating planned and actual costs. On the line, show planned and actual dollar volume of the Work performed as of planned and actual dates used for preparation of payment requests.

1. See Section 012900 "Payment Procedures" for cost reporting and payment procedures.

F. 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 Requests for Information.
3. Rejected or unreturned submittals.
4. Notations on returned submittals.
5. Pending modifications affecting the Work and Contract Time.

G. 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. Indicate changes to working hours, working days, crew sizes, and equipment required to achieve compliance, and date by which recovery will be accomplished.

H. Computer Scheduling Software: Prepare schedules using one of the following programs;

1. Utilize Oracle's Primavera P6.

2. Microsoft Project

3. Approved equal

2.2 CONTRACTOR'S CONSTRUCTION SCHEDULE (CPM SCHEDULE)

A. CPM Schedule: Prepare Contractor's construction schedule using a cost- and resource-loaded, time-scaled CPM network analysis diagram for the Work.

1. Develop network diagram in sufficient time to submit CPM schedule so it can be accepted

for use no later than 60 days after date established for the Notice of Award.

a. Failure to include any work item required for performance of this Contract shall not excuse Contractor from completing all work within applicable completion dates, regardless of Construction Manager's approval of the schedule.

2. Conduct educational workshops to train and inform key Project personnel, including subcontractors' personnel, in proper methods of providing data and using CPM schedule information.
3. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
4. Use "one workday" as the unit of time for individual activities. Indicate nonworking days and holidays incorporated into the schedule in order to coordinate with the Contract Time.

B. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the startup network diagram, prepare a skeleton network to identify probable critical paths.

1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:

a. Preparation and processing of submittals.
b. Mobilization and demobilization.
c. Purchase of materials.
d. Delivery.
e. Fabrication.
f. Utility interruptions.
g. Installation.
h. Work by Owner that may affect or be affected by Contractor's activities.
i. Testing and commissioning.
j. Punch list and final completion.
k. Activities occurring following final completion.

2. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates shall be consistent with Contract milestone dates.
3. Processing: Process data to produce output data on a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.
4. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.

C. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using a network fragment to demonstrate the effect of the proposed change on the overall project schedule.

D. Initial Issue of Schedule: Prepare initial network diagram from a sorted activity list indicating straight "early start-total float." Identify critical activities. Prepare tabulated reports showing the following:

1. Contractor or subcontractor and the Work or activity.
2. Description of activity.

3. Main events of activity.
4. Immediate preceding and succeeding activities.
5. Early and late start dates.
6. Early and late finish dates.
7. Activity duration in workdays.
8. Total float or slack time.
9. Average size of workforce.
10. Dollar value of activity (coordinated with the schedule of values).

E. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:

1. Identification of activities that have changed.
2. Changes in early and late start dates.
3. Changes in early and late finish dates.
4. Changes in activity durations in workdays.
5. Changes in the critical path.
6. Changes in total float or slack time.
7. Changes in the Contract Time.

2.3 REPORTS

A. Daily Construction Reports: Prepare a daily construction report through Oracle's Primavera Contract Management Program to record 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 (see special reports).
10. Stoppages, delays, shortages, and losses.
11. Meter readings and similar recordings.
12. Emergency procedures.
13. Orders and requests of authorities having jurisdiction.
14. Change Orders received and implemented.
15. Construction Change Directives received and implemented.
16. Services connected and disconnected.
17. Equipment or system tests and startups.
18. Partial completions and occupancies.
19. Substantial Completions authorized.

B. Site Condition Reports: Immediately on discovery of a difference between site 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.

2.4 SPECIAL REPORTS

A. General: Submit special reports directly to Owner within one day(s) of an occurrence. Distribute copies of report to parties affected by the occurrence.

B. Reporting Unusual Events: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

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. Issue a hard copy of the schedule as well as an electronic file of the P6 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 Construction Manager, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.

1. 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 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. WEB BASED PROJECT MANAGEMENT – all parties will use the web based the construction manager's online software.

C. Related Requirements:

1. Section 012900 "Payment Procedures" for submitting Applications for Payment and the schedule of values.
2. Section 013200 "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
3. Section 017823 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
4. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
5. Section 017900 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.

1.3 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Construction Manager'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'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."

C. File Transfer Protocol (FTP): Communications protocol that enables transfer of files to and from another computer over a network and that serves as the basis for standard Internet

protocols. An FTP site is a portion of a network located outside of network firewalls within which internal and external users are able to access files.

D. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

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 Construction Manager 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 Construction Manager's final release or approval.
    g. Scheduled date of fabrication.
    h. Scheduled dates for purchasing.
    i. Scheduled dates for installation.
    j. Activity or event number.

1.5 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

A. Construction Manager's Digital Data Files: Electronic digital data files of the Contract Drawings will not be provided by Construction Manager for Contractor's use in preparing submittals unless a waiver is executed by the contractor.

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.
4. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.

    a. Construction Manager reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Construction Manager'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 10 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Construction Manager will advise Contractor when a submittal being processed must be delayed for coordination.
2. Intermediate Review: If intermediate submittal review is necessary, process it in same manner as initial submittal.
3. Resubmittal Review: Allow 5 days for review of each resubmittal.
4. Sequential Review: Where sequential review of submittals by Construction Manager's consultants, Owner, or other parties is indicated, allow 10 days for initial review of each submittal.

5. Concurrent Consultant Review: Where the Contract Documents indicate that submittals may be transmitted simultaneously to Construction Manager and to Construction Manager's consultants, allow 10 days for review of each submittal. Submittal will be returned to Construction Manager before being returned to Contractor.

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. Contractor signature indication that submittal is in conformance to the specifications.
3. 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 Construction Manager.
4. Include the following information for processing and recording action taken:

    a. Project name.
    b. Date.
    c. Name of Construction Manager.
    d. Name of Contractor.
    e. Name of subcontractor.
    f. Name of supplier.
    g. Name of manufacturer.
    h. Submittal number or other unique identifier, including revision identifier.
        1) Submittal number shall use Specification Section number followed by a

decimal point and then a sequential number (e.g., 061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 061000.01.A).

i. Number and title of appropriate Specification Section.
j. Drawing number and detail references, as appropriate.
k. Location(s) where product is to be installed, as appropriate.
l. Other necessary identification.

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

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

a. Transmittal Form for Paper Submittals: Use AIA Document G810.
b. Transmittal Form for Paper Submittals: Provide locations on form for the following information:

1) Project name.
2) Date.
3) Destination (To:).
4) Source (From:).
5) Name of Construction Manager.
6) Name of Contractor.
7) Name of firm or entity that prepared submittal.
8) Names of subcontractor, manufacturer, and supplier.
9) Category and type of submittal.
10) Submittal purpose and description.
11) Specification Section number and title.
12) Specification paragraph number or drawing designation and generic name for each of multiple items.
13) Drawing number and detail references, as appropriate.
14) Indication of full or partial submittal.
15) Transmittal number, numbered consecutively.
16) Submittal and transmittal distribution record.
17) Remarks.
18) Signature of transmitter.

E. Electronic Submittals: N/A

F. 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 Construction Manager on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.

G. 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 Construction Manager's action stamp.

H. 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.

I. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Construction Manager'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. Action Submittals: Submit each submittal via construction manager's web based system at no cost to the contractor unless otherwise indicated.
2. 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.
    c. Standard color charts.
    d. Statement of compliance with specified referenced standards.
    e. Testing by recognized testing agency.
    f. Application of testing agency labels and seals.
    g. Notation of coordination requirements.
    h. Availability and delivery time information.

4. For equipment, include the following in addition to the above, as applicable:

a. Wiring diagrams showing factory-installed wiring.
b. Printed performance curves.
c. Operational range diagrams.
d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.

5. Submit Product Data before or concurrent with Samples.
6. Submit Product Data in the following format:

a. Four (4) paper copies of Product Data unless otherwise indicated. Construction Manager will return one (1) copy to Contractor.

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. Schedules.
c. Compliance with specified standards.
d. Notation of coordination requirements.
e. Notation of dimensions established by field measurement.
f. Relationship and attachment to adjoining construction clearly indicated.
g. 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. Four (4) copies of each submittal. Construction Manager will return one (1) copy to Contractor.

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 that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
b. 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. Construction Manager will return submittal with options selected.

6. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.

a. Number of Samples: Submit three sets of Samples. Construction Manager will retain two Sample sets; remainder will be returned.

1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.

E. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:

1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
2. Manufacturer and product name, and model number if applicable.
3. Number and name of room or space.
4. Location within room or space.
5. Submit product schedule in the following format:
   a. PDF electronic file.
   b. Three paper copies of product schedule or list unless otherwise indicated. Construction Manager will return two copies.

F. Coordination Drawing Submittals: Comply with requirements specified in Section 013100 "Project Management and Coordination."

G. Contractor's Construction Schedule: Comply with requirements specified in Section 013200 "Construction Progress Documentation."

H. Application for Payment and Schedule of Values: Comply with requirements specified in Section 012900 "Payment Procedures."

I. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Section 014000 "Quality Requirements."

J. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Section 017700 "Closeout Procedures."

K. Maintenance Data: Comply with requirements specified in Section 017823 "Operation and Maintenance Data."

L. Omit.

M. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.

N. 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.

O. 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.

P. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.

Q. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

R. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.

S. 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.

T. 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.

U. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project.

Include the following information:

1. Name of evaluation organization.
2. Date of evaluation.
3. Time period when report is in effect.
4. Product and manufacturers' names.
5. Description of product.
6. Test procedures and results.
7. Limitations of use.

V. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.

W. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

X. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

Y. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

2.2 DELEGATED-DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Construction Manager.

B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit three paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.

1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

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 Construction Manager.

B. Project Closeout and Maintenance Material Submittals: See requirements in Section 017700 "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 CONSTRUCTION MANAGER'S ACTION

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

B. Informational Submittals: Construction Manager will review each submittal and will not return it or will return it if it does not comply with requirements. Construction Manager 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 Construction Manager.

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 Construction Manager 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 Construction Manager, Owner, or authorities having jurisdiction are not limited by provisions of this Section.
4. Specific test and inspection requirements are not specified in this Section.

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 Construction Manager.

C. Mockups: Full-size physical assemblies that are constructed on-site. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to

show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.

1. Laboratory Mockups: Full-size physical assemblies constructed at testing facility to verify performance characteristics.
2. Integrated Exterior Mockups: Mockups of the exterior envelope erected separately from the building but on Project site, consisting of multiple products, assemblies, and subassemblies.
3. Room Mockups: Mockups of typical interior spaces complete with wall, floor, and ceiling finishes, doors, windows, millwork, casework, specialties, furnishings and equipment, and lighting.

D. 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.

E. 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.

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

G. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

I. 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).

J. 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 Construction Manager 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 Construction Manager for a decision before proceeding.

1.5 INFORMATIONAL SUBMITTALS

A. Contractor's Quality-Control Plan: For quality-assurance and quality-control activities and responsibilities.

B. Qualification Data: For Contractor's quality-control personnel.

C. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility sent to authorities having jurisdiction before starting work on the following systems:

1. Seismic-force-resisting system, designated seismic system, or component listed in the designated seismic system quality-assurance plan prepared by Construction Manager.
2. Main wind-force-resisting system or a wind-resisting component listed in the wind-force-resisting system quality-assurance plan prepared by Construction Manager.

D. 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.

E. 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 Construction Manager. 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 Construction Manager 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.
7. Identification of product and Specification Section.
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. Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.

1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.

G. 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.

H. 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.

I. 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.

J. 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.
c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
d. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
e. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
f. When testing is complete, remove test specimens, assemblies, and mockups; do not reuse products on Project.

2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Construction Manager, 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.

K. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:

1. Build mockups in location and of size indicated or, if not indicated, as directed by Construction Manager.
2. Notify Construction Manager seven days in advance of dates and times when mockups will be constructed.
3. Employ supervisory personnel who will oversee mockup construction. Employ workers that will be employed during the construction at Project.
4. Demonstrate the proposed range of aesthetic effects and workmanship.
5. Obtain Construction Manager's approval of mockups before starting work, fabrication, or construction.

    a. Allow seven days for initial review and each re-review of each mockup.

6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
7. Demolish and remove mockups when directed unless otherwise indicated.

L. Integrated Exterior Mockups: Construct integrated exterior mockup according to approved Shop Drawings. Coordinate installation of exterior envelope materials and products for which mockups are required in individual Specification Sections, along with supporting materials.

M. Laboratory Mockups: Comply with requirements of preconstruction testing and those specified in individual Specification Sections.

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.

1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
2. Payment for these services will be made from testing and inspecting allowances, as authorized by Change Orders.
3. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.

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 Section 013300 "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.

F. Testing Agency Responsibilities: Cooperate with Construction Manager and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.

1. Notify Construction Manager and Contractor 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.
5. Delivery of samples to testing agencies.
6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
7. Security and protection for samples and for testing and inspecting equipment at Project site.

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.

I. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents as a component of Contractor's quality-control plan. Coordinate and submit concurrently with Contractor's construction schedule. Update as the Work progresses.

1. Distribution: Distribute schedule to Owner, Construction Manager, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

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 Construction Manager.
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 Construction Manager'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 Section 017300 "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 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 DEFINITIONS

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

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

C. "Directed": A command or instruction by 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.

1.3 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.

1.4 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. 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.

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. 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.

IAPMO	International Association of Plumbing and Mechanical Officials www.iapmo.org	(909) 472-4100
ICC	International Code Council www.iccsafe.org	(888) 422-7233
ICC-ES	ICC Evaluation Service, Inc. www.icc-es.org	(800) 423-6587 (562) 699-0543

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.

DOE	Department of Energy www.energy.gov	(202) 586-9220
EPA	Environmental Protection Agency www.epa.gov	(202) 272-0167
OSHA	Occupational Safety & Health Administration www.osha.gov	(800) 321-6742 (202) 693-1999
SD	State Department www.state.gov	(202) 647-4000

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)	(800) 872-2253
	Architectural Barriers Act (ABA)	(202) 272-0080
	Accessibility Guidelines for Buildings and Facilities Available from U.S. Access Board www.access-board.gov	
CFR	Code of Federal Regulations	(866) 512-1800
	Available from Government Printing Office	(202) 512-1800
	www.gpoaccess.gov/cfr/index.html	
FED-STD	Federal Standard (See FS)	
FS	Federal Specification	(215) 697-2664
	Available from Department of Defense Single Stock Point http://dodssp.daps.dla.mil/	
	Available from Defense Standardization Program www.dsp.dla.mil	
	Available from General Services Administration	(202) 619-8925
	www.gsa.gov	

	Available from National Institute of Building Sciences	(202) 289-7800
	www.wbdg.org/ccb	
FTMS	Federal Test Method Standard (See FS)	
UFAS	Uniform Federal Accessibility Standards	(800) 872-2253
	Available from Access Board	(202) 272-0080
	www.access-board.gov	

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 014200

SECTION 014500 QUALITY CONTROL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Documents affecting work of this Section include, but are not necessarily limited to, General Requirements, bidding documents and drawings.

1.2 QUALTIY CONTROL

A. Contractor shall:

1. Be experienced in hot multi-ply roofing and modified bitumen roofing.
2. Be acceptable by owner and roofing material Manufacturer/supplier.

B. Roofing manufacturer shall:

1. Be an Associate Member in good standing with National Roofing Contractors Association (NRCA).
1. Be recognized in roofing, waterproofing and moisture survey industry.
2. Be approved by owner.
3. Material manufacturer/supplier must supply representative to perform periodic inspections throughout course of project. Written reports must be submitted to owner's representative and copies to contractor.
4. Material supplier providing roofing warranty shall have an ISO 9001 certification.

C. Any deficiencies noted during inspections must be corrected by contractor and approved in writing by material manufacturer/supplier's representative.

1.3 RANDOM SAMPLINGS

A. During course of work, owner/owner's representative, may secure samples of materials being used from containers at job site and submit them to an independent laboratory for comparison to specified material.

B. Materials shall be tested using ASTM D2829 - 07 (or most recent) Standard Practice for Sampling and Analysis of Existing Built-Up Roof Systems or other ASTM Standards for collecting, sampling and testing roof materials.

C. If test results prove that a material is not functionally equal to specified material:

1. Contractor shall pay for all testing.
2. Owner will charge Contractor a penalty up to 20 percent of contract price when all work has been completed before test results become known.

3. Owner will charge Contractor a penalty in proportion to amount of work completed before test results become known. Remaining work shall be completed with specified materials.

PART 2 - PRODUCTS

2.1 GENERAL

A. Comply with Quality Control, References, Specification, and Manufacturer's data. Where conflict may exist, more stringent requirements govern.

B. Provide primary products, including each type of roofing sheet (felt), bitumen, base flashings, miscellaneous flashing materials, and sheet metal components from a single manufacturer, which has produced that type of product successfully for not less than three (3) years. Provide secondary products (insulation, mechanical fasteners, lumber, etc.) only as recommended by manufacturer of primary products for use with roofing system specified.

PART 3 - EXECUTION

3.1 SUBMITTALS

A. Provide building owner's representative a letter from roof material manufacturer indicating that applicator is approved to install their products and will provide warranty for this installation.

END OF SECTION

SECTION 014516 FIELD QUALITY CONTROL
PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Documents affecting work of this Section include, but are not necessarily limited to, General Requirements, bidding documents and drawings.

1.2 DESCRIPTION

A. Work included:

1. Provide roofing inspection services as specified herein and as needed for a complete and proper installation.

1.3 SUBMITTALS

A. Secure designated Owner's representative's advance approval of date and time for roof substrata inspection and pre-roofing meeting.

1. Notify roofing inspection service, roofing contractor, and other interested parties, and secure their agreement to attend.
2. At least three calendar days prior to preconstruction meeting, notify designated Owner's representative of names of persons expected to attend.

B. Records:

1. Maintain a complete and legible file, in chronological order, containing a copy of each report, certificate, and other communication received relative to work of this Section.
2. Upon completion of work of this Section, deliver a copy of complete file to designated Owner's representative

PART 2 - PRODUCTS

2.1 ROOFING INSPECTION SERVICES

A. For work of this Section, retain roofing inspection services of company approved in advance by designated Owner's representative.

PART 3 - EXECUTION

3.1 PRE-ROOFING MEETING

A. Not less than three nor more than ten calendar days prior to scheduled start of roofing installation, conduct a roofing substrata inspection and pre-roofing meeting at jobsite.

1. Designated Owner's representative will be chairperson of meeting, will take minutes of meeting, and will record all agreements reached as a result of inspection and meeting.
2. Visually inspect all substrata upon which roofing is scheduled to be applied.
3. Determine general acceptability, and determine areas requiring further preparation.
4. Determine acceptable remedies for unacceptable areas.
5. Discuss proposed schedule for installation of roofing, and reach agreement as to dates of start and finish of installation of roofing.
6. Discuss proposed methods for installation of roofing, and equipment and personnel to be used.
7. Discuss inspection methods to be used, reports to be issued by roofing inspector, responsibilities and limits of responsibilities of roofing inspector, and potential problems arising from use of methods not agreed to in pre-roofing meeting.

3.2 INSPECTION DURING ROOFING INSTALLATION

A. Verify that materials delivered to job site are those approved by designated Owner's representative for use on this Work.

B. Visually observe installation of roofing including, but not necessarily limited to:

1. Check kettle temperatures and verify that bitumens are not heated beyond temperatures recommended by manufacturer of approved roofing system materials.
2. At least three times daily, check temperatures of bitumens as delivered to roof deck and verify that temperatures of bitumens are within range recommended by manufacturer of approved roofing system materials.
3. Verify use of installation procedures agreed upon in pre-roofing meeting.
4. Call attention of contractor's representative on job to unacceptable methods and unacceptable results.
5. Report to Contractor and to designated Owner's representative if contractor fails to correct unacceptable methods or unacceptable results.

C. Prior to application of final surfacing, make test cuts as required by designated Owner's representative.

1. Except as otherwise approved by designated Owner's representative, make test cuts 12" square and through all layers of roofing that are then in place.
2. By precise weighing of identical 12" square pieces of felt, determine amount of bitumen applied in one sq. ft sample.
3. Verify that contractor provides proper patching of areas where test cuts were made.
4. Include within daily report a statement of weights (and corresponding adequacy or inadequacy of roofing) at test cuts.

D. Make Final visual inspection of entire roofing installation.

1. Compile a list of items required to be revised or replaced.
2. Deliver a copy of list to contractor's representative on job and to others as appropriate.
3. Verify proper revision or replacement of all items on list.

3.3 REPORTS

A. Make daily written reports of roofing inspection activities, delivering copies to roofing contractor and others as agreed in pre-roofing meeting.

B. Upon completion of roofing installation, compile a comprehensive report covering activities performed under this Section, and deliver a copy of report to:

1. Designated Owner's representative.
2. Owner.
3. Construction Manager.
4. Roofing contractor.
5. Others as agreed in project meetings.

3.4 LIMITS OF ROOFING INSPECTOR'S RESPONSIBLITIES

A. During progress of roofing installation, roofing inspector is required to:

1. Make visual observations and compile reports described in this Section;
2. Advise roofing contractor's representative on job as to unacceptable methods and unacceptable results when so observed by roofing inspector.

B. In connection with roofing installation, "unacceptable methods and unacceptable results" mean methods and results other than:

1. Those recommended by manufacturer of approved roofing system materials.
2. Those required by pertinent regulations of governmental agencies having jurisdiction;
3. Those required by these Specifications; and
4. Those agreed upon in pre-roofing meeting.

C. The roofing inspector is not empowered to:

1. Act for, or in lieu of, representatives of governmental agencies having jurisdiction;
2. Give directions to Contractor or workmen on job;
3. Revise any part of Contract Documents; or
4. Approve any change in methods agreed upon in pre-roofing meeting.

D. Failure of roofing inspector to observe unacceptable methods or unacceptable results during progress of Work will not absolve Contractor from his responsibility to complete Work in accordance with specified requirements and agreed methods

END OF SECTION

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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

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

B. Related Requirements:

1. Section 011000 "Summary" for work restrictions and limitations on utility interruptions.

1.3 USE CHARGES

A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Construction Manager, testing agencies, and authorities having jurisdiction.

B. Sewer Service: Pay sewer-service use charges for sewer usage by all entities for construction operations.

C. Water Service: Pay water-service use charges for water used by all entities for construction operations.

D. Electric Power Service: Pay electric-power-service use charges for electricity used by all entities for construction operations.

1.4 INFORMATIONAL SUBMITTALS

A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.

B. Erosion- and Sedimentation-Control Plan: Show compliance with requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.

C. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.

D. Moisture-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage.

1. Describe delivery, handling, and storage provisions for materials subject to water absorption or water damage.
2. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and replacing water-damaged Work.
3. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, plastering, and terrazzo grinding, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.

E. Dust- and HVAC-Control Plan: Submit coordination drawing and narrative that indicates the dust- and HVAC-control measures proposed for use, proposed locations, and proposed time frame for their operation. Identify further options if proposed measures are later determined to be inadequate. Include the following:

1. Locations of dust-control partitions at each phase of work.
2. HVAC system isolation schematic drawing.
3. Location of proposed air-filtration system discharge.
4. Waste handling procedures.
5. Other dust-control measures.

1.5 QUALITY ASSURANCE

A. 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.

C. Accessible Temporary Egress: Comply with applicable provisions in ICC/ANSI A117.1.

1.6 PROJECT CONDITIONS

A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to 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.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Chain-Link Fencing: Minimum 2-inch, 0.148-inch- thick, galvanized-steel, chain-link fabric

fencing; minimum 6 feet high with galvanized-steel pipe posts; minimum 2-3/8-inch- OD line posts and 2-7/8-inch- OD corner and pull posts, with 1-5/8-inch- OD top rails.

B. Portable Chain-Link Fencing: Minimum 2-inch, 0.148-inch- thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet high with galvanized-steel pipe posts; minimum 2-3/8-inch- OD line posts and 2-7/8-inch- OD corner and pull posts, with 1-5/8-inch- OD top and bottom rails. Provide concrete bases for supporting posts.

C. Wood Enclosure Fence: Plywood, 6 feet high, framed with four 2-by-4-inch rails, with preservative-treated wood posts spaced not more than 8 feet apart.

D. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10-mil minimum thickness, with flame-spread rating of 15 or less per ASTM E 84 and passing NFPA 701 Test Method 2.

E. Dust-Control Adhesive-Surface Walk-off Mats: Provide mats minimum 36 by 60 inches.

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

2.2 TEMPORARY FACILITIES

A. Definition: Prefabricated, mobile units, or office space adjacent to Project Site with serviceable finishes, temperature controls, and foundations adequate for normal loading.

B. Omit.

2.3 EQUIPMENT

A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.

1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
2. Heating Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction and marked for intended location and application.
3. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 at each return-air grille in system and remove at end of construction and clean HVAC system as required in Section 017700 "Closeout Procedures".

C. Air-Filtration Units: Primary and secondary HEPA-filter-equipped portable units with four- stage filtration. Provide single switch for emergency shutoff. Configure to run continuously.

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 by progress of the Work.

1. Locate facilities to limit site disturbance as specified in Section 01100 "Summary."

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

3.2 TEMPORARY UTILITY INSTALLATION

A. General: Install temporary service or connect to existing service.

1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.

B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.

1. Connect temporary sewers to municipal system as directed by authorities having jurisdiction.

C. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction.

D. Sanitary Facilities:

1. Toilets: Contractor to provide the required number of Porto-Johns for the workforce.

E. 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 that will not have a harmful effect on completed installations or elements being installed.

F. Isolation of Work Areas in Occupied Facilities: Prevent dust, fumes, and odors from entering occupied areas.

1. Prior to commencing work, isolate the HVAC system in area where work is to be performed according to coordination drawings.

a. Disconnect supply and return ductwork in work area from HVAC systems servicing occupied areas.
b. Maintain negative air pressure within work area using HEPA-equipped air- filtration units, starting with commencement of temporary partition construction, and continuing until removal of temporary partitions is complete.

2. Maintain dust partitions during the Work. Use vacuum collection attachments on dust-

producing equipment. Isolate limited work within occupied areas using portable dust-containment devices.

3. Perform daily construction cleanup and final cleanup using approved, HEPA-filter-equipped vacuum equipment.

G. 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 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.

1. Provide dehumidification systems when required to reduce substrate moisture levels to level required to allow installation or application of finishes.

H. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.

1. Install electric power service overhead unless otherwise indicated.

I. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.

1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
2. Install lighting for Project identification sign.

3.3 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:

1. Maintain support facilities until Construction Manager schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

B. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate for construction operations.

1. Provide dust-control treatment that is nonpolluting and non-tracking. Reapply treatment as required to minimize dust.

C. Temporary Use of Permanent Roads and Paved Areas: Locate temporary roads and paved areas in same location as permanent roads and paved areas. Construct and maintain temporary roads and paved areas adequate for construction operations. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations.

1. Coordinate elevations of temporary roads and paved areas with permanent roads and paved areas.
2. Prepare subgrade and install subbase and base for temporary roads and paved areas

according to Section 312000 "Earth Moving."

3. Recondition base after temporary use, including removing contaminated material, regrading, proofrolling, compacting, and testing.
4. Delay installation of final course of permanent hot-mix asphalt pavement until immediately before Substantial Completion. Repair hot-mix asphalt base-course pavement before installation of final course according to Section 321216 "Asphalt Paving."

D. Traffic Controls: Comply with requirements of authorities having jurisdiction.

1. Protect existing site improvements to remain including curbs, pavement, and utilities.
2. Maintain access for fire-fighting equipment and access to fire hydrants.

E. Parking: No on-site or off- site parking will be provided. Employees of the Contractor and Subcontractors are responsible for their own parking.

F. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.

1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.
2. Remove snow and ice as required to minimize accumulations.

G. Project Signs: Not required

H. Waste Disposal Facilities: Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."

I. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with progress cleaning requirements in Section 01730 "Execution."

J. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.

1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

K. Temporary Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate.

L. Temporary Use of Permanent Stairs: Use of new stairs for construction traffic will be permitted, provided stairs are protected and finishes restored to new condition at time of Substantial Completion.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.

B. Environmental Protection: Provide protection, operate temporary facilities, and conduct

construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.

1. Comply with work restrictions specified in Section 011000 "Summary."

C. Temporary Erosion and Sedimentation Control: Comply with requirements of 2003 EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent and requirements specified in Division 31 Section "Site Clearing."

D. Storm water Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of storm water from heavy rains.

E. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.

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

G. Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gates.

1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations.
2. Maintain security by limiting number of keys and restricting distribution to authorized personnel.

H. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each work day.

I. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

J. Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.

K. 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 incomplete, insulate temporary enclosures.

L. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire-prevention program.

1. Prohibit smoking in construction areas.
2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
3. Develop and supervise an overall fire-prevention and -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.
4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

3.5 MOISTURE AND MOLD CONTROL

A. Contractor's Moisture-Protection Plan: Avoid trapping water in finished work. Document visible signs of mold that may appear during construction.

B. Exposed Construction Phase: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:

1. Protect porous materials from water damage.
2. Protect stored and installed material from flowing or standing water.
3. Keep porous and organic materials from coming into prolonged contact with concrete.
4. Remove standing water from decks.
5. Keep deck openings covered or dammed.

C. Partially Enclosed Construction Phase: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:

1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
2. Keep interior spaces reasonably clean and protected from water damage.
3. Periodically collect and remove waste containing cellulose or other organic matter.
4. Discard or replace water-damaged material.
5. Do not install material that is wet.
6. Discard, replace, or clean stored or installed material that begins to grow mold.
7. Perform work in a sequence that allows any wet materials adequate time to dry before enclosing the material in drywall or other interior finishes.

D. Controlled Construction Phase of Construction: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:

1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
2. Use permanent HVAC system to control humidity.
3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.

    a. Hygroscopic materials that may support mold growth, including wood and gypsum-based products, that become wet during the course of construction and remain wet for 48 hours are considered defective.
    b. Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record readings beginning at time of

exposure and continuing daily for 48 hours. Identify materials containing moisture levels higher than allowed. Report findings in writing to Construction Manager.

c. Remove materials that cannot be completely restored to their manufactured moisture level within 48 hours.

3.6 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.

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.

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

D. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.

E. 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 property of Contractor. Owner reserves right to take possession of Project identification signs.
2. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
3. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 017700 "Closeout Procedures."

END OF SECTION

SECTION 015953

SAFETY & HEALTH

PART 1 - GENERAL

1.1 COMPLIANCE WITH REGULATIONS

A. Contractor Responsibility: The Contractor shall assume full responsibility and liability for compliance with all applicable codes, standards and regulations pertaining to the health and safety of personnel during execution of the Work, and shall hold the Owner harmless for any action on the Contractor's part, including employees or subcontractors, that results in illness, injury or death. All Contractors shall comply with Occupational Safety and Health Administration (OSHA) requirements. The Contractor shall provide a copy of their Corporate Safety & Health Plan for record.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PROTECTION OF PERSONNEL

A. The Contract shall take all necessary precautions to prevent injury to the public, occupants, or damage to property of others. The public and occupants includes all persons not employed by the Contractor or a subcontractor.

B. Wherever practical, the work area shall be fenced, barricaded or otherwise blocked off from the public or occupants to prevent unauthorized entry into the work area.

3.2 ENVIRONMENTAL PROTECTION

A. Dispose of solid, liquid and gaseous contaminants in accordance with local codes, laws, ordinances and regulations.

END OF SECTION

SECTION 016000

PRODUCT 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 selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; and special warranties.

B. Related Requirements:

1. Section 012100 "Allowances" for products selected under an allowance.
2. Section 014200 "References" for applicable industry standards for products specified.

1.3 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 the 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.

1.4 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. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
2. If a dispute arises between contractors over concurrently selectable but incompatible products, Construction Manager will determine which products shall be used.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

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

B. Delivery and Handling:

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

C. Storage:

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

1.6 PRODUCT WARRANTIES

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

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

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

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

3. See other Sections for specific content requirements and particular requirements for submitting special warranties.

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

PART 2 - PRODUCTS

2.1 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," Construction Manager will make selection.
5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.

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

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

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

END OF SECTION

SECTION 016610

FUME REDUCTION EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Documents affecting work of this Section include, but are not necessarily limited to, General Requirements, bidding documents and drawings.

1.2 DESCRIPTION

A. Provide and use a Fume Reduction System as required to reduce bitumen fuming and any odors that are objectionable to owner's representative.

1.3 QUALIFICATIONS

A. Qualifications of Fume Reduction System

1. Products used in performance of this work shall be produced by manufacturers regularly engaged in manufacture or supply of functionally similar items and with a history of successful use acceptable to District.

1.4 REFERENCES

A. Fume Reduction System shall conform to specifications as listed in latest edition of following:

1. ASTM – Book of Standards (American Society of Testing Materials).
2. ASHAE – Testing Methods (American Society of Heating, Refrigeration, Air Conditioning Engineers).
3. OSHA – CTPV's Concentration in Air; OSHA (Occupational Safety and Health Administration); CTPV's (Coal Tar Pitch Volatiles) as Benzene Soluble Fraction of Total Particulate.

1.5 SUBMITTALS

A. General: Comply with provisions of Section which applies to pre-project product approval.

B. Product Data: Prior to award of contract with bid submit:

1. Complete list of all items proposed to be furnished and utilized under this section.
2. Approved manufactures or suppliers specifications.

3. CTPV's concentration in Air Test results as per OSHA/NIOSH methods.
4. NIOSH (National Institute for Occupational Safety and Health)

1.6 QUALITY CONTROL

A. Fume Reduction System is to be used whenever roofing bitumen in kettle or tanker is being heated. The system shall be operated at any time there is a heating of bitumen. If fumes are present while system in not in use, then bitumen source shall be removed from site.

B. The kettle shall be sized properly to keep up with production and not to overheat bitumen.

C. The kettle lid must fit and align per manufactures specifications to eliminate any fume loss.

D. The kettle exterior of must be clean and free of excessive bitumen accumulation.

E. The times of operation of Fume Reduction System shall be coordinated with owner's representative.

PART 2 - PRODUCTS

2.1 EQUIPMENT

A. The following are basis of design Equipment/manufacturers for the Fume Reduction Equipment:

1. Reeves Afterburner by Reeves Roofing Equipment Company Inc.
2. Fume Guard by Garlock Equipment Co.
3. Eliminator by Cleasby manufacturing company, inc.
4. FRS-6000 Fume Recovery system by Aercology, Inc.
5. Or approved equal

2.2 EQUIPMENT REQUIRMENTS

A. Kettles shall be equipped with following in good working order:

1. Temperature gauge calibrated to within + or -15°.
2. Thermostatic heating controls.
3. Circulating pump.

PART 3 - EXECUTION

3.1 OPERATION

A. Operation of Fume Reduction shall in every way conform to written instruction and/or operation manual.

B. Operator shall thoroughly trained and familiar with function design, performance, operation and

maintenance of Fume Reduction System Equipment

3.2 FUME REDUCTION SYSTEM

A. Fume Reduction System shall be operating at all times while heating bitumen and complying with manufactures recommendations

B. Fume Reduction System shall be maintained with clean and efficient filter at all times

C. Oils or other substances collected through filtration process must be retained for proper recycling and/or disposal in accordance with all local, state, and federal regulations.

D. Fume Reduction System shall be positioned so that no obstruction of air flows.

E. Temperature of kettle shall be maintained in accordance with membrane manufacturer's instruction

END OF SECTION

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:

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

B. Related Requirements:

1. Section 011000 "Summary" for limits on use of Project site.
2. Section 013300 "Submittal Procedures" for submitting surveys.
3. Section 017700 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.
4. Section 078413 "Penetration Firestopping" for patching penetrations in fire-rated construction.

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 INFORMATIONAL SUBMITTALS

A. Qualification Data: For land surveyor.

B. Certificates: Submit certificate signed by land surveyor certifying that location and elevation of improvements comply with requirements.

C. Cutting and Patching Plan: Submit plan describing procedures at least 10 days prior to the time cutting and patching will be performed. Include the following information:

1. Extent: Describe reason for and extent of each occurrence of cutting and patching.
2. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building appearance and other significant visual elements.
3. Products: List products to be used for patching and firms or entities that will perform patching work.
4. Dates: Indicate when cutting and patching will be performed.
5. Utilities and Mechanical and Electrical Systems: List services and systems that cutting and patching procedures will disturb or affect. List services and systems that will be relocated and those that will be temporarily out of service. Indicate length of time permanent services and systems will be disrupted.

    a. Include description of provisions for temporary services and systems during interruption of permanent services and systems.

D. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.

E. Final Property Survey: Submit 10 copies showing the Work performed and record survey data.

1.5 QUALITY ASSURANCE

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

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

1. Structural Elements: When cutting and patching structural elements, notify Construction Manager of locations and details of cutting and await directions from Construction Manager before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection

2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operational elements include the following:
    a. Primary operational systems and equipment.
    b. Fire separation assemblies.
    c. Air or smoke barriers.
    d. Fire-suppression systems.

e. Mechanical systems piping and ducts.
f. Control systems.
g. Communication systems.
h. Fire-detection and -alarm systems.
i. Conveying systems.
j. Electrical wiring systems.
k. Operating systems of special construction.

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

a. Water, moisture, or vapor barriers.
b. Membranes and flashings.
c. Exterior curtain-wall construction.
d. Sprayed fire-resistive material.
e. Equipment supports.
f. Piping, ductwork, vessels, and equipment.
g. Noise- and vibration-control elements and systems.

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

C. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

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

PART 2 - PRODUCTS

2.1 MATERIALS

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

1. Omit.

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

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

PART 3 - EXECUTION

3.1 EXAMINATION

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

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

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

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

C. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:

1. Description of the Work.
2. List of detrimental conditions, including substrates.
3. List of unacceptable installation tolerances.
4. Recommended corrections.

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

3.2 PREPARATION

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

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

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

diagrammatically on Drawings.

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to Construction Manager according to requirements in Section 013100 "Project Management and Coordination."

3.3 CONSTRUCTION LAYOUT

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

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

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

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

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

E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Construction Manager.

3.4 FIELD ENGINEERING

A. Identification: Owner will identify existing benchmarks, control points, and property corners.

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

1. Do not change or relocate existing benchmarks or control points without prior written approval of Construction Manager. Report lost or destroyed permanent benchmarks or

control points promptly. Report the need to relocate permanent benchmarks or control points to Construction Manager before proceeding.

2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.

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

1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

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

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

1. Show boundary lines, monuments, streets, site improvements and utilities, existing improvements and significant vegetation, adjoining properties, acreage, grade contours, and the distance and bearing from a site corner to a legal point.
2. Recording: At Substantial Completion, have the final property survey recorded by or with authorities having jurisdiction as the official "property survey."

3.5 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.
4. Maintain minimum headroom clearance of 96 inches in occupied spaces and in unoccupied spaces.

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

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

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

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

F. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels in excess of local city ordinances.

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

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

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

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

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

3.6 CUTTING AND PATCHING

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

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

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

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

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

E. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching according to requirements in Section 011000 "Summary."

F. 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 prevent interruption to occupied areas.

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

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
6. Proceed with patching after construction operations requiring cutting are complete.

H. 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. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

    a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.

4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.

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

3.7 OWNER-INSTALLED PRODUCTS

A. Site Access: Provide access to Project site for Owner's construction personnel.

B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction personnel.

1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
2. Pre-installation Conferences: Include Owner's construction personnel at pre-installation conferences covering portions of the Work that are to receive Owner's work. Attend pre-installation conferences conducted by Owner's construction personnel if portions of the Work depend on Owner's construction.

3.8 PROGRESS CLEANING

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

1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F.
3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

    a. Use containers intended for holding waste materials of type to be stored.

4. Coordinate progress cleaning for joint-use areas where Contractor and other contractors are working concurrently.

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. Comply with waste disposal requirements in Section 015000 "Temporary Facilities and Controls" and Section 017419 "Construction Waste Management and Disposal."

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.

3.9 STARTING AND ADJUSTING

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

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

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

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

3.10 PROTECTION OF INSTALLED CONSTRUCTION

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

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

END OF SECTION 017300

SECTION 017419

CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

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. Recycling nonhazardous construction waste.
2. Disposing of nonhazardous construction waste.

1.3 DEFINITIONS

A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.

B. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.

C. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.

D. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.

E. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

1.4 PERFORMANCE REQUIREMENTS

A. General: Achieve end-of-Project rates for salvage/recycling of 50 percent by weight of total non-hazardous solid waste generated by the Work. Practice efficient waste management in the use of materials in the course of the Work. Use all reasonable means to divert construction and demolition waste from landfills and incinerators. Facilitate recycling and salvage of materials.

1. Construction Waste:

a. Masonry and CMU.
b. Lumber.
c. Wood sheet materials.
d. Wood trim.
e. Metals.
f. Insulation.
g. Carpet and pad.
h. Gypsum board.
i. Piping.
j. Electrical conduit.
k. Packaging: Regardless of salvage/recycle goal indicated in "General" Paragraph above, salvage or recycle 100 percent of the following uncontaminated packaging materials:

1) Paper.
2) Cardboard.
3) Boxes.
4) Polystyrene packaging.
5) Wood crates.
6) Plastic pails.

1.5 ACTION SUBMITTALS

A. Waste Management Plan: Submit plan within 7 days of date established for commencement of the Work.

1.6 INFORMATIONAL SUBMITTALS

A. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit report. Use Form CWM-7 for construction waste. Include the following information:

1. Material category.
2. Generation point of waste.
3. Total quantity of waste in tons.
4. Quantity of waste recycled, both estimated and actual in tons.
5. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.

B. Waste Reduction Calculations: Before request for Substantial Completion, submit calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.

C. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

D. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

E. Omit

1.7 QUALITY ASSURANCE

A. Omit

B. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.

1.8 WASTE MANAGEMENT PLAN

A. General: Develop a waste management plan according to ASTM E 1609 and requirements in this Section. Plan shall consist of waste identification, waste reduction work plan, and cost/revenue analysis. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.

B. Waste Identification: Indicate anticipated types and quantities of construction waste generated by the Work. Use Form CWM-1 for construction waste. Include estimated quantities and assumptions for estimates.

C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Use Form CWM-3 for construction waste. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.

1. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
2. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
3. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location where materials separation will be performed.

D. Cost/Revenue Analysis: Indicate total cost of waste disposal as if there was no waste management plan and net additional cost or net savings resulting from implementing waste management plan. Use Form CWM-5 for construction waste. Include the following:

1. Total quantity of waste.
2. Estimated cost of disposal (cost per unit). Include hauling and tipping fees and cost of collection containers for each type of waste.
3. Total cost of disposal (with no waste management).
4. Revenue from recycled materials.
5. Savings in hauling and tipping fees by donating materials.
6. Savings in hauling and tipping fees that are avoided.
7. Handling and transportation costs. Include cost of collection containers for each type of waste.
8. Net additional cost or net savings from waste management plan.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.

1. Comply with operation, termination, and removal requirements in Section 015000 "Temporary Facilities and Controls."

B. Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan. Coordinator shall be present at Project site full time for duration of Project.

C. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work.

1. Distribute waste management plan to everyone concerned within three days of submittal return.
2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.

D. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
2. Comply with Section 015000 "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

3.2 RECYCLING CONSTRUCTION WASTE, GENERAL

A. General: Recycle paper and beverage containers used by on-site workers.

B. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to Owner.

C. Preparation of Waste: Prepare and maintain recyclable waste materials according to recycling or reuse facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.

D. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical according to approved construction waste management plan.

1. Provide appropriately marked containers or bins for controlling recyclable waste until removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.

a. Inspect containers and bins for contamination and remove contaminated materials if found.

2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
3. Remove recyclable waste from Owner's property and transport to recycling receiver or processor.

3.3 RECYCLING DEMOLITION WASTE

A. Metals: Separate metals by type.

1. Structural Steel: Stack members according to size, type of member, and length.
2. Remove and dispose of bolts, nuts, washers, and other rough hardware.

B. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location. Remove edge trim and sort with other metals. Remove and dispose of fasteners.

C. Carpet: Roll large pieces tightly after removing debris, trash, adhesive, and tack strips.

1. Store clean, dry carpet in a closed container or trailer provided by Carpet Reclamation Agency or carpet recycler.

3.4 RECYCLING CONSTRUCTION WASTE

A. Packaging:

1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
2. Polystyrene Packaging: Separate and bag materials.
3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.

B. Wood Materials:

1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.

3.5 DISPOSAL OF WASTE

A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.

1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.

2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not burn waste materials.

C. Disposal: Remove waste materials from Owner's property and legally dispose of them.

3.6 ATTACHMENTS

A. Form CWM-1 for construction waste identification.

B. Form CWM-3 for construction waste reduction work plan.

C. Form CWM-5 cost/revenue analysis of construction waste reduction work plan.

D. Form CWM-7 for construction waste

END OF SECTION 017419

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. The Maintenance Bond and all Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion.

C. Related Requirements:

1. Section 013233 "Photographic Documentation" for submitting final completion construction photographic documentation.
2. Section 017300 "Execution" for progress cleaning of Project site.
3. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.
4. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
5. Section 017900 "Demonstration and Training" for requirements for instructing Owner's personnel.

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 CLOSEOUT SUBMITTALS

A. Certificates of Release: From authorities having jurisdiction.

B. Certificate of Insurance: For continuing coverage.

C. Field Report: For pest control inspection.

1.5 MAINTENANCE MATERIAL SUBMITTALS

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

1.6 SUBSTANTIAL COMPLETION PROCEDURES

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

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

1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
2. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Construction Manager. Label with manufacturer's name and model number where applicable.

    a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Construction Manager's signature for receipt of submittals.

5. Submit test/adjust/balance records.
6. Omit.
7. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.

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

1. Advise Owner of pending insurance changeover requirements.
2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
3. Complete startup and testing of systems and equipment.
4. Perform preventive maintenance on equipment used prior to Substantial Completion.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 01790 "Demonstration and Training."
6. Advise Owner of changeover in heat and other utilities.
7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
9. Complete final cleaning requirements, including touchup painting.
10. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

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

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

1.7 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 Section 012900 "Payment Procedures."
2. Certified List of Incomplete Items: Submit certified copy of Construction Manager's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Construction Manager. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Submit pest-control final inspection report.

B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Construction Manager will either proceed with inspection or notify Contractor of unfulfilled requirements. Construction Manager will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.8 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. Use CSI Form 14.1A.

1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.
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 Construction Manager.
    d. Name of Contractor.
    e. Page number.

4. Submit list of incomplete items in the following format:

    a. MS Excel electronic file. Construction Manager will return annotated file.
    b. Three paper copies.

1.9 SUBMITTAL OF PROJECT WARRANTIES

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

B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.

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

1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.

3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
4. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

D. 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.

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

PART 3 - EXECUTION

3.1 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, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
d. Remove tools, construction equipment, machinery, and surplus material from Project site.
e. Remove snow and ice to provide safe access to building.
f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.

g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similarspaces.
h. Sweep concrete floors broom clean in unoccupied spaces.
i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stainsremain.
j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
k. Remove labels that are not permanent.
l. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
m. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
n. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
o. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter oninspection.

1) Clean HVAC system in compliance with NADCA Standard 1992-01. Provide written report on completion of cleaning.

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

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

D. Construction Waste Disposal: Comply with waste disposal requirements in Section 015000 "Temporary Facilities and Controls." And Section 017419 "Construction Waste Management and Disposal."

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 orrestoration.

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

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

END OF SECTION 017700

SECTION 017823

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

B. Related Requirements:

1. Section 013300 "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.

1.3 DEFINITIONS

A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.

B. Subsystem: A portion of a system with characteristics similar to a system.

1.4 CLOSEOUT SUBMITTALS – **Indexed per site/building**

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

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

B. Format: Submit Operations and Maintenance Manuals, Operations Manuals, Product Maintenance Manuals, System & Equipment Manuals in the following format:

1. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to Construction Manager.

   a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
   b. Enable inserted reviewer comments on draft submittals.

2. Three paper copies. Include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves. Construction Manager will return two copies.

C. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing demonstration and training. Construction Manager will comment on whether general scope and content of manual are acceptable.

D. 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 will return copy with comments.

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

PART 2 - PRODUCTS

2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

A. Directory: Prepare a single, comprehensive directory of emergency, operation, and maintenance data and materials, listing items and their location to facilitate ready access to desired information. Include a section in the directory for each of the following:

1. List of documents.
2. List of systems.
3. List of equipment.
4. Table of contents.

B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.

C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.

D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

2.2 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:

1. Title page.
2. Table of contents.
3. Manual contents.

B. Title Page: Include the following information:

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

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

1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.

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

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

1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
2. File Names and Bookmarks: Enable bookmarking of individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names

used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

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

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

    a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
    b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents, and indicate Specification Section number on bottom of spine. Indicate volume number for multiple-volume sets.

2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment.
4. Supplementary Text: Prepared on 8-1/2-by-11-inch white bond paper.
5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.

    a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
    b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

2.3 EMERGENCY MANUALS

A. Content: Organize manual into a separate section for each of the following:

1. Type of emergency.
2. Emergency instructions.
3. Emergency procedures.

B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:

1. Fire.
2. Flood.

3. Gas leak.
4. Water leak.
5. Power failure.
6. Water outage.
7. System, subsystem, or equipment failure.
8. Chemical release or spill.

C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

D. Emergency Procedures: Include the following, as applicable:

1. Instructions on stopping.
2. Shutdown instructions for each type of emergency.
3. Operating instructions for conditions outside normal operating limits.
4. Required sequences for electric or electronic systems.
5. Special operating instructions and procedures.

2.4 OPERATION MANUALS

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

1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
2. Performance and design criteria if Contractor 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.

B. Descriptions: Include the following:

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

C. Operating Procedures: Include the following, as applicable:

1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

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

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

2.5 PRODUCT MAINTENANCE MANUALS

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

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

C. Product Information: Include the following, as applicable:

1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.
4. Material and chemical composition.
5. Reordering information for specially manufactured products.

D. Maintenance Procedures: Include manufacturer's written recommendations and the following:

1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.
4. Schedule for routine cleaning and maintenance.
5. Repair instructions.

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

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

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

2.6 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

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

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

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

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

D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:

1. Test and inspection instructions.
2. Troubleshooting guide.
3. Precautions against improper maintenance.
4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
5. Aligning, adjusting, and checking instructions.
6. Demonstration and training video recording, if available.

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

1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

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

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

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

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

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.

B. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.

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

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

1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

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

1. 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.

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

1. Do not use original project record documents as part of operation and maintenance manuals.
2. Comply with requirements of newly prepared record Drawings in Section 017839 "Project Record Documents."

G. Comply with Section 017700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 017823

SECTION 017836 WARRANTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Documents affecting work of this Section include, but are not necessarily limited to, General Requirements, bidding documents and drawings.

1.2 GENERAL

A. This specification section sets forth warranty requirements.

1.3 WARRANTY

A. The bid will include a price for a twenty (**20)** year no dollar limit, non-prorated warranty to be provided by the material supplier. If your supplier is a subsidiary company, the warranty must be issued by the parent company.

B. The material supplier will issue the warranty to owner upon material supplier acceptance of project completion and full payment of all bills related to project.

C. Warranty supplier shall, as part of the warranty, provide one (1) maintenance visit within the first two (2) years of the warranty period. Each maintenance visit will include Inspections, Housekeeping, Routine Maintenance and Preventive Maintenance as described below.

1. General

    a. All repairs will follow the manufacturer's written repair and maintenance guidelines or NRCA recommended repair procedure.

2. Debris

    a. A complete walkover of the existing roof areas to determine the immediate surface conditions of the roof.
    b. Removal of all naturally occurring debris (i.e., leaves, branches, paper and similar items) from the roof membrane.
    c. Service will include removal of surface debris from the roof drains, gutters, and scuppers, but not clogged piped or plumbing.
    d. All debris will be disposed of at the owner's approved site location.

3. Terminations and Flashing

    a. Sealant voids in termination bars, counter flashings and parapet caps will be cleaned and resealed as required.
    b. Exposed fasteners will be resealed on perimeter metal details where required.
    c. All pitch pans will be refilled and topped off as required.

d. Metal projections (hoods and clamps) will be checked and resealed.
e. Soil stack leads will be inspected for cuts or holed and temporarily resealed when required with appropriate materials until arrangements can be made for permanent repair.
f. Re-secure loose metal coping caps, termination bars, counter flashings and metal edge systems where required with appropriate fasteners.

4. Membrane

a. Tears, splits and breaks in the perimeter and internal membrane flashing systems and flashing strip-ins will be repaired with appropriate repairmaterials.
b. Visible membrane defects which may allow water into the roofing system will be repaired with appropriate repair materials.
c. Dress-up reflective coatings where mastic repairs have been made.
d. Drains and Gutters
e. Check and re-secure drain bolts and clamping rings.
f. Check strip-in around drain leads, coat with approved mastics if required.
g. Reattach loose gutter straps, seal open gutter joints, and repair gutter strip- ins where required.
h. Check scupper boxes for open solder or caulking and seal with appropriate materials if required.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 SPECIAL PROJECTWARRANTY:

A. Submit roofing Installer's warranty, on warranty form at end of this Section, signed by Installer, covering the Work of this Section, including all components of built-up roofing such as built-up roofing membrane, base flashing, roof insulation, fasteners, cover boards, substrate boards, vapor retarders, roof pavers, and walkway products, for the following warranty period:

B. Warranty Period: **Five (5)** years from date of Substantial Completion.

C. ROOFING INSTALLER'S WARRANTY

D. WHEREAS_____of_____, herein called the "Roofing Installer," has performed roofing and associated work ("work") on the following project:

1. Owner:_____.
2. Address:_____.
3. Building Name/Type:_____.
4. Address:_____.

5. Area of Work: _____.

6. Acceptance Date: _____.

7. Warranty Period: _____.

8. Expiration Date: _____.

E. AND WHEREAS Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period,

F. NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period he will, at his own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.

G. This Warranty is made subject to the following terms and conditions:

1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:

   a. lightning;
   b. peak gust wind speed exceeding **72 mph**;
   c. fire;
   d. failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
   e. faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;
   f. vapor condensation on bottom of roofing; and
   g. activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.

2. When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.
3. Roofing Installer is responsible for damage to work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of work.
4. During Warranty Period, if Owner allows alteration of work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of said alterations, but only to the extent said alterations affect work covered by this Warranty. If Owner engages Roofing Installer to perform said alterations, Warranty shall not become null and void unless Roofing Installer, before starting said work, shall have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.
5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty shall become

null and void on date of said change, but only to the extent said change affects work covered by this Warranty.

6. Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.
7. This Warranty is recognized to be the only warranty of Roofing Installer on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of original work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

H. IN WITNESS THEREOF, this instrument has been duly executed this _____ day of _____, _____.

1. Authorized Signature: _____.
2. Name: _____.
3. Title: _____.

END OF SECTION

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.
4. Miscellaneous record submittals.

B. Related Requirements:
1. Section 017300 "Execution" for final property survey.
2. Section 017700 "Closeout Procedures" for general closeout procedures.
3. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.

1.3 CLOSEOUT SUBMITTALS

A. Record Drawings: Comply with the following:

1. Number of Copies: Submit one set(s) of marked-up record prints.
2. Number of Copies: Submit copies of record Drawings as follows:

a. Initial Submittal:

1) Submit one paper-copy set(s) of marked-up record prints.
2) Construction Manager will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.

b. Final Submittal:
1) Submit PDF electronic files of scanned record prints and three set(s) of prints.
2) Print each drawing, whether or not changes and additional information were recorded.

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

C. Record Product Data: Submit one paper copy and 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.

D. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit one paper copy and annotated PDF electronic files and directories of each submittal.

E. Reports: Submit written report weekly indicating items incorporated into project record documents concurrent with progress of the Work, including revisions, concealed conditions, field changes, product selections, and other notations incorporated.

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. Depths of foundations below first floor.
d. Locations and depths of underground utilities.
e. Revisions to routing of piping and conduits.
f. Revisions to electrical circuitry.
g. Actual equipment locations.
h. Duct size and routing.
i. Locations of concealed internal utilities.
j. Changes made by Change Order or Construction Change Directive.
k. Changes made following Construction Manager's written orders.
l. Details not on the original Contract Drawings.

m. Field records for variable and concealed conditions.
n. Record information on the Work that is shown only schematically.

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.

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. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
4. For each principal product, indicate whether record Product Data has been submitted in operation and maintenance manuals instead of submitted as record Product Data.
5. Note related Change Orders, record Product Data, and record Drawings where applicable.

B. Format: Submit record Specifications as annotated PDF electronic file and paper copy.

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, record Specifications, and record Drawings where applicable.

B. Format: Submit record Product Data as annotated PDF electronic file and paper copy.

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

2.4 MISCELLANEOUS RECORD SUBMITTALS

A. Assemble miscellaneous records required by other Specification Sections for miscellaneous

record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use andreference.

B. Format: Submit miscellaneous record submittals as PDF electronic file and papercopy.

1. Include miscellaneous record submittals directory organized by Specification Section number and title, electronically linked to each item of miscellaneous recordsubmittals.

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's reference during normal workinghours.

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. Demonstration of operation of systems, subsystems, and equipment.
2. Training in operation and maintenance of systems, subsystems, and equipment.
3. Demonstration and training video recordings.

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.

B. Qualification Data: For facilitator and instructor.

C. Attendance Record: For each training module, submit list of participants and length of instruction time.

D. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

1.4 CLOSEOUT SUBMITTALS

A. Demonstration and Training Video Recordings: Submit two copies within seven days of end of each training module.

1. Identification: On each copy, provide an applied label with the following information:

a. Name of Project.
b. Name and address of videographer.
c. Name of Construction Manager.
d. Name of Contractor.
e. Date of video recording.

2. Transcript: Prepared and bound in format matching operation and maintenance manuals. Mark appropriate identification on front and spine of each binder. Include a cover sheet with same label information as the corresponding video recording. Include name of Project and date of video recording on each page.
3. Transcript: Prepared in PDF electronic format. Include a cover sheet with same label information as the corresponding video recording and a table of contents with links to corresponding training components. Include name of Project and date of video recording on each page.
4. At completion of training, submit complete training manual(s) for Owner's use prepared and bound in format matching operation and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.

B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 014000 "Quality Requirements," experienced in operation and maintenance procedures and training.

C. Videographer Qualifications: A professional videographer who is experienced photographing demonstration and training events similar to those required.

D. Pre-instruction Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination." Review methods and procedures related to demonstration and training including, but not limited to, the following:

1. Inspect and discuss locations and other facilities required for instruction.
2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
3. Review required content of instruction.
4. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

1.6 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 has been reviewed and approved by Construction Manager.

PART 2 - PRODUCTS

2.1 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.

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:

1. Basis of System Design, Operational Requirements, and Criteria: Include the following:

    a. System, subsystem, and equipment descriptions.
    b. Performance and design criteria if Contractor is delegated design responsibility.
    c. Operating standards.
    d. Regulatory requirements.
    e. Equipment function.
    f. Operating characteristics.
    g. Limiting conditions.
    h. Performance curves.

2. Documentation: Review the following items in detail:

    a. Emergency manuals.
    b. Operations manuals.
    c. Maintenance manuals.
    d. Project record documents.
    e. Identification systems.
    f. Warranties and bonds.
    g. Maintenance service agreements and similar continuing commitments.

3. Emergencies: Include the following, as applicable:

    a. Instructions on meaning of warnings, trouble indications, and error messages.
    b. Instructions on stopping.
    c. Shutdown instructions for each type of emergency.
    d. Operating instructions for conditions outside of normal operating limits.
    e. Sequences for electric or electronic systems.
    f. Special operating instructions and procedures.

4. Operations: Include the following, as applicable:
    a. Startup procedures.
    b. Equipment or system break-in procedures.

c. Routine and normal operating instructions.
d. Regulation and control procedures.
e. Control sequences.
f. Safety procedures.
g. Instructions on stopping.
h. Normal shutdown instructions.
i. Operating procedures for emergencies.
j. Operating procedures for system, subsystem, or equipment failure.
k. Seasonal and weekend operating instructions.
l. Required sequences for electric or electronic systems.
m. Special operating instructions and procedures.

5. Adjustments: Include the following:

a. Alignments.
b. Checking adjustments.
c. Noise and vibration adjustments.
d. Economy and efficiency adjustments.

6. Troubleshooting: Include the following:

a. Diagnostic instructions.
b. Test and inspection procedures.

7. Maintenance: Include the following:

a. Inspection procedures.
b. Types of cleaning agents to be used and methods of cleaning.
c. List of cleaning agents and methods of cleaning detrimental to product.
d. Procedures for routine cleaning
e. Procedures for preventive maintenance.
f. Procedures for routine maintenance.
g. Instruction on use of special tools.

8. Repairs: Include the following:

a. Diagnosis instructions.
b. Repair instructions.
c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
d. Instructions for identifying parts and components.
e. Review of spare parts needed for operation and maintenance.

PART 3 - EXECUTION

3.1 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 Section 017823 "Operation and Maintenance Data."

B. Set up instructional equipment at instruction location.

3.2 INSTRUCTION

A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.

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

1. Construction Manager will furnish an instructor to describe basis of system design, operational requirements, criteria, and regulatory requirements.
2. Owner will furnish an instructor to describe Owner's operational philosophy.
3. Owner will furnish Contractor with names and positions of participants.

C. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.

1. Schedule training with Owner, through Construction Manager, with at least seven days' advance notice.

D. 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.

E. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of a demonstration performance-based test.

F. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

3.3 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

A. General: Engage a qualified commercial videographer to record demonstration and training video recordings. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.

1. At beginning of each training module, record each chart containing learning objective and lesson outline.

B. Video: Provide minimum 640 x 480 video resolution converted to .mp4 format file type, on electronic media.

1. Electronic Media: Read-only format compact disc acceptable to Owner, with commercial-grade graphic label.
2. File Hierarchy: Organize folder structure and file locations according to project manual table of contents. Provide complete screen-based menu.
3. File Names: Utilize file names based upon name of equipment generally described in video segment, as identified in Project specifications.

4. Contractor and Installer Contact File: Using appropriate software, create a file for inclusion on the Equipment Demonstration and Training DVD that describes the following for each Contractor involved on the Project, arranged according to Project table of contents:

    a. Name of Contractor/Installer.
    b. Business address.
    c. Business phone number.
    d. Point of contact.
    e. E-mail address.

C. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to adequately cover area of demonstration and training. Display continuous running time.

    1. Film training session(s) in segments not to exceed 15 minutes.

        a. Produce segments to present a single significant piece of equipment per segment.
        b. Organize segments with multiple pieces of equipment to follow order of Project Manual table of contents.
        c. Where a training session on a particular piece of equipment exceeds 15 minutes, stop filming and pause training session. Begin training session again upon commencement of new filming segment.

D. Light Levels: Verify light levels are adequate to properly light equipment. Verify equipment markings are clearly visible prior to recording.

    1. Furnish additional portable lighting as required.

E. Narration: Describe scenes on video recording by audio narration by microphone while video recording is recorded. Include description of items being viewed.

F. Transcript: Provide a transcript of the narration. Display images and running time captured from videotape opposite the corresponding narration segment.

G. Pre-produced Video Recordings: Provide video recordings used as a component of training modules in same format as recordings of live training.

END OF SECTION 017900

SECTION 024100
DEMOLITION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Selective demolition of building elements for alteration purposes.

B. Carpet and base removal.

C. Remove, store and replace existing furnishings and equipment.

1.02 REFERENCE STANDARDS

A. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations.

1.03 SUBMITTALS

A. Demolition Plan: Submit demolition plan as specified by OSHA and local authorities.
   1. Indicate extent of demolition, removal sequence, bracing and shoring, and location and construction of barricades and fences.
   2. Indicate extent of demolition plans and removal sequence.
   3. Identify demolition firm and submit qualifications.
   4. Include a summary of safety procedures.

PART 2 PRODUCTS -- NOT USED

PART 3 EXECUTION

3.01 SCOPE

A. Removal of existing adhered carpeting and base.

B. Remove other items indicated, for relocation and replacement.
   1. Carefully remove, store and replace all furnishings and movable equipment in areas indicated to have existing flooring materials removed and new flooring materials installed.

3.02 GENERAL PROCEDURES AND PROJECT CONDITIONS

A. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
   1. Obtain required permits.
   2. Comply with applicable requirements of NFPA 241.
   3. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.
   4. Provide, erect, and maintain temporary barriers and security devices.
   5. Use physical barriers to prevent access to areas that could be hazardous to workers or the public.
   6. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
   7. Do not close or obstruct roadways or sidewalks without permit.
   8. Conduct operations to minimize obstruction of public and private entrances and exits; do not obstruct required exits at any time; protect persons using entrances and exits from removal operations.
   9. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon or limit access to their property.
   10. **Carpet to be removed in a manner to protect the integrity of the VAT flooring below.**

B. Do not begin removal until receipt of notification to proceed from Owner.

C. Do not begin removal until elements to be salvaged or relocated have been removed.

D. Protect existing room and other elements and finishes that are not to be removed.
   1. Provide bracing and shoring.
   2. Prevent movement or settlement of adjacent structures.
   3. Stop work immediately if adjacent structures appear to be in danger.

E. If hazardous materials are discovered during removal operations, stop work and notify Architect and Owner; hazardous materials include regulated asbestos containing materials, lead, PCB's, and mercury.

3.03 SELECTIVE DEMOLITION FOR ALTERATIONS

A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
   1. Verify that construction and utility arrangements are as indicated.
   2. Report discrepancies to Architect before disturbing existing installation.
   3. Beginning of demolition work constitutes acceptance of existing conditions that would be apparent upon examination prior to starting demolition.

B. Separate areas in which demolition is being conducted from other areas that are still occupied.
   1. Provide, erect, and maintain temporary dustproof partitions of construction as required t protect occupants and existing conditions .

C. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.

D. Remove existing work as indicated and as required to accomplish new work.
   1. Remove rotted wood, corroded metals, and deteriorated masonry and concrete; replace with new construction specified.
   2. Remove items indicated on drawings.

E. Services (Including but not limited to HVAC, Fire Protection, Electrical, and Telecommunications): Remove existing systems and equipment as indicated.
   1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components.
   2. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
   3. Verify that abandoned services serve only abandoned facilities before removal.
   4. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification.

F. Protect existing work to remain.
   1. Prevent movement of structure; provide shoring and bracing if necessary.
   2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
   3. Repair adjacent construction and finishes damaged during removal work.
   4. Patch as specified for patching new work.

3.04 DEBRIS AND WASTE REMOVAL

A. Remove debris, junk, and trash from site.

B. Remove from site all materials not to be reused on site; do not burn or bury.

C. Leave site in clean condition, ready for subsequent work.

END OF SECTION

SECTION 028216
ENGINEERING CONTROL OF ASBESTOS CONTAINING MATERIALS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. System for encapsulation of asbestos-containing flooring material.

1.02 RELATED REQUIREMENTS

A. 096500 - Resilient Flooring: Resilient tile flooring.

1.03 SUBMITTALS

A. Product Data: Provide data for membrane barrier and accessories.

B. Installation Instructions: Method of installing system.

C. Installer's Qualification Statement.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Company certified in performing work of the type specified and with at least three years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver membrane barrier and accessories to project site in original cartons from the factory.

B. Store inside building under cover and elevated above grade.

1.06 FIELD CONDITIONS

A. Existing Conditions: Existing carpeting has been removed exposing intact asbestos-containing flooring material.

PART 2 PRODUCTS

2.01 ASBESTOS BARRIER SYSTEM ASSEMBLY

A. Basis of Design Assembly Provider: National Asbestos Flooring Encasement System, Inc. (NAFES, Inc.) Asbestos Barrier System.

B. Materials:
   1. Barrier Membrane: Self adhering polypropylene, scrim and foil.

C. Accessories: Perimeter sealing tape and adhesive.

D. Resilient Tile Flooring: Product as specified in Section 096500.

PART 3 EXECUTION

3.01 INSTALLERS

A. Installer List: Certified by National Asbestos Flooring Encasement System, Inc. (NAFES,Inc.).
   1. Substitution Limitations: Not permitted.

3.02 EXAMINATION

A. Verification of Conditions: Verify that the existing asbestos-containing flooring is in place and intact.

3.03 PREPARATION

A. Protection of In-Place Conditions: Re-adhere any loose tiles of asbestos-containing flooring or use floor leveling compound to level out floor as required..

B. Removal: Resilient base.

C. Surface Preparation:

D. Clean the existing abestos-containing flooring by wet mopping. Vacuum the existing flooring with a high efficiancy particulate aier (HEPA) vacuum to pick up any dust or debris.

3.04 INSTALLATION

A. Install asbestos barrier membrane system in accordance with manufacturer's instructions.

B. Install resilient tile flooring in accordance with manufacturer's instructions.

3.05 PROTECTION

A. Do not permit traffic over unprotected floor surface.

END OF SECTION

SECTION 031513 - WATERSTOPS FOR CONCRETE JOINTS

PART 1 - GENERAL

1.01 Provision Includes

A. Embedded waterstop in concrete including contraction, expansion and construction joints creating a continuous diaphragm to prevent the passage of fluid.

B. The use of nonmetallic waterstops for use in concrete joints subjected to chlorinated water, sea water, oils, solvents, acids, salts, fuels and many other aggressive chemicals and fluids.

1.02 References

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

A. American Society for Testing and Materials (ASTM)

1. ASTM D 395 — Test Methods for Rubber Property – Compression Set.
2. ASTM D 412 — Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers — Tension.
3. ASTM D 471 — Test Method for Rubber Properties – Effects of Chemicals.
4. ASTM D 624 — Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomer.
5. ASTM D 746 — Test Method for Brittleness Temperature of Plastics by Impact.
6. ASTM D 792 — Test Method for Specific Gravity (Gravity Density) and Density of Plastics by Displacement.
7. ASTM D 1171 — Test Method for Ozone Resistance at 500 pphm.
8. ASTM D 2240 — Test Method for Shore Hardness.

B. Federal Specifications

1. COE CEGS-03250 July 1995 Guide Specification for Military Construction.
2. EPA Title 40 CFR Section 265.193.

C. American Concrete Institute

1. ACI 350.2R-04 — Concrete Structures for Containment of Hazardous Wastes.

D. NSF International

1. NSF/ANSI Standard 61Certification for Drinking Water System Components — Health Effects.

E. BuildingGreen, Inc.

1. GreenSpec® — GreenSpec® Directory, 6th Edition.

1.03 Submittal Procedures

A. Chemical Resistant Waterstops

1. Earth Shield TPV Waterstop submittal shall contain the following:

a. Samples of each size and shape to be used.

b. Plate drawings of the waterstop profile indicating all dimensions.
c. Shop drawings of shop made fittings to be provided by the manufacturer or prepared by the contractor.
d. Copy of test results of ASTM D 471 Chemical Resistance showing compliance with Appendix A.
e. Copy of independent certification to NSF/ANSI Standard 61 Certification for Drinking Water System Components — Health Effects.
f. Copy of independent testing to ASTM D 1171 Ozone Resistance to 500 pphm concentration.
g. Manufacturer's Literature, including MSDS sheets, installation instructions and splicing instructions.
h. Certificate of compliance to physical properties outlined in this specification.

2. Non-metallic Waterstop and Splices - Specimens identified to indicate manufacturer, type of material, size, quantity of material, and shipment or lot represented. Each sample shall be a piece not less than 6 inches long of each type, size, and lot furnished. One splice sample of each size and type for every 50 splices made in the shop and every 10 splices made at the job site. The splice samples shall be made using straight run pieces with the splice located at the mid-length of the sample and finished as required for the installed waterstop. The total length of each splice shall be not less than 12 inches long.

1.04 Delivery and Storage

Material delivered and placed in storage shall be stored off the ground and protected from moisture, dirt, and other contaminants.

PART 2 - PRODUCTS

2.01 Waterstops

Intersection and change of direction waterstops shall be shop fabricated.

A. Manufacturer:

1. JP Specialties, Inc.
2. Hohmann & Bernard, Inc.
3. Henry
4. Or approved equal.

B. Non-Metallic Waterstops — Non-metallic waterstops shall be manufactured from a fully cross-liked thermoplastic vulcanizate, containing no scrap or reclaimed material.

1. Thermoplastic Vulcanizate (TPV) Waterstop shall conform to EPA Title 40 CFR Section 265.193. The suitability of the waterstop for a specific application should be determined by specific testing for that particular requirement by ASTM D 471.
2. Thermoplastic Vulcanizate (TPV) Waterstop shall be certified for use in potable water per NSF/ANSI Standard 61. Third-party certified documentation to be provided by manufacturer.

Thermoplastic Vulcanizate (TPV) Waterstop shall conform to the following typical physical properties:

Property	Test Method	Required Results
Specific Gravity	ASTM D 792	.96
Shore A Hardness (5 sec.)	ASTM D 2240	90±3 at 77°F
Tensile Strength	ASTM D 412	2,300 psi
Ultimate Elongation	ASTM D 412	530%
100% Modulus	ASTM D 746	1,000 psi
Tear Strength	ASTM D 624	278 pli at 77°F
Compression Set	ASTM D 395	29% at 77°F
Brittle Point	ASTM D 746	-78°F
Drinking Water Safe	NSF/ANSI 61	Certified for use in potable water *(see Appendix B).*
Ozone Resistance	ASTM D 1171	Passed, no cracking at 500 pphm
Chemical Resistance	ASTM D 471	Meet or exceed specific testing standards for contained fluids as required by Owner and *certified* by Manufacturer.
Green Certification	GreenSpec	Approved

Unless otherwise specified or indicated on the drawings provide the following types or approved equal:

1. **Part No. JP436** — 4" x 3/16" ribbed centerbulb, as manufactured by **JP Specialties, Inc.** *(all- purpose waterstop; if specified with factory installed brass eyelets use part no.EYJP436)* NSF
2. **Part No. JP636** — 6" x 3/16" ribbed centerbulb, as manufactured by **JP Specialties, Inc.** *(all- purpose waterstop; if specified with factory installed brass eyelets use part no.EYJP636)* NSF
3. **Part No. JP936** — 9" x 3/16" ribbed centerbulb, as manufactured **JP Specialties, Inc.** *(all-purpose waterstop; if specified with factory installed brass eyelets use part no.EYJP936)* NSF
4. **Part No. JP678** — 6" x 3/16" ribbed tear web, as manufactured by **JP Specialties, Inc.** *(for extreme joint movement; if specified with factory installed brass eyelets use part no.EYJP678)* NSF
5. **Part No. JP978** — 9" x 3/16" ribbed tear web, as manufactured by **JP Specialties, Inc.** *(for extreme joint movement; if specified with factory installed brass eyelets use part no.EYJP978)* NSF
6. **Part No. JP211** — 9" x 3/16" base seal, as manufactured by **JP Specialties, Inc.** *(for runway and pavement applications)* NSF
7. **Part No. JP320L** — 3" x 3/16" tear web retrofit, as manufactured by **JP Specialties, Inc.** *(for joining concrete to existing surface; if specified with factory installed brass eyelets use part no. EYJP320L)* NSF
8. **Part No. JP325T** — 3" x 3/16" T-shaped retrofit, as manufactured by **JP Specialties, Inc.** *(for joining concrete to existing surface; if specified with factory installed brass eyelets use part no. EYJP325T)* NSF
9. **Part No. JP336L** — 3" x 3/16" retrofit, as manufactured by **JP Specialties, Inc.** (*for joining concrete to existing surface; if specified with factory installed brass eyelets use part no. EYJP336L)* NSF
10. **Part No. JP621L** — 4-1/2" x 3/16" large movement retrofit, as manufactured by **JP Specialties, Inc.** (*for joining concrete to existing surface; large shear movements)* NSF
11. **Part No. JP450T** — 5" x 3/16" T-shaped retrofit, as manufactured by **JP Specialties, Inc.** *(for joining concrete to existing surface; if specified with factory installed brass eyelets use part no. EYJP450T)* NSF
12. **Part No. JP647** — 6" x 1/4" dumbbell, as manufactured by **JP Specialties, Inc.** *(for construction joints)* NSF
13. **Part No. JP648** — 6" x 3/8" dumbbell, as manufactured by **JP Specialties, Inc.** *(especially designed for Carollo Engineers [construction joints])* NSF
14. **Part No. JP948** — 9" x 3/8" dumbbell, as manufactured by **JP Specialties, Inc.** *(for construction joints)* NSF

15. **Part No. JP949** — 9” x 3/8” dumbbell centerbulb, as manufactured by **JP Specialties, Inc.** *(especially designed for Carollo Engineers [expansion joints])* NSF
16. **Part No. JP1149** — 12” x 3/8” dumbbell centerbulb, as manufactured by **JP Specialties, Inc.** *(especially designed for Carollo Engineers [expansion joints])* NSF
17. **Part No. JP158** — 1” screed key cap, as manufactured by **JP Specialties, Inc.** *(designed for keyed joints)* NSF
18. **Part No. JPEB350** — 1/2” integrated cap seal waterstop, as manufactured by **JP Specialties, Inc.** *(designed for expansion joints; if specified with factory installed brass eyelets use part no. EYJPEB350)*
19. **Part No. JPEB375** — 3/4” integrated cap seal waterstop, as manufactured by **JP Specialties, Inc.** *(designed for expansion joints; if specified with factory installed brass eyelets use part no. EYJPEB375)*
20. **Part No. JPEB375R** — 3/4” integrated cap seal retrofit waterstop, as manufactured by **JP Specialties, Inc.** *(designed for expansion joints; if specified with factory installed brass eyelets use part no. EYJPEB375R)*

PART 3 - EXECUTION

3.01 Waterstop, Installations and Splices

Waterstops shall be installed at the locations shown to form a continuous fluid-tight diaphragm. Adequate provision shall be made to support and completely protect the waterstops during the progress of the work. Any waterstop punctured or damaged shall be repaired or replaced. Exposed waterstops shall be protected during application of form release agents to avoid being coated. Suitable guards shall be provided to protect exposed projecting edges and ends of partially embedded waterstops from damage when concrete placement has been discontinued. Splices shall be made by certified, trained personnel using approved equipment and procedures.

A. Non-Metallic Shop Made Fittings — Fittings shall be shop made using a machine specifically designed to mechanically weld the waterstop. A miter guide, proper fixturing (profile dependent), and portable power saw shall be used to miter cut the ends to be joined to ensure good alignment and contact between joined surfaces. The splicing of straight lengths shall be done by squaring the ends to be joined and using an ST-10® waterstop splicing tool. Continuity of the characteristic features of the cross section of the waterstop (ribs, tabular center axis, protrusions, etc.) shall be maintained across the splice.

B. Thermoplastic Vulcanizate Waterstop — The splicing of straight lengths shall be done by squaring the ends to be joined and using an ST-10® waterstop splicing tool utilizing a thermoplastic splicing iron with a non-stick surface specifically designed for waterstop welding. The correct temperature (410°F to 430°F) shall be used to sufficiently melt without charring the plastic. The spliced area, when cooled, shall show no signs of separation, holes, or other imperfections when bent by hand in as sharp an angle as possible.

3.02 Preparation

A. Uncoil waterstop 24 hours prior to installation for ease of handling and fabrication.
B. Position waterstop to ensure proper distance from steel reinforcing bars to prevent rock pockets and honeycomb (see installation section 3.04).

C. Protect waterstop from damage during progress of work.

D. Clean concrete joint after first pour to remove debris and dirt.

3.03 Examination/Inspection

A. Prior to placement of concrete notify engineer for field inspection approval.

B. Inspect waterstop and field splices for defects and conformance to Quality Assurance Standard section 3.05.

C. Upon inspection of waterstop installation, replace any damaged or unacceptable waterstop and dispose of defective material.

3.04 Installation

A. Position waterstop in joint as indicated on drawings.

B. Center waterstop on joint, with approximately one-half of waterstop width to be embedded in concrete on each side of the joint.

C. Allow clearance between waterstop and reinforcing steel of a minimum two times the largest aggregate size. Prevent rock pockets and air voids caused by aggregate bridging.

D. Ensure centerbulb is not embedded at expansion joints.

E. Secure waterstop in correct position using optional factory-installed brass eyelets (or JPS hog rings crimped between last two ribs on 12 inch maximum centers), and wire tie to adjacent reinforcing steel. Center-to-center spacing may be increased upon written request and approval from ENGINEER.

F. Carefully place concrete without displacing waterstop from proper position.

G. Thoroughly and systematically vibrate concrete in the vicinity of the joint, and to maximized intimate contact between concrete and waterstop.

H. After first pour, clean unembedded waterstop leg to ensure full contact of second concrete pour. Remove laitance, spillage, form oil and dirt.

3.05 Quality Assurance — Edge welding will not be permitted. Centerbulbs shall be compressed or closed when welding to non-centerbulb type. Waterstop splicing defects which are unacceptable include, but are not limited to the following:

A. Tensile strength not less than 60 percent of parent sections.

B. Free lap joints.

C. Misalignment of centerbulb, ribs, and end bulbs greater than 1/16 inch.

D. Misalignment which reduces waterstop cross section ore than 15 percent.

E. Bond failure at joint deeper than 1/16 inch or 15 percent of material thickness.

F. Misalignment of waterstop splice resulting in misalignment of waterstop in excess of 1/2 inch in 10 feet.

G. Visible porosity in the weld.

H. Charred or burnt material.

I. Bubbles or inadequate bonding.

J. Visible signs of splice separation when cooled splice (24 hours or greater) is bent by hand at sharp angle.

APPENDIX A

Earth Shield® Thermoplastic Vulcanizate Waterstop (TPER/TPV) — Effect of 166 hour immersion (ASTM D-471) on properties of Earth Shield® Thermoplastic Vulcanizate Waterstop

Fluids	Temp., °C	Ultimate Elongation Percent Retention	Ultimate Tensile Strength Percent Retention	100% Modulus Percent Retention	Hardness, Change, Shore A Units	Weight Change Percent
98% Sulfuric Acid	23	77	82	108	-1	2.1
10% Hydrochloric Acid	23	88	87	85	6	0.3
50% Sodium Hydroxide	23	101	107	104	-4	-0.1
10% Potassium Hydroxide	23	101	101	106	-1	0.1
Water	100	84	94	106	4	2.9
10% Zinc Chloride	23	89	87	83	5	0
Sea Water	23	98	107	99	4	0.3
15% Sodium Chloride	23	93	90	94	5	0.7
18% Calcium Chloride/14% Calcium	150	71	86	110	-2	-0.1
Bromide, 2.5% Detergent (Tide®)	23	103	103	103	0	-0.1
Acetic Acid	23	103	102	102	-2	3.2
Acrylonitrile	23	102	104	110	-4	0.9
Aniline	23	99	94	99	-2	1.5
Bromobenzene	23	94	91	88	-3	41.9
n-Butyl Acetate	23	95	92	80	5	0.3
Carbon Disulfide	23	94	68	82	-19	60.4
Cyclohexane	23	63	58	62	-6	45.3
Diethyl Ether	23	98	97	95	-7	-1.8
Dimethylformamide	23	96	105	100	6	0
Dioctyl Phthalate	23	101	97	103	-1	-0.2
1,4-Dioxane	23	98	94	95	-3	1.1
95% Ethanol	23	106	98	99	0	-1.7
Glycerol	23	102	101	103	-2	-0.2
n-Hexane	23	90	92	94	-10	5.7
Isophorone Diisocyanate	23	101	92	105	7.2	.30
Methylethylketone	23	95	94	79	6	-4.8
Nitrobenzene	23	100	98	102	-2	-1.5
Piperidene	23	98	105	94	6	-1.9
1-Propanol	23	93	98	100	6	-4.3
Toluene Diisocyanate	23	88	98	103	7.2	4.93
Pyridine	23	98	105	94	6	-1.9
Trichloroethylene	23	101	105	85	-13	97.2
Turpentine	23	80	75	85	-10	34.8
Xylene	23	84	85	90	-11	24.9
ASTM #1 Oil	100	88	91	99	1	13.5
ASTM #1 Oil	125	70	78	91	-1	21.6

Fluids	Temp., °C	Ultimate Elongation Percent Retention	Ultimate Tensile Strength Percent Retention	100% Modulus Percent Retention	Hardness, Change, Shore A Units	Weight Change Percent
ASTM #2 Oil	100	82	86	93	-2	27.1
ASTM #2 Oil	125	65	79	93	-6	40.1
ASTM #3 Oil	100	72	75	80	-6	41.6
ASTM #3 Oil	125	60	71	83	-13	59.8
IRM 902	100	85	86	100	-5	20.8
IRM 902[2]	125	71	79	97	-7	29.3
IRM 903	100	76	78	91	-9	35.4
IRM 903[2]	125	60	69	84	-15	50.6
Reference Fuel A (Isooctane)	23	86	85	82	-1	13.2
Reference Fuel B (Isooctane/Toluene, 70/30)	23	82	84	81	-7	24.5
Reference Fuel C (Isooctane/Toluene, 50/50)	23	67	68	75	-4	29.4
Diesel	23	89	81	87	-11	17
JP4 Jet Fuel	23	100	71	79	-11	17
JP8 Jet Fuel	23	100	93	95	-7	8
Kerosene	23	92	85	88	-10	15
Automatic Transmission Fluid	125	63	77	82	-11	43.4
Hydraulic Brake Fluid	23	95	102	95	5	-1.8
Hydraulic Brake Fluid 2	100	89	94	97	6	-12.8
Lithium Grease	23	93	98	92	5	3.5
Lithium Grease	100	88	88	92	-7	18.8
Power Steering Fluid	125	54	59	68	-12	52.2
Antifreeze, 50/50 Ethylene Glycol (Prestone®)/water	125	84	99	96	2	3.1
Pydraul® 312	125	79	85	90	0	17.6
Skydrol® 500 B4	125	93	104	101	4	-4.2
Sunvis® 706 Fluid	125	67	77	84	-8	39.9
Ucon® CC732	125	91	99	96	2	5.3
Ucon® 50HB5100	125	91	99	96	2	5.3
Freon® 11	5	92	88	88	-9	32.3

All solution concentrations by weight.

APPENDIX B

Earth Shield® Thermoplastic Vulcanizate Waterstop (TPER/TPV) — NSF International Drinking Water System Components — Health Effects.

END OF SECTION 031513

SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Formwork for cast-in-place concrete, with shoring, bracing, and anchorage.
2. Formwork accessories.
3. Form stripping.
4. Reinforcing steel for cast-in-place concrete.
5. Cast-in-place concrete, including concrete for the following:
   a. Foundations, footings.
   b. Foundation walls.
   c. Floor slabs.
   d. Retaining walls.
   e. Equipment pads and bases.
   f. Exterior stairs.
   g. Ramps.
6. Concrete curing.

1.2 DEFINITIONS

A. Unexposed Finish: A general-use finish, with no appearance criteria, applicable to all formed concrete concealed from view after completion of construction.

B. Exposed Finish: A general-use finish applicable to all formed concrete exposed to view and including surfaces which may receive a paint coating (if any).

1.3 SUBMITTALS

A. Product Data: Submit manufacturer’s product data for the following:

1. Concrete admixtures.
2. Fibrous reinforcement (if used).
3. Waterstops.
4. Grout.
5. Curing compound.
6. Bonding compound.

B. Aggregates: Submit test reports showing compliance with specified quality and gradation.

C. Shop Drawings: Submit shop drawings for fabrication and placement of the following:

1. Reinforcement: Comply with ACI SP-66. Include bar schedules, diagrams of bent bars, arrangement of concrete reinforcement, and splices.
   a. Show construction and control joints.
   b. Include details of reinforcement at openings through concrete structures.
   c. Include elevations of reinforcement in walls.
   d. Show stirrup spacing.

D. Quality Control Submittals: Submit the following information related to quality assurance requirements specified:

1. Concrete Mix Design data: Submit proposed mix designs and test data before concrete operations begin. Identify for each mix submitted the method by which proportions have been selected. Each mix shall be identified as it will appear on batch tickets delivered to project site.
    a. For mix designs based on field experience, include individual strength test results, standard deviation, and required average compressive strength f(cr) calculations.
    b. For mix designs based on trial mixtures, include trial mix proportions, test results, and graphical analysis and show required average compressive strength f(cr).
    c. Indicate quantity of each ingredient per cubic yard of concrete.
    d. Indicate type and quantity of admixtures proposed or required.
2. Test reports: Submit laboratory test reports for all testing specified. Submit field reports for all testing and inspections performed. Include descriptions of all tests and inspections performed, as well as listings of all non-conforming tests and action taken.
3. Certifications: Submit affidavits from an independent testing agency certifying that all materials furnished under this section conform to specifications.
4. Certifications: Provide certification from manufacturers of concrete admixtures that chloride content complies with specified requirements.
5. Submit batch tickets complying with ASTM C 685 or delivery tickets complying with ASTM C 94, as applicable for each load of concrete used in the work.
    a. Include on the tickets the additional information specified in the ASTM document.
6. Cold weather concreting: Submit description of planned protective measures.
7. Hot weather concreting: Submit description of planned protective measures.

1.4 QUALITY ASSURANCE

A. Codes and Standards: Comply with the following documents, except where requirements of the contract documents or of governing codes and government authorities are more stringent.

    1. ACI 301.
    2. ACI 318.
    3. CRSI Manual of Standard Practice.

B. Testing Agency Services:

    1. Employ, at contractor's expense, an independent testing agency acceptable to the architect to perform specified tests and other services required for quality assurance. Submit name, address, telephone number of testing agency and person assigned to project for approval prior to start of concrete operations.
        a. Testing agency shall meet ASTM E 329 requirements.
        b. Provide testing agency with all relevant information regarding concrete work. Provide drawings, specifications, and copies of approved concrete mix design prior to start of concrete operations.

C. Source of Materials: Obtain materials of each type from same source for the entire project.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver reinforcement to project site bundled and tagged with metal tags, indicating bar size, lengths, and other data corresponding to information shown on placement drawings.

    1. Store concrete reinforcement materials at the site to prevent damage and accumulation of dirt or rust.

B. Store cementitious materials in a dry, weathertight location. Maintain accurate records of shipment and use.

C. Store aggregates to permit free drainage and to avoid contamination with deleterious matter or other aggregates. When stockpiled on ground, discard bottom 6 inches of pile.

D. Handle aggregates to avoid segregation.

1.6 PROJECT CONDITIONS

A. Cold-Weather Concreting: Comply fully with the recommendations of ACI 306.

1. Well in advance of proposed concreting operations, advise the architect of planned protective measures including but not limited to heating of materials, heated enclosures, and insulating blankets.

B. Hot-Weather Concreting: Comply fully with the recommendations of ACI 305R.

1. Well in advance of proposed concreting operations, advise the architect of planned protective measures including but not limited to cooling of materials before or during mixing, placement during evening to dawn hours, fogging during finishing and curing, shading, and windbreaks.

PART 2 - PRODUCTS

2.1 FORMWORK

A. Facing Materials:

1. Unexposed finish concrete: Any standard form materials that produce structurally sound concrete.
2. Exposed finish concrete: Materials selected to offer optimum smooth, stain-free final appearance and minimum number of joints. Provide materials with sufficient strength to resist hydrostatic head without bow or deflection in excess of allowable tolerances, and as follows:
   a. Overlaid plywood: PS-1 “B-B High Density Concrete Form Overlay,” Class I.

B. Formwork Accessories:

1. Foam coating: Foam release agent that will not adversely affect concrete surfaces or prevent subsequent application of concrete coatings.
2. Metal ties: Commercially manufactured types; cone snap ties, taper removable bolt, or other type which will leave no metal closer than 1-1/2 inches from surface of concrete when forms are removed, leaving not more than a 1-inch-diameter hole in concrete surface.
3. Fillets: Wood or plastic fillets for chamfered corners, in maximum lengths possible.

2.2 REINFORCING MATERIALS

A. Reinforcing Bars: Provide deformed bars complying with the following, except where otherwise indicated:

1. ASTM A 615, Grade 60.

B. Reinforcing Bar Mats: ASTM A 184, clipped type.

C. Welded Wire Fabric: ASTM A 185, cold-drawn steel, plain.

D. Reinforcing Accessories:

1. Tire wire: Black annealed type, 16-1/2 gage or heavier.
2. Supports: Bar supports conforming to specifications of CRSI “Manual of Standard Practice.”
   a. Class 1 (plastic protected) at all formed surfaces which will be exposed to weather.
   b. Class 1 (plastic protected) or Class 2 (stainless steel protected) at all formed surfaces which will be exposed to view but not to weather.

c. Precast concrete blocks of strength equal to or greater than specified strength of concrete or Class 3 supports equipped with sand plates, where concrete will be cast against earth. Concrete masonry units will not be accepted.

2.3 CONCRETE MATERIALS

A. Portland Cement: ASTM C 150, and as follows:

1. Type I, except where other type is specifically permitted or required,
   a. Type I may be replaced by Type III (high early strength) for concrete placed during coldweather.

B. Water: Potable.

C. Aggregates:

1. Normal weight concrete: ASTM C 33.
   a. Class 3S.
2. Maximum size of coarse aggregates, whichever is least: 6.
   a. One-fifth narrowest dimension between sides of forms.
   b. Three-fourths of minimum clear distance between reinforcing bars or between bars and side of form.
   c. Columns and piers: Two-thirds of minimum clear distance between bars.

D. Admixtures - General: Admixtures which result in more than 0.1 percent of soluble chloride ions by weight of cement are prohibited.

E. Air-Entraining Admixture: ASTM C 260 and certified by manufacturer for compatibility with other mix components.

1. Products: The following products, provided they comply with requirements of the contract documents, will be among those considered acceptable:
   a. “Air Mix”; The Euclid Chemical Company.
   b. “Sika-Aer”; Sika Corporation.
   c. “Micro-Air”; Master Builders, Inc.
   d. “Darex AEA”; W. R. Grace and Company.
   e. “Burke 2001” or “Burke 2002”; The Burke Company.
   f. “Air-Tite”; Cormix Construction Chemicals.
   g. Or Approved Equal.

F. Water-Reducing Admixture: ASTM C 494, Type A.

1. Products: The following products, provided they comply with requirements of the contract documents, will be among those considered acceptable:
   a. “WRDA Hycol”; W. R. Grace and Company.
   b. “PSI-N”; Cormix Construction Chemicals,
   c. “Eucon WR-75”; The Euclid Chemical Company.
   d. “Pozzolith Normal”; Master Builders, Inc.
   e. “Plastocrete 161”; Sika Corporation.
   f. “Prokete N”; Conchem.
   g. Or Approved Equal.

G. Water-Reducing, Retarding Admixture: ASTM C 494, Type D.

1. Products: The following products, provided they comply with requirements of the contract documents, will be among those considered acceptable:

a. “Pozzolith Retarder”; Master Builders, Inc.
b. “Eucon Retarder 75”; The Euclid Chemical Company.
c. “Daratard-17”; W. R. Grace and Company.
d. “PSI-R Plus”; Cormix Construction Chemicals.
e. “Plastiment”; Sika Corporation.
f. “Protard”; Conchem.
g. Or Approved Equal.

H. Water-Reducing and Accelerating Admixtures: ASTM C 494, Type E.

1. Products: The following products, provided they comply with requirements of the contract documents, will be among those considered acceptable:
a. “Accelguard 80”; The Euclid Chemical Company.
b. “Pozzutec 20”; Master Builders, Inc.
c. “Gilco Accelerator”; Cormix Construction Chemicals.
d. Or Approved Equal.

I. High-Range Water-Reducing Admixture (Superplasticizer): ASTM C 494, Type F or G.

1. Products: The following products, provided they comply with requirements of the contract documents, will be among those considered acceptable:
a. “WRDA 19” or “Daracem-100”; W. R. Grace and Company.
b. “PSP Superplasticizer”; Conchem.
c. “A-H Super P”; Anti Hydro Company, Inc.
d. “Sikament 300”; Sika Corporation.
e. “Mighty 150”; Boremco Specialty Chemicals Division/Borden and Remington Corporation.
f. “Eucon 37”; The Euclid Chemical Company.
g. “PSI Super”; Cormix Construction Chemicals.
h. “Rheobuild”; Master Builders, Inc.
i. Or Approved Equal.

J. Fibrous Reinforcement: Polypropylene fibers designed and engineered specifically for secondary reinforcement of concrete.

1. Products: The following products, provided they comply with requirements of the contract documents, will be among those considered acceptable:
a. “Forta CR”; Forta Corporation.
b. “Fibermesh”; Fibermesh Company.
c. Or Approved Equal.

K. Waterproofing Admixtures:

1. Products: The following products, provided they comply with requirements of the contract documents, will be among those considered acceptable:
a. “Anti-Hydro”; Anti Hydro Company.
b. Or Approved Equal.

2.4 MISCELLANEOUS MATERIALS AND ACCESSORIES

A. Waterstops, General: Provide waterstops at construction joints and as otherwise indicated, sized and configured to suit joints.

1. Refer to specification Section 031513 for additional information.

B. Nonshrink Grout: CRD-C 621, Grade B.

1. Type: Provide nonmetallic type only.
2. Products: The following products, provided they comply with requirements of the contract documents, will be among those considered acceptable:
    a. Nonmetallic type:
        1. “Masterflow 928”; Master Builders, Inc.
        2. “Sonogrout”; Sonneborn Building Products Division/ChemRex, Inc.
        3. “Euco N-S Grout”; The Euclid Chemical Company.
        4. “Supreme”; Cormix Construction Chemicals.
        5. “Crystex”; L & M Construction Chemicals, Inc.
        6. “Sure-Grip High Performance Grout”; Dayton Superior Corporation.
        7. “Horn Non-Corrosive Non-Shrink Grout”; A. C. Horn, Inc.
        8. “Five Star Grout”; Five Star Products, Inc.
        9. Or Approved Equal.

C. Burlap: AASHTO M 182, Class 2 jute or kenaf cloth.

D. Moisture-Retaining Cover: ASTM C 171, and as follows:

1. Waterproof paper.
2. Polyethylene film.
3. White burlap-polyethylene sheeting.

E. Liquid Curing Compounds:

1. Material - curing compounds: Comply with ASTM C 309, Type 1.
    a. Non-yellowing formulation where subject to ultraviolet light.
2. Solvents: Provide water-based products.

F. Bonding Compound: Non-redisperable acrylic bonding admixture, ASTM C 1059, Type II.

G. Expansion Joint Filler:

1. Nonextruding bituminous type: ASTM D 1751.

2.5 CONCRETE MIX DESIGN

A. Review: Do not begin concrete operations until proposed mix has been reviewed by the structural engineer. Mix design submittal shall include all mix proportions for specific project requirements. Submit separate mix designs individually identified for all proposed combinations of admixtures and proportions.

B. Proportioning of Normal Weight Concrete: Comply with recommendations of ACI 211.1.

C. Required Average Strength: Establish the required average strength f(cr) of the design mix on the basis of either field experience or trial mixtures as specified in ACI 301, and proportion mixes accordingly. If trial mixtures method is used, employ an independent testing agency acceptable to the architect for preparing and reporting proposed mix design.

D. Specified compressive strength f'(c) at 28 days:

1. Foundations and Footings: 3500 psi
2. Floor slabs on grade: 3500 psi
3. Miscellaneous curbs and pads: 3000 psi

E. Slump: The concrete mix design shall provide for a concrete slump appropriate to the project conditions. The concrete shall be sufficiently fluid to allow for ease of placement and sufficiently stiff to prevent segregation.

F. Fibrous Reinforcement: Where specified or approved, add to mix at rate recommended by manufacturer for specific application.

1. Add to concrete mix in lieu of providing welded wire fabric reinforcement for interior floor slabs, at contractor's option and with prior approval of Architect.

G. Admixtures:

1. Air-entraining admixture: Use in mixes for exterior exposed concrete unless otherwise specifically indicated. Add at rate to achieve total air content in accordance with Table 1.4.3 of ACI 201.1. For concrete not exposed to exterior, add at rate to achieve total air content between 2 percent and 4 percent.
   a. Do not use in slabs-on-grade scheduled to receive topping, unless manufacturer of topping recommends use over air-entrained concrete.
2. Water-reducing admixture: Add as required for placement and workability.
3. Water-reducing and retarding admixture: Add as required in concrete mixes to be placed at ambient temperatures above 90 degrees F.
4. Water-reducing and accelerating admixture: Add as required in concrete mixes to be placed at ambient temperatures below 50 degrees F.
5. High-range water-reducing admixture (superplasticizer): As required for placement and workability.
6. Do not use admixture not specified or approved.

H. Mix Adjustments: Provided that no additional expense to owner is involved, contractor may submit for architect's approval requirements for adjustment to approved concrete mixes when circumstances such as changed project conditions, weather, or unfavorable test results occur. Include laboratory test data substantiating specified properties with mix adjustment requests.

2.6 CONTROL OF MIX IN THE FIELD

A. Slump: A tolerance of up to 1 inch above approved design mix slump will be permitted for 1 batch in 5 consecutive batches tested. Concrete of lower slump than that specified may be used, provided proper placing and consolidation is obtained.

B. Total Air Content: A tolerance of plus or minus 1 percent of approved design mix air content will be allowed for field measurements.

C. Do not use batches that exceed tolerances.

2.7 CONCRETE MIXING

A. On-Site Equipment: Mix concrete materials in appropriate drum type batch machine mixer, in compliance with ASTM C 685. Mix each batch minimum of 1-1/2 minutes and maximum of 5 minutes before discharging concrete. Clean thoroughly at end of day and before changing concrete type.

B. Transit Mixers: Mix concrete materials in transit mixers, complying with requirements of ASTM C 94.

1. At ambient temperatures of 85 to 90 degrees F, reduce mixing and delivery time to 75 minutes.
2. At ambient temperatures above 90 degrees F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 CONCRETE FORM PREPARATION

A. General: Comply with requirements of ACI 301 for formwork, and as herein specified. The contractor is responsible for design, engineering, and construction of formwork, and for its timely removal.

B. Earth Forms: Hand-trim bottoms and sides of earth forms to profiles indicated on the drawings. Remove loose dirt before placing concrete.

C. Design: Design and fabricate forms for easy removal, without impact, shock, or damage to concrete surfaces or other portions of the work. Design to support all applied loads until concrete is adequately cured, within allowable tolerances and deflection limits.

D. Construction: Construct and brace formwork to accurately achieve end results required by contract documents, with all elements properly located and free of distortion. Provide for necessary openings, inserts, anchorages, and other features shown or otherwise required.

1. Joints: Minimize form joints and make watertight to prevent leakage of concrete.
   a. Align joints symmetrically at exposed conditions.
2. Chamfers: Provide chamfered edges and corners at exposed locations, unless specifically indicated otherwise on the drawings.
3. Permanent openings: Provide openings to accommodate work of other trades, sized and located accurately. Securely support items built into forms; provide additional bracing at openings and discontinuities in formwork.
4. Temporary openings: Provide temporary openings for cleaning and inspection in most inconspicuous locations at base of forms, closed with tight-fitting panels designed to minimize appearance of joints in finished concrete work.

E. Tolerances for Formed Surfaces: Comply with minimum tolerances established in ACI 117, unless more stringent requirements are indicated on the drawings.

F. Release Agent: Provide either form materials with factory-applied nonabsorptive liner or field-applied form coating. If field-applied coating is employed, thoroughly clean and recondition formwork and reapply coating before each use. Reuse on form surfaces is unacceptable.

3.2 PLACING REINFORCEMENT

A. General: Comply with requirements of ACI 301 and as herein specified.

B. Preparation: Clean reinforcement of loose rust and mill scale, soil, and other materials which adversely affect bond with concrete.

C. Placement: Place reinforcement to achieve not less than minimum concrete coverages required for protection. Accurately position, support, and secure reinforcement against displacement. Provide Class C

tension lap splices complying with ACI 318 unless otherwise indicated. Do not field-bend partially embedded bars unless otherwise indicated or approved.

1. Use approved bar supports and tie wire, as required. Set wire ties to avoid contact with or penetration of exposed concrete surfaces. Tack welding of reinforcing is not permitted.
2. Wire fabric: Install in maximum lengths possible, lapping adjoining pieces not less than one full mesh. Offset end laps to prevent continuous laps in either direction, and splice laps with tie wire.

D. Welding: Welding of reinforcement is not permitted.

3.3 JOINT CONSTRUCTION

A. Construction Joints: Locate and install construction joints as indicated on drawings. If construction joints are not indicated, locate in manner which will not impair strength and will have least impact on appearance, as acceptable to the architect.

1. Keyways: Provide keyways not less than 1-1/2 inches deep.
2. Reinforcement: Continue reinforcement across and perpendicular to construction joints, unless details specifically indicate otherwise.
3. Waterstops: Provide waterstops as indicated, installing to form continuous, watertight dam, with field joints fabricated in strict accordance with manufacturer's instructions.

B. Expansion Joints: Construct expansion joints where indicated. Install expansion joint filler to full depth of concrete. Recess edge of filler to depth indicated to receive joint sealant (and backer rod where necessary) specified in Division 7.

3.4 INSTALLATION OF EMBEDDED ITEMS

A. General: Set anchorage devices and other items required for other work connected to or supported by cast-in-place concrete, using templates, setting drawings, and instructions from suppliers of items to be embedded.

3.5 CONCRETE PLACEMENT

A. Preparation: Provide materials necessary to ensure adequate protection of concrete during inclement weather before beginning installation of concrete.

B. Inspection: Before beginning concrete placement, inspect formwork, reinforcing steel, and items to be embedded, verifying that all such work has been completed.

1. Wood forms: Moisten immediately before placing concrete in locations where form coatings are not used.

C. Placement - General: Comply with requirements of ACI 304 and as follows:

1. Schedule continuous placement of concrete to prevent the formation of cold joints.
2. Provide construction joints if concrete for a particular element or component cannot be placed in a continuous operation.
3. Deposit concrete as close as possible to its final location, to avoid segregation. Maximum height of drop for concrete being deposited into forms shall be 4 feet. Provide chutes, trunks, etc. to facilitate concrete placement.

D. Placement in Forms: Limit horizontal layers to depths which can be properly consolidated, but in no event greater than 24 inches.

1. Consolidate concrete by means of mechanical vibrators, inserted vertically in freshly placed concrete in a systematic pattern at close intervals. Penetrate previously placed concrete to ensure that separate concrete layers are knitted together.
2. Vibrate concrete sufficiently to achieve consistent consolidation without segregation of coarse aggregates.
3. Do not use vibrators to move concrete laterally.

E. Cold Weather Placement: Comply with recommendations of ACI 306 when air temperatures are expected to drop below 40 degrees F either during concrete placement operations or before concrete has cured.

1. Do not use frozen or ice-laden materials.
2. Do not place concrete on frozen substrates.

F. Hot Weather Placement: Comply with recommendations of ACI 305R when ambient temperature before, during, or after concrete placement is expected to exceed 90 degrees F or when combinations of high air temperature, low relative humidity, and wind speed are such that the rate of evaporation from freshly poured concrete would otherwise exceed 0.2 pounds per square foot per hour.

1. Do not add water to approved concrete mixes under hot weather conditions.
2. Provide mixing water at lowest feasible temperature, and provide adequate protection of poured concrete to reduce rate of evaporation.
3. Use fog nozzle to cool formwork and reinforcing steel immediately prior to placing concrete.

3.6 FINISHING FORMED SURFACES

A. Repairs - General: Repair surface defects, including tie holes, immediately after removing formwork.

1. Remove honeycombed areas and other defective concrete down to sound concrete, cutting perpendicular to surface or slightly undercutting. Dampen patch location and area immediately surrounding it prior to applying bonding compound or patching mortar.
2. Before bonding compound has dried, apply patching mixture matching original concrete in materials and mix except for omission of coarse aggregate, and using a blend of white and normal Portland cement as necessary to achieve color match. Consolidate thoroughly and strike off slightly higher than surrounding surface.

B. Unexposed Form Finish: Repair tie holes and patch defective areas. Rub down or chip off fins or other raised areas exceeding 1/4 inch height.

C. Exposed Form Finish: Repair and patch defective areas, with fins or other projections completely removed and smoothed.

1. Smooth rubbed finish: Apply to surfaces indicated no later than 24 hours after form removal.
   a. Wet concrete surfaces to be finished and rub with Carborundum brick or other abrasive until uniform color and texture are achieved.
   b. Do not apply separate grout mixture.
2. Contiguous unformed surfaces: Strike smooth and float to a similar texture tops of walls, horizontal offsets, and other unformed surfaced adjacent to or contiguous with formed surfaces. Continue final finish of formed surfaces across unformed surfaces, unless otherwise specifically indicated.

3.7 CONCRETE CURING AND PROTECTION

A. General:

1. Prevent premature drying of freshly placed concrete, and protect from excessively cold or hot temperatures until concrete has cured.

2. Provide curing of concrete by one of the methods listed and as appropriate to service conditions and type of applied finish in each case.

B. Curing Period:

1. Not less than 7 days for standard cements and mixes.
2. Not less than 4 days for high early strength concrete using Type III cement.

C. Formed Surfaces: Cure formed concrete surfaces by moist curing with forms in place for full curing period or until forms are removed.

1. Keep wet wooden or metal forms exposed to heat of the sun.
2. If forms are removed prior to completion of curing process, continue curing by one of the applicable methods specified.

D. Surfaces Not in Contact with Forms

1. Moisture-retaining cover: Lap not less than 3 inches at edges and ends, and seal with waterproof tape or adhesive. Repair holes or tears during curing period with same tape or adhesive. Maintain covering in intimate contact with concrete surface. Secure to avoid displacement.
   a. Do not use plastic sheeting on surfaces which will be exposed to view when in service.
2. Curing compound: Apply at rate stated by manufacturer to conform with moisture-retention requirements specified, using second, immediate application at right angles to first, if necessary, and reapply if damaged by rain.
3. Use curing compounds only in locations permitted or required. Do not apply to surfaces to receive other finished, coatings, or coverings.

E. Avoid rapid drying at end of curing period.

F. During and following curing period, protect concrete from temperature changes of adjacent air in excess of 5 degrees F per hour and 50 degrees F per 24 hours. Progressively adjust protective measures to provide uniform temperature change over entire concrete surface.

3.8 REMOVAL OF FORMS AND SUPPORTS

A. Non-Load-Bearing Formwork: Provided that concrete has hardened sufficiently that it will not be damaged, forms not actually supporting weight of concrete or weight of soffit forms may be removed after concrete has cured at not less than 50 degrees F for 24 hours. Maintain curing and protection operations after form removal.

3.9 MISCELLANEOUS CONCRETE ITEMS

A. Fill-in: Fill in holes and openings left in concrete structures for passage of work by other trades after such work is in place. Place such fill-in concrete to blend with existing construction, using same mix and curing methods.

B. Equipment Bases and Foundations: Provide machine and equipment bases and foundations, as indicated on drawings. Set anchor bolts at correct elevations, complying with diagrams or templates of equipment manufacturer.

1. Grout base plates and foundations as indicated with nonshrink grout.
2. Use nonmetallic grout for exposed conditions, unless otherwise indicated.

C. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Screed, tamp, and finish concrete surfaces as scheduled.

D. Reinforced Masonry: Provide concrete grout for reinforced masonry where indicated on drawings and as scheduled.

3.10 CONCRETE REPAIRS

A. Perform cosmetic repairs of concrete surfaces as specified under concrete application.

3.11 QUALITY CONTROL TESTING DURING CONSTRUCTION

A. Composite Sampling, and Making and Curing of Specimens: ASTM C 172 and ASTM C 31.

1. Take samples at point of discharge.
2. For pumped concrete, perform sampling and testing at the frequencies specified herein at point of delivery to pump, and perform additional sampling and testing at the same frequency at discharge from line. Results obtained at point of delivery shall be used for acceptance of concrete.
3. Take samples and perform tests for concrete before and after field addition of admixtures. Report results of all tests.

B. Slump: ASTM C 143. Test first 2 loads delivered for each pour and 1 test per strength test and additional tests if concrete consistency changes.

1. Modify sampling to comply with ASTM C 94.
2. For concrete containing superplasticizer added at the job site, perform slump test prior to addition of admixture and after mixing. Report both test results.
3. Visual estimate of slump may be accepted once uniform results are achieved over a minimum of 4 samples. Report all estimated results as such.

C. Air Content or Normal Weight Concrete: ASTM C 173 or ASTM C 231. Test first 2 loads delivered for each pour and one test per strength test performed on air-entrained concrete.

D. Concrete Temperature:

1. Test hourly when air temperature is 40 degrees F or below.
2. Test hourly when air temperature is 90 degrees F or above.
3. Test each time a set of strength test specimens is made.

E. Compressive Strength Tests: ASTM C 39.

1. Compression test specimens: Mold and cure one set of 4 standard cylinders for each compressive strength test required.
2. Testing for acceptance of potential strength of as-delivered concrete:
    a. Obtain samples on a statistically sound, random basis.
    b. Minimum frequency:
        1. One test per 50 cubic yards or fraction thereof for each day's pour of each concrete class.
        2. One test per 2500 square feet of slab or wall area or fraction thereof for each day's pour of each concrete class.
        3. When less than 5 cubic yards is placed in one day, the architect may, at architect's option, waive laboratory testing of specimens if adequate evidence of satisfactory strength is provided. (Molding and curing of these specimens is not waived.)
        4. When the above testing frequency would provide fewer than 5 strength tests for a given class of concrete during the project, conduct testing from not less than 5 randomly selected batches or from each batch if fewer than 5.
    c. Test one specimen per set at 7 days for information unless an earlier age is required.

d. Test 2 specimens per set for acceptance of strength potential; test at 28 days unless other age is specified. The test result shall be the average of the two specimens. If one specimen shows evidence of improper sampling, molding, or testing, the test result shall be the result of the remaining specimen; if both show such evidence, discard the test result and inform the architect.
e. Retain one specimen from each set for later testing, if required.
f. Strength potential of as-delivered concrete will be considered acceptable if all of the following criteria are met:
    1. No individual test result falls below specified compressive strength by more than 500 psi.
    2. Not more than 10 percent of individual test results fall below specified compressive strength f'(c).
    3. Average of any 3 consecutive strength test results equals or exceeds specified compressive strength f'(c).
g. Evaluate construction and curing procedures and implement corrective action when strength results for field-cured specimens area less than 85 percent of test values for companion laboratory-cured specimens.

F. Test Results: Testing agency shall report field and laboratory test results in writing to architect and contractor within 24 hours of test.

1. Field test results which do not comply with the project specifications shall be immediately reported to project superintendent. Field reports shall include documentation of all such reports and the name of the person results were reported to.
2. Test reports shall contain the following data:
    a. Project name, number, and other identification.
    b. Name of concrete testing agency.
    c. Date and time of sampling.
    d. Concrete type and class.
    e. Location of concrete batch in the completed work.
    f. All information required by respective ASTM Test methods.
    g. Concrete mix parameters and tolerances.
3. Nondestructive testing devices such as impact hammer or sonoscope may be used at architect's option for assistance in determining probable concrete strength at various locations or for selecting areas to be cored, but such tests shall not be the sole basis for acceptance or rejection.
4. The testing agency shall make additional tests or in-place concrete as directed by the architect when test results indicate that specified strength and other concrete characteristics have not been attained.
    a. Testing agency may conduct tests of cored cylinders complying with ASTM C 42, or tests as directed.
    b. Cost of additional testing shall be borne by the contractor when unacceptable concrete has been verified.

END OF SECTION 033000

SECTION 040120 - MAINTENANCE OF UNIT MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes maintenance of unit masonry consisting of brick clay masonry restoration and cleaning as follows:

1. Repairing unit masonry, including replacing units.
2. Repointing joints.
3. Preliminary cleaning, including removing plant growth.
4. Cleaning exposed unit masonry surfaces.

1.2 DEFINITIONS

A. Low-Pressure Spray: 100 to 400 psi; 4 to 6 gpm.

1.3 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on masonry units as follows.

1. Existing Brick: Test each type of existing masonry unit indicated for replacement, according to testing methods in ASTM C 67 for compressive strength, 24-hour cold-water absorption, 5-hour boil absorption, saturation coefficient, and initial rate of absorption (suction). Carefully remove five existing units from locations designated by Architect. Take testing samples from these units.
2. Existing Mortar: Test according to ASTM C 295, modified as agreed by testing service and Architect for Project requirements, to determine proportional composition of original ingredients, sizes and colors of aggregates, and approximate strength. Use X-ray diffraction, infrared spectroscopy, and differential thermal analysis as necessary to supplement microscopical methods. Carefully remove existing mortar from within joints at five locations designated by Architect.
3. Temporary Patch: As directed by Architect, provide temporary materials at locations from which existing samples were taken.
4. Replacement Brick: Test each proposed type of replacement masonry unit, according to sampling and testing methods in ASTM C 67 for compressive strength, 24-hour cold-water absorption, 5-hour boil absorption, saturation coefficient, and initial rate of absorption (suction).

1.4 SUBMITTALS

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

B. Samples: For each exposed product and for each color and texture specified.

C. Preconstruction test reports.

1.5 QUALITY ASSURANCE

A. Restoration Specialist Qualifications: Engage an experienced masonry restoration and cleaning firm to perform work of this Section. Firm shall have completed work similar in material, design, and extent to that indicated for this Project with a record of successful in-service performance. Experience installing standard unit masonry is not sufficient experience for masonry restoration work.

1. At Contractor's option, work may be divided between two specialist firms: one for cleaning work and one for repair work.
2. Field Supervision: Restoration specialist firms shall maintain experienced full-time supervisors on Project site during times that clay masonry restoration and cleaning work is in progress.
3. Restoration Worker Qualifications: Persons who are experienced in restoration work of types they will be performing.

B. Mockups: Prepare mockups of restoration and cleaning to demonstrate aesthetic effects and set quality standards for materials and execution and for fabrication and installation.

1. Masonry Repair: Prepare sample areas for each type of masonry material indicated to have repair work performed. If not otherwise indicated, size each mockup not smaller than 2 adjacent whole units or approximately 48 inches in least dimension. Erect sample areas in existing walls unless otherwise indicated, to demonstrate quality of materials, workmanship, and blending with existing work. Include the following as a minimum:

a. Replacement:

1) Four brick units replaced.

b. Patching: Three small holes at least 1 inch in diameter for each type of masonry material indicated to be patched, so as to leave no evidence of repair.

2. Repointing: Rake out joints in 2 separate areas, each approximately 36 inches high by 48 inches wide for each type of repointing required and repoint one of the areas.
3. Cleaning: Clean an area approximately 25 sq. ft. for each type of masonry and surface condition.

C. Preinstallation Conference: Conduct conference at Project site.

PART 2 - PRODUCTS

2.1 MASONRY MATERIALS

A. Face Brick: Provide face brick, including specially molded, ground, cut, or sawed shapes where required to complete masonry restoration work.

1. Manufacturer: Basis-of-Design: Subject to compliance with requirements, provide products from the following:

a. Extech Building Materials
b. Or approved equal.

2. Provide units with physical properties, colors, color variation within units, surface texture, size, and shape to match existing brickwork.

a. Physical Properties per ASTM C 67.

b. For existing brickwork that exhibits a range of colors or color variation within units, provide brick that proportionally matches that range and variation rather than brick that matches an individual color within that range.

3. Special Shapes:

a. Provide specially molded, 100 percent solid shapes for applications where core holes or "frogs" could be exposed to view or weather when in final position and where shapes produced by sawing would result in sawed surfaces being exposed to view.
b. Provide specially ground units, shaped to match patterns, for arches and where indicated.
c. Mechanical chopping or breaking brick, or bonding pieces of brick together by adhesive, are not acceptable procedures for fabricating special shapes.

B. Coordinate with specification Section 042113 “Brick Masonry”

2.2 MORTAR MATERIALS

A. Portland Cement: ASTM C 150, Type I.
1. Type III may be substituted during cold-weather construction.
2. Provide Portland cement of color required to product approved mortar sample.

3. Provide cement containing not more than 0.60 percent total alkali when tested according to ASTM C 114.

B. Hydrated Lime: ASTM C 207, Type S.

C. Mortar Sand: ASTM C 144 unless otherwise indicated.

1. Color: Provide natural sand or ground marble, granite, or other sound stone of color necessary to produce required mortar color.
2. For pointing mortar, provide sand with rounded edges.
3. Match size, texture, and gradation of existing mortar sand as closely as possible. Blend several sands if necessary to achieve suitable match.

D. Grout Aggregate: ASTM C 404.

E. Mortar Pigments: Natural and synthetic iron oxides, compounded for mortar mixes. Use only pigments with a record of satisfactory performance in masonry mortars.

F. Water: Potable.

G. Accelerating Admixture: Nonchloride type for cold weather mortar mixes, in proportion recommended by manufacturer.

H. No Air-Entraining Admixture shall be allowed.

2.3 MANUFACTURED REPAIR MATERIALS

A. Masonry Patching Compound: Factory-mixed cementitious product that is custom manufactured for patching masonry.

1. Products: Basis-of-Design: Subject to compliance with requirements, provide products from the following:

a. Edison Coatings, Inc.; Custom System 45
   1) Provide formula for a BR and CN substrate application.
b. Or approved equal.

2. To be used at High School East to repair damaged concrete horizontal band pieces between the first and second floors on the east, west and south sides of the building. Coordinate work with Drawing 01-A113.

3. Use formulation that is vapor- and water permeable (equal to or more than the masonry unit), exhibits low shrinkage, has lower modulus of elasticity than the masonry units being repaired, and develops high bond strength to all types of masonry.
4. Formulate patching compound used for patching brick in colors and textures to match each masonry unit being patched.

2.4 CLEANING MATERIALS

A. Water: Potable.

B. Hot Water: Water heated to a temperature of 140 to 160 deg F.

C. Nonacidic Liquid Cleaner: Manufacturer's standard gel formulation, with pH between 6 and 9 that contains detergents with chelating agents and is specifically formulated for cleaning masonry surfaces.

1. Products: Basis-of-Design: Subject to compliance with requirements, provide product by the following:

   a. PROSOCO; Sure Klean Heavy Duty Concrete Cleaner
   b. Or approved equal.

2.5 ACCESSORY MATERIALS

A. Setting Buttons: Resilient plastic buttons, nonstaining to masonry, sized to suit joint thicknesses and bed depths of masonry units without intruding into required depths of pointing materials.

2.6 MORTAR MIXES

A. Measurement and Mixing: Measure cementitious materials and sand in a dry condition by volume or equivalent weight. Do not measure by shovel; use known measure. Mix materials in a clean, mechanical batch mixer.

1. Mixing Pointing Mortar: Thoroughly mix cementitious materials and sand together before adding any water. Then mix again adding only enough water to produce a damp, unworkable mix that will retain its form when pressed into a ball. Maintain mortar in this dampened condition for 15 to 30 minutes. Add remaining water in small portions until mortar reaches desired consistency. Use mortar within one hour of final mixing; do not retemper or use partially hardened material.

B. Colored Mortar: Produce mortar of color required by using specified ingredients. Do not alter specified proportions without Architect's approval.

1. Mortar Pigments: Where mortar pigments are indicated, do not exceed a pigment-to-cement ratio of 1:10 by weight.

C. Do not use admixtures in mortar unless otherwise indicated.

D. Mortar Proportions: Mix mortar materials in the following proportions:

1. Pointing Mortar for Brick: 1 part portland cement, 2 parts lime, and 6 parts sand.

   a. Add mortar pigments to produce mortar colors required.

2. Pointing Mortar for Terra Cotta: 1 part white portland cement, 1 part lime, and 6 parts sand.

   a. Add mortar pigments to produce mortar colors required.

3. Rebuilding (Setting) Mortar: Same as pointing mortar. Comply with ASTM C 270, Proportion Specification, Type N unless otherwise indicated. Cementitious material limited to Portland cement and lime.

2.7 CHEMICAL CLEANING SOLUTIONS

A. Dilute chemical cleaners with water to produce solutions not exceeding concentration recommended by chemical-cleaner manufacturer.

PART 3 - EXECUTION

3.1 PROTECTION

A. Protect persons, motor vehicles, surrounding surfaces of building being restored, building site, plants, and surrounding buildings from harm resulting from masonry restoration work.

B. Comply with chemical-cleaner manufacturer's written instructions for protecting building and other surfaces against damage from exposure to its products. Prevent chemical-cleaning solutions from coming into contact with people, motor vehicles, landscaping, buildings, and other surfaces that could be harmed by such contact.

1. Cover adjacent surfaces with materials that are proven to resist chemical cleaners used unless chemical cleaners being used will not damage adjacent surfaces. Use materials that contain only waterproof, UV-resistant adhesives. Apply masking agents to comply with manufacturer's written instructions. When no longer needed, promptly remove masking to prevent adhesive staining.
2. Keep wall wet below area being cleaned to prevent streaking from runoff.

3.2 BRICK REMOVAL AND REPLACEMENT

A. At locations indicated, remove bricks that are damaged, spalled, or deteriorated. Carefully demolish or remove entire units from joint to joint, without damaging surrounding masonry, in a manner that permits replacement with full-size units.

B. Support and protect remaining masonry that surrounds removal area. Maintain flashing, reinforcement, lintels, and adjoining construction in an undamaged condition.

C. Notify Architect of unforeseen detrimental conditions including voids, cracks, bulges, and loose units in existing masonry backup, rotted wood, rusted metal, and other deteriorated items.

D. Remove in an undamaged condition as many whole bricks as possible.

1. Remove mortar, loose particles, and soil from brick by cleaning with hand chisels, brushes, and water.
2. Remove sealants by cutting close to brick with utility knife and cleaning with solvents.

E. Clean bricks surrounding removal areas by removing mortar, dust, and loose particles in preparation for replacement.

F. Replace removed damaged brick with other removed brick in good quality, where possible, or with new brick matching existing brick, including size. Do not use broken units unless they can be cut to usable size.

G. Install replacement brick into bonding and coursing pattern of existing brick. If cutting is required, use a motor-driven saw designed to cut masonry with clean, sharp, unchipped edges.

1. Maintain joint width for replacement units to match existing joints.
2. Use setting buttons or shims to set units accurately spaced with uniform joints.

H. Lay replacement brick with completely filled bed, head, and collar joints. Butter ends with sufficient mortar to fill head joints and shove into place. Wet both replacement and surrounding bricks that have ASTM C 67 initial rates of absorption (suction) of more than 30 g/30 sq. in. per min. Use wetting methods that ensure that units are nearly saturated but surface is dry when laid.

1. Tool exposed mortar joints in repaired areas to match joints of surrounding existing brickwork.
2. Rake out mortar used for laying brick before mortar sets and point new mortar joints in repaired area to comply with requirements for repointing existing masonry, and at same time as repointing of surrounding area.
3. When mortar is sufficiently hard to support units, remove shims and other devices interfering with pointing of joints.

3.3 MASONRY UNIT PATCHING

A. Patching Bricks:

1. Remove loose material from masonry surface. Carefully remove additional material so patch will not have feathered edges but will have square or slightly undercut edges on area to be patched and will be at least 1/4 inch thick, but not less than recommended by patching compound manufacturer.
2. Mask adjacent mortar joint or rake out for repointing if patch will extend to edge of masonry unit.
3. Mix patching compound in individual batches to match each unit being patched.
4. Rinse surface to be patched and leave damp, but without standing water.
5. Brush-coat surfaces with slurry coat of patching compound according to manufacturer's written instructions.
6. Place patching compound in layers as recommended by patching compound manufacturer, but not less than 1/4 inch or more than 2 inches thick. Roughen surface of each layer to provide a key for next layer.
7. Trowel, scrape, or carve surface of patch to match texture and surrounding surface plane or contour of the masonry unit. Shape and finish surface before or after curing, as determined by testing, to best match existing masonry unit.
8. Keep each layer damp for 72 hours or until patching compound has set.

3.4 CLEANING MASONRY, GENERAL

A. Proceed with cleaning in an orderly manner; work from bottom to top of each scaffold width and from one end of each elevation to the other. Ensure that dirty residues and rinse water will not wash over cleaned, dry surfaces.

B. Use only those cleaning methods indicated for each masonry material and location.

1. Do not use wire brushes or brushes that are not resistant to chemical cleaner being used. Do not use plastic-bristle brushes if natural-fiber brushes will resist chemical cleaner being used.
2. Use spray equipment that provides controlled application at volume and pressure indicated, measured at spray tip. Adjust pressure and volume to ensure that cleaning methods do not damage masonry.

    a. Equip units with pressure gages.

3. For chemical-cleaner spray application, use low-pressure tank or chemical pump suitable for chemical cleaner indicated, equipped with cone-shaped spray tip.
4. For water-spray application, use fan-shaped spray tip that disperses water at an angle of 25 to 50 degrees.
5. For heated water-spray application, use equipment capable of maintaining temperature between 140 and 160 deg F at flow rates indicated.

C. Perform each cleaning method indicated in a manner that results in uniform coverage of all surfaces, including corners, moldings, and interstices, and that produces an even effect without streaking or damaging masonry surfaces.

D. Water-Spray Application Method: Unless otherwise indicated, hold spray nozzle at least 6 inches from surface of masonry and apply water in horizontal back and forth sweeping motion, overlapping previous strokes to produce uniform coverage.

E. Chemical-Cleaner Application Methods: Apply chemical cleaners to masonry surfaces to comply with chemical-cleaner manufacturer's written instructions; use brush or spray application. Do not spray apply at pressures exceeding 50 psi. Do not allow chemicals to remain on surface for periods longer than those indicated or recommended by manufacturer.

F. Rinse off chemical residue and soil by working upward from bottom to top of each treated area at each stage or scaffold setting. Periodically during each rinse, test pH of rinse water running off of cleaned area to determine that chemical cleaner is completely removed.

1. Apply neutralizing agent and repeat rinse if necessary to produce tested pH of between 6.7 and 7.5.

3.5 PRELIMINARY CLEANING

A. Removing Plant Growth: Completely remove visible plant, moss, and shrub growth from masonry surfaces. Carefully remove plants, creepers, and vegetation by cutting at roots and allowing to dry as long as possible before removal. Remove loose soil and debris from open masonry joints to whatever depth they occur.

B. Preliminary Cleaning: Before beginning general cleaning, remove extraneous substances that are resistant to cleaning methods being used. Extraneous substances include paint, calking, asphalt, and tar.

1. Carefully remove heavy accumulations of material from surface of masonry with a sharp chisel. Do not scratch or chip masonry surface.
2. Remove paint and calking with alkaline paint remover.

    a. Repeat application up to two times if needed.

3. Remove asphalt and tar with solvent-type paint remover.

    a. Apply paint remover only to asphalt and tar by brush without pre-wetting.
    b. Allow paint remover to remain on surface for 10 to 30 minutes.
    c. Repeat application if needed.

3.6 CLEANING MASONRY

A. Nonacidic Liquid Chemical Cleaning:

1. Wet masonry with cold water applied by low-pressure spray.
2. Apply cleaner to masonry by brush or low-pressure spray. Let cleaner remain on surface for period indicated below:

    a. As recommended by chemical-cleaner manufacturer.

3. Rinse with cold water applied by low-pressure spray to remove chemicals and soil.
4. Repeat cleaning procedure above where required to produce cleaning effect established by mockup. Do not repeat more than once.

3.7 REPOINTING MASONRY

A. Rake out and repoint joints to the following extent:

1. All joints in areas indicated.
2. Joints where mortar is missing or where they contain holes.
3. Cracked joints where cracks can be penetrated at least 1/4 inch by a knife blade 0.027 inch thick.
4. Cracked joints where cracks are 1/8 inch or more in width and of any depth.
5. Joints where they sound hollow when tapped by metal object.
6. Joints where they are worn back 1/4 inch or more from surface.
7. Joints where they are deteriorated to point that mortar can be easily removed by hand, without tools.
8. Joints where they have been filled with substances other than mortar.
9. Joints indicated as sealant-filled joints.

B. Do not rake out and repoint joints where not required.

C. Rake out joints as follows, according to procedures demonstrated in approved mockup:

1. Remove mortar from joints to depth of joint width plus 1/8 inch, but not less than 1/2 inch or not less than that required to expose sound, unweathered mortar.
2. Remove mortar from masonry surfaces within raked-out joints to provide reveals with square backs and to expose masonry for contact with pointing mortar. Brush, vacuum, or flush joints to remove dirt and loose debris.
3. Do not spall edges of masonry units or widen joints. Replace or patch damaged masonry units as directed by Architect.

a. Cut out mortar by hand with chisel and resilient mallet. Do not use power-operated grinders.
b. Cut out center of mortar bed joints using angle grinders with diamond-impregnated metal blades. Remove remaining mortar by hand with chisel and resilient mallet.

D. Notify Architect of unforeseen detrimental conditions including voids in mortar joints, cracks, loose masonry units, rotted wood, rusted metal, and other deteriorated items.

E. Pointing with Mortar:

1. Rinse joint surfaces with water to remove dust and mortar particles. Time rinsing application so, at time of pointing, joint surfaces are damp but free of standing water. If rinse water dries, dampen joint surfaces before pointing.
2. Apply pointing mortar first to areas where existing mortar was removed to depths greater than surrounding areas. Apply in layers not greater than 3/8 inch until a uniform depth is formed. Fully compact each layer thoroughly and allow it to become thumbprint hard before applying next layer.
3. After low areas have been filled to same depth as remaining joints, point all joints by placing mortar in layers not greater than 3/8 inch. Fully compact each layer and allow to become thumbprint hard before applying next layer. Where existing masonry units have worn or rounded edges, slightly recess finished mortar surface below face of masonry to avoid widened joint faces. Take care not to spread mortar beyond joint edges onto exposed masonry surfaces or to featheredge the mortar.
4. When mortar is thumbprint hard, tool joints to match original appearance of joints as demonstrated in approved mockup. Remove excess mortar from edge of joint by brushing.
5. Cure mortar by maintaining in thoroughly damp condition for at least 72 consecutive hours including weekends and holidays.

    a. Acceptable curing methods include covering with wet burlap and plastic sheeting, periodic hand misting, and periodic mist spraying using system of pipes, mist heads, and timers.

6. Hairline cracking within the mortar or mortar separation at edge of a joint is unacceptable. Completely remove such mortar and repoint.

F. Where repointing work precedes cleaning of existing masonry, allow mortar to harden at least 30 days before beginning cleaning work.

3.8 FINAL CLEANING

A. After mortar has fully hardened, thoroughly clean exposed masonry surfaces of excess mortar and foreign matter; use wood scrapers, stiff-nylon or -fiber brushes, and clean water, spray applied at low pressure.

1. Do not use metal scrapers or brushes.
2. Do not use acidic or alkaline cleaners.

END OF SECTION 040120

SECTION 042000
UNIT MASONRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Concrete block.

B. Clay facing brick.

C. Mortar.

D. Reinforcement and Anchorage.

E. Flashings.

F. Lintels.

G. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 014000 - Quality Requirements

B. Section 03 3000 - Cast-in-Place Concrete: Concrete design for precast concrete lintels.

C. Section 05 5100 - Structural Steel Framing: Installation of masonry anchors furnished under this section.

D. Section 061000 - Rough Carpentry: Nailing strips built into masonry.

E. Section 071113 - Bituminous Dampproofing: Dampproofing masonry surfaces.

F. Section 072100 - Thermal Insulation: Insulation for cavity spaces.

G. Section 072500 - Weather Barriers: Water-resistive barriers or air barriers applied to the exterior face of the backing sheathing or masonry.

H. Section 078400 - Firestopping: Firestopping at penetrations of fire-rated masonry and at top of fire-rated walls.

I. Section 079200 - Joint Sealants: Sealing control and expansion joints.

1.03 REFERENCE STANDARDS

A. ASTM A276/A276M - Standard Specification for Stainless Steel Bars and Shapes.

B. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength.

C. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts.

D. ASTM A951/A951M - Standard Specification for Steel Wire for Masonry Joint Reinforcement.

E. ASTM C1019 - Standard Test Method for Sampling and Testing Grout for Masonry.

F. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or (50-mm) Cube Specimens).

G. ASTM C1093 - Standard Practice for Accreditation of Testing Agencies for Masonry.

H. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete.

I. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete.

J. ASTM E488/E488M - Standard Test Methods for Strength of Anchors in Concrete Elements.

K. ASTM F593 - Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.

L. ASTM F594 - Standard Specification for Stainless Steel Nuts.

M. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures.

N. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

O. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.

P. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.

Q. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.

R. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

S. ASTM A951/A951M - Standard Specification for Steel Wire for Masonry Joint Reinforcement.

T. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.

U. ASTM C67 - Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile.

V. ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units.

W. ASTM C91/C91M - Standard Specification for Masonry Cement.

X. ASTM C140/C140M - Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units.

Y. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar.

Z. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes.

AA. ASTM C216 - Standard Specification for Facing Brick (Solid Masonry Units Made From Clay or Shale).

BB. ASTM C270 - Standard Specification for Mortar for Unit Masonry.

CC. ASTM C387/C387M - Standard Specification for Packaged, Dry, Combined Materials for Concrete and High Strength Mortar.

DD. ASTM C404 - Standard Specification for Aggregates for Masonry Grout.

EE. ASTM C476 - Standard Specification for Grout for Masonry.

FF. ASTM C780 - Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.

GG. ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete.

HH. BIA Technical Notes No. 7 - Water Penetration Resistance – Design and Detailing.

II. BIA Technical Notes No. 13 - Ceramic Glazed Brick Exterior Walls.

JJ. BIA Technical Notes No. 28B - Brick Veneer/Steel Stud Walls.

KK. BIA Technical Notes No. 46 - Maintenance of Brick Masonry.

LL. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures.

MM. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by all relevant installers.

1.05 PERFORMANCE REQUIREMENTS

A. Provide structural unit masonry that develops indicated net-area compressive strengths (f'm) at 28 days.

B. Determine net-area compressive strength (f'm) of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to Tables 1 and 2 in TMS 402/602.

1.06 SUBMITTALS

A. See Section 013300-Submittal Procedures.

B. Product Data: Provide data for masonry units, fabricated wire reinforcement, mortar, and masonry accessories.

C. Samples: Submit four samples of facing brick units to illustrate color, texture, and extremes of color range.

D. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.

E. Material Certificates: Include statements of material properties indicating compliance with requirements including compliance with standards and type designations within standards. Provide for each type and size of the following:
   1. Masonry units.
      a. Include material test reports substantiating compliance with requirements.
      b. For bricks, include size-variation data verifying that actual range of sizes falls within specified tolerances.
      c. For exposed brick, include material test report for efflorescence according to ASTM C67.
      d. For masonry units used in structural masonry, include data and calculations establishing average net-area compressive strength of units.
   2. Cementitious materials. Include brand, type, and name of manufacturer.
   3. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
   4. Grout mixes. Include description of type and proportions of ingredients.
   5. Reinforcing bars.
   6. Joint reinforcement.
   7. Anchors, ties, and metal accessories.

F. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
   1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C109/C109M for compressive strength and ASTM C91/C91M for air content.
   2. Include test reports, per ASTM C1019, for grout mixes required to comply with compressive strength requirement.

G. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to Tables 1 and 2 in TMS 402/602.

H. Cold-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with cold-weather requirements.

I. Manufacturer's Qualification Statement.

J. Installer's Qualification Statement.

1.07 QUALITY ASSURANCE

A. Comply with provisions of TMS 402/602, except where exceeded by requirements of Contract Documents.

B. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section with minimum three years of documented experience.

C. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

D. Testing Agency Qualifications: An independent agency qualified according to ASTM C1093 for testing indicated.

E. Preconstruction Testing Service: Contractor shall engage and pay for a qualified independent testing agency to perform preconstruction testing indicated below.
   1. Concrete Masonry Unit Test: For each type of unit required, per ASTM C140/C140M for compressive strength.
   2. Mortar Test (Property Specification): For each mix required, per ASTM C780 for compressive strength.
   3. Grout Test (Compressive Strength): For each mix required, per ASTM C1019.

1.08 MOCK-UP

A. Construct a masonry wall as a mock-up panel sized 8 feet long by 6 feet high; include mortar, accessories, structural backup, flashings (with lap joint, corner, and end dam), wall insulation, and weather barrier in mock-up.

B. Locate where directed.

C. Mock-up may remain as part of the Work.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

B. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

C. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

D. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

E. Deliver preblended, dry mortar mix in moisture-resistant containers designed for lifting and emptying into dispensing silo. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover.

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

1.10 FIELD CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
   1. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.

2. Where 1 wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe and hold cover in place.

B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least 3 days after building masonry walls or columns.

C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
   1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
   2. Protect sills, ledges, and projections from mortar droppings.
   3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
   4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 402/602.
   1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and above and will remain so until masonry has dried, but not less than 7 days after completing cleaning.

E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 402/602.

PART 2 PRODUCTS

201 CONCRETE MASONRY UNITS

A. Concrete Block: Comply with referenced standards and as follows:
   1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1900 psi.
   2. Size: Standard units with nominal face dimensions of 16 by 8 inches and nominal depths as indicated on drawings for specific locations.
   3. Load-Bearing Units: ASTM C90, normal weight.
      a. Hollow block.
         1) Provide two core masonry units unless indicated otherwise.
      b. Exposed Faces: Manufacturer's standard color and texture where indicated.
   4. Provide solid units with uniform exposed surfaces where corbels or racking would expose cores or unfinished surfaces.

202 BRICK UNITS

A. Manufacturers:
   1. Belden Brick; (to be determined).
   2. Endicott Clay Products Co; (to be determined).
   3. Glen Gery.
   4. Or equal.

B. Facing Brick: ASTM C216, Type FBS Smooth, Grade SW.
   1. Color and texture: Color to be selected by the Architect from manufacturer’s samples in the color range of the existing brick to be matched.
   2. Nominal size: 8 inches long by 4 inches deep by 2 5/8 inches high.

3. Special shapes: Molded units as required by conditions indicated, unless standard units can be sawn to produce equivalent effect.
4. Compressive strength: 3000 PSI, measured in accordance with ASTM C67.

203 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C150/C150M, Type I; color as required to produce approved color sample.
   1. Not more than 0.60 percent alkali.

B. Hydrated Lime: ASTM C207, Type S.

C. Mortar Aggregate: ASTM C144.

D. Grout Aggregate: ASTM C404.

E. Pigments for Colored Mortar: Pure, concentrated mineral pigments specifically intended for mixing into mortar and complying with ASTM C979/C979M.
   1. Color(s): As selected by Architect from manufacturer's full range.
   2. Manufacturers:
      a. Davis Colors.
      b. Lambert Corporation.
      c. Solomon Colors.
      d. Or Equal.

F. Water: Clean and potable.

G. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C494/C494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.
   1. Products:
      a. Addiment Incorporated; Mortar Kick.
      b. Euclid Chemical Company (The); Accelguard 80.
      c. Grace Construction Products, a unit of W. R. Grace & Co. - Conn.; Morset.
      d. Sonneborn, Div. of ChemRex; Trimix-NCA.

H. Packaged Dry Material for Mortar for Unit Masonry: Premixed Portland cement, hydrated lime, and sand; complying with ASTM C1714/C1714M and capable of producing mortar of the specified strength in accordance with ASTM C270 with the addition of water only.
   1. Type: Types as scheduled in this section.
   2. Color: Mineral pigments added as required to produce approved color sample.

I. Packaged Dry Material for Mortar for Repointing: Premixed Portland cement, hydrated lime, and graded sand; capable of producing Type O mortar in accordance with ASTM C270 with the addition of water only.
   1. Color: Mineral pigments added as required to produce approved color sample.

204 REINFORCEMENT AND ANCHORAGE

A. Manufacturers:
   1. Hohmann & Barnard, Inc.
   2. WIRE-BOND.
   3. Or equal.

B. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi), deformed billet bars; uncoated.

C. Joint Reinforcement: Use ladder type joint reinforcement where vertical reinforcement is involved and truss type elsewhere, unless otherwise indicated.
   1. Conform to ASTM A951/A951M.

2. Interior Walls: Mill- galvanized, carbon steel.
3. Exterior Walls, Wet or Humid Interior Area Walls, and Walls Containing Pressure Piping and Shower/Kitchen Area Walls: Hot-dip galvanized, carbon steel.
4. Wire Size for Side Rods: 0.1483 inch.
5. Wire Size for Cross Rods: 0.1483 inch.
6. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.
7. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units at all block.

D. Single Wythe Joint Reinforcement: Ladder type; ASTM A1064/A1064M steel wire, mill galvanized to ASTM A641/A641M, Class 3; 0.1483 inch side rods with 0.1483 inch cross rods; width as required to provide not more than 1 inch and not less than 1/2 inch of mortar coverage on each exposure.
1. Provide Homann & Barnard, Inc. No. 220 Ladder-Mesh reinforcing or comparable product.

E. Adjustable Multiple Wythe Joint Reinforcement: Ladder type with adjustable ties or tabs spaced at 16 in on centerand fabricated with moisture drip; ASTM A1064/A1064M steel wire, hot dip galvanized after fabrication to ASTM A153/153M, Class B; 0.1875 inch side rods with 0.1483 inch cross rods and adjustable components of 0.1875 inch wire; width of components as required to provide not more than 1 inch and not less than 1/2 inch of mortar coverage from each masonry face.
1. Provide Homann & Barnard, Inc. No. 270 Ladder Lox-All Adjustable Eye-Wire reinforcing or comparable product.
   a. Vertical adjustment: Not less than 2 inches.

2.05 FLASHINGS

A. Stainless Steel/Polymer Fabric Flashing: ASTM A240/A240M; 2 mil type 304 stainless steel sheet bonded on one side to one sheet of polymer fabric.
1. Manufacturers:
   a. Hohmann & Barnard, Inc; Mighty-Flash Stainless Flashing.
   b. York Manufacturing, Inc; Multi-Flash SS.
   c. Or equal.

B. Stainless Steel Flashing: ASTM A666, Type 304, soft temper; 26 gage, 0.0187 inch thick; finish 2B to 2D, complying with SMACNA's "Architectural Sheet Metal Manual, Division 07 Section "Sheet Metal Flashing and Trim" and as follows:
1. Fabricate continuous flashings in sections 96 inches long minimum, but not exceeding 12 feet. Provide splice plates at joints of formed, smooth metal flashing.
2. Fabricate through-wall flashing with snaplock receiver on exterior face where indicated to receive counterflashing.

C. Applications of Flashing Types: Unless otherwise indicated, use the following:
1. Where flashing is indicated to receive counterflashing, use metal flashing.
2. Where flashing is indicated to be turned down at or beyond the wall face, and below finish grade, use metal flashing.

D. Single-Wythe CMU Flashing System: System of CMU cell flashing pans and interlocking CMU web covers made from UV-resistant, high-density Polypropylene. Cell flashing pans have integral weep spouts designed to be built into mortar bed joints and that extend into the cell to prevent clogging with mortar. Attached web covers will span from pan to pan providing protection over the web and the joints of the CMU.
1. Manufacturers:
   a. Mortar Net Solutions; BlockFlash.
   b. Substitutions: Or equal.

E. Flashing Sealant/Adhesives: Silicone, polyurethane, or silyl-terminated polyether/polyurethane or other type required or recommended by flashing manufacturer; type capable of adhering to type of flashing used.
   1. Manufacturers, Modified Polyether Products:
      a. Mortar Net Solutions
      b. York Manufacturing, Inc; UniverSeal US-100 Liquid Tape.
      c. Or equal.

F. Drip Edge: Stainless steel; angled drip with hemmed edge; compatible with membrane and adhesives.
   1. Manufacturers:
      a. Mortar Net Solutions; Metal Drip Edges.
      b. York Manufacturing.
      c. Or equal.

G. Lap Sealants and Tapes: As recommended by flashing manufacturer; compatible with membrane and adhesives.

206 MISCELLANEOUS ANCHORS

A. Anchor Bolts: Headed or L-shaped steel bolts complying with ASTM A307, Grade A; with ASTM A563 hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A153/A153M, Class C; of dimensions indicated.

B. Postinstalled Anchors: Provide chemical anchors, with capability to sustain, without failure, a load equal to six times the load imposed when installed in solid or grouted unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E488/E488M conducted by a qualified independent testing agency.
   1. Corrosion Protection: Stainless-steel components complying with ASTM F593 and ASTM F594, Alloy Group 1 or 2 for bolts and nuts; ASTM A666 or ASTM A276/A276M, Type 304 or 316, for anchors.

207 ACCESSORIES

A. Preformed Control Joints: Rubber material. Provide with corner and tee accessories, fused joints.
   1. Manufacturers:
      a. Blok-Lok Limited.
      b. Hohmann & Barnard, Inc; RS Series - Rubber Control Joint.
      c. WIRE-BOND.
      d. Or equal.

B. Joint Filler: Closed cell Neoprene; oversized 50 percent to joint width; self expanding; in maximum lengths available.

C. Cavity Mortar Control: Semi-rigid polyethylene or polyester mesh panels, sized to thickness of wall cavity, and designed to prevent mortar droppings from clogging weeps and cavity vents and allow proper cavity drainage.
   1. Mortar Diverter: Semi-rigid mesh designed for installation at flashing locations.
      a. Manufacturers:
         1) Advanced Building Products Inc; Mortar Break.
         2) Mortar Net Solutions.
         3) York Manufacturing, Inc; Weep Net.
         4) Or equal.

D. Termination Bars: Stainless steel; compatible with membrane and adhesives.

E. Drip Edge: Stainless steel; compatible with membrane and adhesives.

F. Lap Sealants and Tapes: As recommended by flashing manufacturer; compatible with membrane and adhesives.

G. Weeps:
   1. Type: Molded PVC grilles, insect resistant.
   2. Color(s): As selected by Architect from manufacturer's full range.
      a. Manufacturers:
         1) Hohmann & Barnard, Inc.
         2) Mortar Net Solutions.
         3) WIRE-BOND.
         4) Or equal.

H. Cavity Vents:
   1. Type: Molded PVC grilles, insect resistant.
   2. Color(s): As selected by Architect from manufacturer's full range.
      a. Manufacturers:
         1) CavClear/Archovations, Inc.
         2) Hohmann & Barnard, Inc .
         3) Mortar Net Solutions.
         4) Or equal.
         5) Substitutions: See Section 016000 - Product Requirements.

I. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

208 LINTELS

A. General: Provide lintels as scheduled on contract documents.

B. Bond Beam Masonry Lintels: Built-in-place masonry lintels made from standard “U” bond beam concrete masonry units bearing on fully grouted block with horizontal reinforcing bars placed as indicated and filled with coarse grout. Temporarily support built-in-place lintels until cured.
   1. Fill with grout, rod to maximum compaction, and cure for 28 days before removing temporary supports.
   2. Wall above may be placed provided temporary supports are capable of supporting load or after lintel has cured for 28 days.

209 MORTAR AND GROUT MIXING

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. Limit cementitious materials in mortar to portland cement and lime.
   3. Limit cementitious materials in mortar for exterior masonry to portland cement and lime.
   4. 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: ASTM C270, using the Property Specification.
   1. Masonry below grade and in contact with earth: Type M.
   2. Exterior, loadbearing masonry: Type N.
   3. Exterior, non-loadbearing masonry: Type N.

4. Interior, loadbearing masonry: Type N.
5. Interior, non-loadbearing masonry: Type N.

D. Colored Mortar: Proportion selected pigments and other ingredients to match Architect's sample, without exceeding manufacturer's recommended pigment-to-cement ratio.

E. Grout: ASTM C476; consistency required to fill completely volumes indicated for grouting; fine grout for spaces with smallest horizontal dimension of 2 inches or less; coarse grout for spaces with smallest horizontal dimension greater than 2 inches.
1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 1.15.1 in TMS 402/602 for dimensions of grout spaces and pour height.
2. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C143/C143M.

F. Admixtures: Add to mixture at manufacturer's recommended rate and in accordance with manufacturer's instructions; mix uniformly.

G. Mixing: Use mechanical batch mixer and comply with referenced standards.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive masonry.

B. Verify that related items provided under other sections are properly sized and located.

C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

3.02 PREPARATION

A. Direct and coordinate placement of metal anchors supplied for installation under other sections.

B. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

3.03 COLD AND HOT WEATHER REQUIREMENTS

A. Comply with requirements of TMS 402/602 or applicable building code, whichever is more stringent.

3.04 COURSING

A. Establish lines, levels, and coursing indicated. Protect from displacement.

B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.

C. Concrete Masonry Units:
1. Bond: Running.
2. Coursing: One unit and one mortar joint to equal 8 inches.
3. Mortar Joints: Concave.

D. Brick Units:
1. Bond: Running.
2. Coursing: Three units and three mortar joints to equal 8 inches.
3. Mortar Joints: Concave.

3.05 PLACING AND BONDING

A. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.

B. Lay hollow masonry units with face shell bedding on head and bed joints.

C. Lay hollow brick and concrete masonry units as follows:
   1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
   2. With webs fully bedded in mortar in all courses of piers, columns, and pilasters.
   3. With webs fully bedded in mortar in grouted masonry, including starting course on footings.
   4. With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.

D. 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.

E. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 4-inches. Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

F. Fill cores in hollow concrete masonry units with grout 24 inches under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.

G. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.

H. Remove excess mortar and mortar smears as work progresses.

I. Interlock intersections and external corners.

J. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.

K. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.

L. Cut mortar joints flush where resilient base is scheduled.

M. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above, unless otherwise indicated.
   1. Isolate masonry partitions from vertical structural framing members with a control joint as indicated.
   2. Isolate top joint of masonry partitions from horizontal structural framing members and slabs or decks with compressible joint filler.
   3. Fasten partition top anchors to structure above and build into top of partition. Grout cells of CMUs solidly around anchors. Space anchors 48 inches o.c., unless otherwise indicated.
   4. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with rated assembly.

3.06 WEEPS/CAVITY VENTS

A. Install weeps in single wythe walls at 32 inches on center horizontally above through-wall flashing and at bottom of walls.

B. Install cavity vents in veneer and cavity walls at CMU 32 inches on center horizontally below shelf angles and lintels and near top of walls.

C. Install cavity vents in veneer and cavity walls at brick 24 inches on center horizontally below shelf angles and lintels and near top of walls.

3.07 CAVITY MORTAR CONTROL

A. Do not permit mortar to drop or accumulate into cavity air space or to plug weep/cavity vents.

B. For cavity walls, build inner wythe ahead of outer wythe to accommodate accessories.

C. Install cavity mortar diverter at base of cavity and at other flashing locations as recommended by manufacturer to prevent mortar droppings from blocking weep/cavity vents.

3.08 REINFORCEMENT AND ANCHORAGE - GENERAL, SINGLE WYTHE MASONRY, AND CAVITY WALL MASONRY

A. Unless otherwise indicated on drawings or specified under specific wall type, install horizontal joint reinforcement 16 inches on center.
   1. 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.

B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.

C. Place continuous joint reinforcement in first and second joint below top of walls.

D. Embed longitudinal wires of joint reinforcement in mortar joint with at least 5/8 inch mortar cover on each side.

E. Lap joint reinforcement ends minimum 6 inches.

F. Interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.

G. Provide continuity at wall intersections by using prefabricated T-shaped units.

H. Provide continuity at corners by using prefabricated L-shaped units.

I. Cut and bend reinforcing units as directed by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

J. Reinforce joint corners and intersections with strap anchors 16 inches on center.

3.09 REINFORCEMENT AND ANCHORAGE - SINGLE WYTHE MASONRY

A. Install horizontal joint reinforcement 16 inches on center.

B. Place masonry joint reinforcement in first horizontal joints above and below openings. Extend minimum 16 inches each side of opening.

C. Place continuous joint reinforcement in first joint below top of walls.

D. Lap joint reinforcement ends minimum 6 inches.

E. Reinforce joint corners and intersections with strap anchors 16 inches on center.

3.10 REINFORCEMENT AND ANCHORAGE - MASONRY VENEER

A. Install horizontal joint reinforcement 16 inches on center.

B. Place masonry joint reinforcement in first horizontal joints above and below openings. Extend minimum 16 inches each side of opening.

C. Place continuous joint reinforcement in firstand second joint below top of walls.

D. Lap joint reinforcement ends minimum 6 inches.

E. Masonry Back-Up: Embed anchors to bond veneer at maximum 16 inches on center vertically and 36 inches on center horizontally. Place additional anchors at perimeter of openings and ends of panels, so maximum spacing of anchors is 8 inches on center.

F. Reinforcestack bonded unit joint corners and intersections with strap anchors 16 inches on center.

3.11 MASONRY FLASHINGS

A. Whether or not specifically indicated, install masonry flashing to divert water to exterior at all locations where downward flow of water will be interrupted.

1. Extend flashings full width at such interruptions and at least 6 inches, minimum, into adjacent masonry or turn up flashing ends at least 1 inch, minimum, to form watertight pan at non-masonry construction.
2. Remove or cover protrusions or sharp edges that could puncture flashings.
3. Seal lapped ends and penetrations of flashing before covering with mortar.

B. Terminate flashing up 8 inches minimum on vertical surface of backing:
1. Install vertical leg of flashing over fluid-applied or self-adhered air/vapor barriers over backing or per manufacturer's directions.
2. Anchor vertical leg of flashing into backing with a termination bar and sealant.
3. Apply cap bead of sealant on top edge of self-adhered flashing.

C. Install flashing in accordance with manufacturer's instructions and BIA Technical Notes No. 7.

D. Extend metal flashings through exterior face of masonry and terminate in an angled drip with hemmed edge. Install joint sealer below drip edge to prevent moisture migration under flashing.

E. Install single-wythe CMU flashing system in bed joints of CMU walls where indicated to comply with manufacturer's written instructions. Install CMU cell pans with upturned edges located below face shells and webs of CMUs above and with weep spouts aligned with face of wall. Attached web covers will span from pan to pan providing protection over the web and the joints of the CMU.

F. Lap end joints of flashings at least 6 inches, minimum, and seal watertight with flashing sealant/adhesive.

3.12 LINTELS

A. Install loose steel lintels over openings.

B. Install reinforced unit masonry lintels over openings where steel or precast concrete lintels are not scheduled.
1. Openings to 42 inches: Place two, No. 3 reinforcing bars 1 inch from bottom web.
2. Openings from 42 inches to 78 inches: Place two, No. 5 reinforcing bars 1 inch from bottom web.
3. Openings over 78 inches: Reinforce openings as detailed.
4. Do not splice reinforcing bars.
5. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.
6. Place and consolidate grout fill without displacing reinforcing.
7. Allow masonry lintels to attain specified strength before removing temporary supports.

C. Maintain minimum 8 inch bearing on each side of opening.

3.13 GROUTED COMPONENTS

A. Reinforce bond beams with 2, No. 5 bars, 1 inch from bottom web.

B. Lap splices minimum 24 bar diameters.

C. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.

D. Place and consolidate grout fill without displacing reinforcing.

3.14 CONTROL AND EXPANSION JOINTS

A. Provide control joints at the following location and in accordance with National Concrete Masonry Association TEK 10-2B unless otherwise indicated.
1. At changes in wall height.
2. At changes in wall thickness, such as at pipe and duct chases and pilasters.

3. At (above) movement joints in foundations and floors.
4. At (below) movement joints in roofs and floors that bear on a wall.
5. Near one or both sides of door and window openings.
6. Adjacent to corners of walls or intersections within a distance equal to half the control joint spacing.

B. Do not continue horizontal joint reinforcement through control or expansion joints.

C. Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.

D. Size control joints as indicated on drawings; if not indicated, 3/4 inch wide and deep.

E. Form expansion joint as detailed on drawings.

3.15 BUILT-IN WORK

A. As work progresses, install built-in metal door frames and window frames and other items to be built into the work and furnished under other sections.

B. Install built-in items plumb, level, and true to line.

C. Bed anchors of metal door frames in adjacent mortar joints. Fill frame voids solid with grout.
1. Fill adjacent masonry cores with grout minimum 12 inches from framed openings.

D. Do not build into masonry construction organic materials that are subject to deterioration.

3.16 TOLERANCES

A. Maximum Variation From Unit to Adjacent Unit: 1/16 inch.

B. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft and 1/2 inch in 20 ft or more.

C. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.

D. Maximum Variation from Level Coursing: 1/8 inch in 3 ft and 1/4 inch in 10 ft; 1/2 inch in 30 ft.

E. Maximum Variation of Mortar Joint Thickness: Head joint, minus 1/4 inch, plus 3/8 inch.

F. Maximum Variation from Cross Sectional Thickness of Walls: 1/4 inch.

3.17 CUTTING AND FITTING

A. Cut and fit for conduit. Coordinate with other sections of work to provide correct size, shape, and location.

B. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.18 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 014000 - Quality Requirements.

B. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform testing and inspection items as defined in Section 01 4533 - Code Required Special Inspections. Contractor is required to cooperate with the Independent Agency for the tests and inspections listed in Section 01 4533 - Code Required Special Inspections and not for completing those requirements. Allow inspectors access to scaffolding and work areas, as needed to perform inspections.

C. Concrete Masonry Unit Tests: Test each variety of concrete unit masonry in accordance with ASTM C140/C140M for compliance with requirements of this specification.

D. Mortar Tests: Test each type of mortar in accordance with ASTM C780, testing with same frequency as masonry samples.

E. Inspections: Level B assurance according to the "Building Code Requirements for Masonry Structures."
   1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
   2. Place grout only after inspectors have verified compliance of grout spaces and ofgrades, sizes, and locations of reinforcement.
   3. Place grout only after inspectors have verified proportions of site-prepared grout.

3.19 CLEANING

A. Remove excess mortar and mortar droppings.

B. Replace defective mortar. Match adjacent work.

C. Clean soiled surfaces with cleaning solution.

D. Use non-metallic tools in cleaning operations.

3.20 PROTECTION

A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

END OF SECTION

SECTION 042113 - BRICK MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Face brick.

1.2 SUBMITTALS

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

B. Samples: For each type and color of brick and colored mortar.

C. Material Certificates: For each type and size of product indicated.

1.3 QUALITY ASSURANCE

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

1.4 PROJECT CONDITIONS

A. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.

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

PART 2 - PRODUCTS

2.1 MASONRY UNITS, GENERAL

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

2.2 BRICK

A. Regional Materials: Provide brick that has been manufactured within 500 miles of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.

B. General: Provide shapes indicated and as follows.

1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
2. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.

C. Face Brick: Facing brick complying with ASTM C 216.

1. Products: Subject to compliance with requirements, provide products from the following:

a. Extech Building Materials.
b. Or approved equal.

2. Grade: SW
3. Type: FBS
4. Initial Rate of Absorption: Less than 30 g/30 sq. in. per minute when tested per ASTM C 67.
5. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."
6. Surface Coating: Brick with colors or textures produced by application of coatings shall withstand 50 cycles of freezing and thawing per ASTM C 67 with no observable difference in the applied finish when viewed from 10 feet.
7. Size (Actual Dimensions): Match new brick size with existing brink.

2.3 MORTAR MATERIALS

A. Regional Materials: Provide aggregate for mortar that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.

B. Portland Cement: ASTM C 150, Type I. Provide natural color or white cement as required to produce mortar color indicated.

C. Hydrated Lime: ASTM C 207, Type S.

D. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.

E. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C 979. Use only pigments with a record of satisfactory performance in masonry mortar.

1. Products: Subject to compliance with requirements, provide product by the following:

a. Davis Colors; True Tone Mortar Colors.
b. Or approved equal.

F. Colored Cement Product: Packaged blend made from portland cement and hydrated lime and mortar pigments, all complying with specified requirements, and containing no other ingredients.

1. Products: Subject to compliance with requirements, provide product from the following:

    a. Colored Portland Cement-Lime Mix:

        1) Lehigh Cement Company; Lehigh Custom Color Portland/Lime Cement.
        2) Or approved equal.

G. Aggregate for Mortar: ASTM C 144.

1. White-Mortar Aggregates: Natural white sand or crushed white stone.
2. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.

H. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.

1. Products: Subject to compliance with requirements, provide product by the follwoing:

    a. Grace Construction Products, W. R. Grace & Co. - Conn.; Morset.
    b. Or approved equal.

I. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with concrete masonry units, containing integral water repellent by same manufacturer.

1. Products: Subject to compliance with requirements, provide product by the following:

    a. Grace Construction Products, W. R. Grace & Co. - Conn.; Dry-Block Mortar Admixture.
    b. Or approved equal.

2.4 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; formulated from neoprene.

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

2.5 MORTAR MIXES

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

1. Do not use calcium chloride in mortar.
2. Use portland cement-lime mortar unless otherwise indicated.
3. 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. Pigmented Mortar: Use colored cement product or select and proportion pigments with other ingredients to produce color required. Do not add pigments to colored cement products.

1. Pigments shall not exceed 10 percent of portland cement by weight.
2. Pigments shall not exceed 5 percent of masonry cement by weight.
3. Application: Use pigmented mortar for exposed mortar joints.

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.

1. Mix to match Architect's sample.
2. Application: Use colored aggregate mortar for exposed mortar joints.

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.

B. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.

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

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 1/2 inch maximum.
3. For vertical lines and surfaces do not vary from plumb by more than 1/4 inch in 10 feet, 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 1/4 inch in 20 feet maximum.
5. For lines and surfaces do not vary from straight by more than 3/8 inch in 20 feet 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; do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
2. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch.

3.3 MORTAR BEDDING AND JOINTING

A. Lay hollow brick as follows:

1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
2. With entire units, including areas under cells, fully bedded in mortar at starting course on footings.

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

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

3.4 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform tests and inspections. Retesting of materials that fail to meet specified requirements shall be done at Contractor's expense.

B. Inspections: Level 1 special inspections according to the "International Building Code."

1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.

C. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C 780.

3.5 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 uncleaned for comparison purposes
2. Protect adjacent surfaces from contact with cleaner.
3. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
4. Clean brick by bucket-and-brush hand-cleaning method described in "BIA Technical Notes 20."
5. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.
6. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.

3.6 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. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 042113

SECTION 055000
METAL FABRICATIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Shop fabricated steel items.

1.02 RELATED REQUIREMENTS

A. Section 042000 - Unit Masonry: Placement of metal fabrications in masonry.

1.03 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.

B. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

C. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates.

D. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength.

E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

F. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.

G. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination.

H. AWS D1.1/D1.1M - Structural Welding Code - Steel.

I. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer.

J. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic").

K. SSPC-SP 2 - Hand Tool Cleaning.

1.04 SUBMITTALS

A. See Section 013300 - Submittal procedures.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.

1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

C. Welders' Certificates: Submit certification for welders employed on the project, verifying AWS qualification within the previous 12 months.

PART 2 PRODUCTS

2.01 MATERIALS - STEEL

A. Steel Sections: ASTM A36/A36M.

B. Plates: ASTM A283/A283M.

C. Slotted Channel Framing: ASTM A653/A653M, Grade 33.

D. Slotted Channel Fittings: ASTM A1011/A1011M.

E. Mechanical Fasteners: Same material as or compatible with materials being fastened; type consistent with design and specified quality level.

F. Bolts, Nuts, and Washers: ASTM A307, Grade A, plain.

G. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

H. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

I. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.02 FABRICATION

A. Fit and shop assemble items in largest practical sections, for delivery to site.

B. Fabricate items with joints tightly fitted and secured.

C. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

D. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.03 FABRICATED ITEMS

A. Ledge Angles, Shelf Angles, Channels, and Plates Not Attached to Structural Framing: For support of metal decking; prime paint finish.

B. Lintels: As detailed; galvanized finish.

C. Slotted Channel Framing: Fabricate channels and fittings from structural steel complying with the referenced standards; factory-applied, rust-inhibiting thermoset acrylic enamel finish.

2.04 FINISHES - STEEL

A. Prime paint steel items.
   1. Exceptions: Galvanize items to be embedded in concrete and items to be embedded in masonry.
   2. Exceptions: Do not prime surfaces in direct contact with concrete, where field welding is required, and items to be covered with sprayed fireproofing.

B. Prepare surfaces to be primed in accordance with SSPC-SP2.

C. Prime Painting: One coat.

D. Galvanizing of Non-structural Items: Galvanize after fabrication to ASTM A123/A123M requirements.

2.05 FABRICATION TOLERANCES

A. Squareness: 1/8 inch maximum difference in diagonal measurements.

B. Maximum Offset Between Faces: 1/16 inch.

C. Maximum Misalignment of Adjacent Members: 1/16 inch.

D. Maximum Bow: 1/8 inch in 48 inches.

E. Maximum Deviation From Plane: 1/16 inch in 48 inches.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

A. Clean and strip primed steel items to bare metal where site welding is required.

B. Supply setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

3.03 INSTALLATION

A. Install items plumb and level, accurately fitted, free from distortion or defects.

B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

C. Field weld components as indicated on drawings.

D. Perform field welding in accordance with AWS D1.1/D1.1M.

E. Obtain approval prior to site cutting or making adjustments not scheduled.

F. After erection, prime welds, abrasions, and surfaces not shop primed , except surfaces to be in contact with concrete.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

C. Maximum Out-of-Position: 1/4 inch.

END OF SECTION

SECTION 055150 - FIXED VERTICAL LADDER

PART 1 - GENERAL

1.1 SUMMARY

A. Aluminum Fixed Vertical Ladder including ladder, rest platforms, floor mounting brackets.

B. Products Required, But Not Supplied Under This Section.

1.2 SYSTEM DESCRIPTION

A. The system is an aluminum ladder designed to be attached to a wall for exterior and interior application based on specified models.

1.3 DELIVERY, STORAGE, AND HANDLING.

A. Examine ladder when it arrives on site. Notify the carrier and manufacturer of any damage.

B. Store ladder until installation under roof, if possible; or, if stored outside, under a tarp or suitable cover.

1.4 REFERENCES

A. AA – Aluminum Association
B. ASTM B209 – Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
C. ASTM B221 – Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
D. OSHA 1910.27 – Fixed Ladders.

1.5 SUBMITTALS

A. Submit under provisions of Specification Section 013300 – Submittal Procedures.
B. Product Data: Manufacturer's data sheets on each products.
C. Shop Drawings:
   1. Detail fabrication and erection of eachladder indicated. Include plans, elevations, sections, and details of metal fabrications and their connections.
   2. Provide templates for anchors and bolts specified for installation under other sections.
   3. Provide reaction loads for each hanger and bracket.
D. Qualification Data:
   1. Refer to Quality Assurance provisions for submittal requirements evidencing experience, certifications and resources.
E. Selection Samples: For each finish specified, two complete sets color shops representing manufacturer's full range of available colors.
F. Verification Samples: for each finish specified, two samples, minimum size 6 inches square, represent actual product color.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A firm experienced in producing aluminum metal ladders similar to those indicated for this project.
   1. Record of successful in-service performance.
   2. Sufficient production capacity to produce required units.
   3. Professional engineering competent in design and structural analysis to fabricate ladders in compliance with industry standards and local codes.

B. Installer Qualifications: Competent and experienced firm capable of selecting fasteners and installing ladders to attain designed operational and structural performance.

C. Product Qualification: Product design shall comply with OSHA 1910.27 minimum standards for ladders.

1.7 WARRANTY

A. Manufacturer has responsibility for an extended Corrective Period for work of this section for a period of 5 years commencing on the shipment date of the product against all the conditions indicated below, and when notified in writing from Owner, manufacturer shall promptly and without inconvenience and cost to Owner correct said deficiencies.

1. Defects in materials and workmanship.

2. Deterioration of material and surface performance below minimum OSHA standards as certified by independent third party testing laboratory. Ordinary wear and tear, unusual abuse or neglect.

3. Within the warranty period, the manufacturer shall, at its option, repair, replace, or refund the purchase price of defective ladder.

B. Manufacturer shall be notified immediately of defective products, and be given a reasonable opportunity to inspect the goods prior to return. Manufacturer will not assume responsibility, or compensation, for unauthorized repairs or labor. Manufacturer makes no other warranty, expressed or implied, to the merchantability, fitness for a particular purpose, design, sale, installation, or use, of the ladder; and shall not be liable for incidental or consequential damages, losses of or expenses, resulting from the use of ladder products.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Basis-of-design products: subject to compliance with requirements, provide products by the following:

1. Okeeffe's, Inc.

a. Model No. 503A

B. Or approved equal.

2.2 FINISHES

A. Model No. 503A

1. Powder Coated finish as selected by Architect from entire Manufacturer's RAL Color Chart.

C. FASTENERS: As per manufacturer's specifications.

1. Provide Off Floor Mounting Bracket for Both Ladders

D. MATERIALS

1. The ladder shall be completely fabricated ready for installation before shipment to the site.
2. Aluminum Sheets: Alloy 5005-H34 to comply with ASTM B209
3. Aluminum Extrusions: Alloy 6063-T6 to comply with ASTM B221

E. FABRICATION

1. Rugs: Not less than 1-1/4 inches in section and 18-3/8 inches long, formed from Tubular aluminum extrusions. Squared and deeply serrated on all sides.

a. Rugs shall withstand a 1,500 pound load without deformation or failure.

2. Channel Side Rails: Not less than 1/8 inch wall thickness by 3 inches wide.
3. Heavy Duty Tubular Side Rails: Assembled from two interlocking aluminum extrusions no less than 1/8 inch wall thickness by 3 inches wide. Construction shall be self-locking stainless steel fasteners, full penetrations TIG welds and clean, smooth and burr-free surfaces.
4. Walk-Through Rail and Roof Rail Extension: not less than 3 feet 6 inches above the landing and shall be fitted with deeply serrated, square, tubular grab rails.
5. Landing Platform: 1-1/2 inches or greater diameter, tubular aluminum guardrail and decks of serrated aluminum treads.
6. Rail and Harness Fall Arrest System: Supplied in accordance with OSHA regulation 1910.27; permanently mounted to ladder rungs and complete with necessary components. **Provide Fall Arrest System for ladders which are noted with "4B" per construction key notes on drawing 01-A130.**

PART 3 - EXECUTION

3.1 EXAMINATION

A. Coordinate anchorages. Furnish setting drawings, templates, and anchorage structural loads for fastener resistance.

B. Do not begin installation until supporting structure is complete and ladder installation will not interfere with supporting structure work.

C. If supporting structure is the responsibility of another installer, notify Architect of unsatisfactory supporting work before proceeding.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions and in proper relationship with adjacent construction.

3.3 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before substantial completion.

END OF SECTION 055150

SECTION 061000 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wood blocking and nailers.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements.

1.3 INFORMATIONAL SUBMITTALS

A. 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.

B. Evaluation Reports: For the following, from ICC-ES:

1. Wood-preservative-treated wood.
2. Fire-retardant-treated wood.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Certified Wood: Materials shall be produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, for the following:

1. Dimension lumber framing.
2. Miscellaneous lumber.

B. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece.

3. Provide dressed lumber, S4S, unless otherwise indicated.

C. Maximum Moisture Content of Lumber: 15 percent for 2-inch nominal thickness or less, 19 percent for more than unless otherwise indicated.

D. Engineered Wood Products: Provide engineered wood products acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for Project.

1. Allowable Design Stresses: Provide engineered wood products with allowable design stresses, as published by manufacturer, which 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.

2.2 WOOD-PRESERVATIVE-TREATED LUMBER

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 and for interior construction not in contact with the ground, Use Category UC3b for exterior construction not in contact with the ground, and Use Category UC4a for items in contact with the ground.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.

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.

1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.

2.3 FIRE-RETARDANT-TREATED MATERIALS

A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.

1. Exterior Type: Treated materials shall comply with requirements specified above for fire- retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.

2. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.

C. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent.

D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.

E. Application: Treat all rough carpentry unless otherwise indicated.

1. Concealed blocking.
2. Roof construction.
3. Plywood backing panels.

2.4 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

1. Blocking.
2. Nailers.

B. For items of dimension lumber size, provide Construction or No. 2 grade lumber of any species.

C. For concealed boards, provide lumber with 15 percent maximum moisture content and any of the following species and grades:

1. Mixed southern pine; No. 2 grade; SPIB.
2. Eastern softwoods; No. 2 Common grade; NeLMA.
3. Northern species; No. 2 Common grade; NLGA.
4. Western woods; Construction or No. 2 Common grade; WCLIB or WWPA.

2.5 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners, with hot-dip zinc coating complying with ASTM A 153/A 153M.

B. Power-Driven Fasteners: NES NER-272.

C. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.

2.6 MISCELLANEOUS MATERIALS

A. Sill-Sealer Gaskets: Glass-fiber-resilient insulation, fabricated in strip form, for use as a sill sealer; 1- inch nominal thickness, compressible to 1/32 inch; selected from manufacturer's standard widths to suit width of sill members indicated.

B. Sill-Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to suit width of sill members indicated.

C. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, and similar supports to comply with requirements for attaching other construction.

B. Install fire-retardant treated plywood backing panels with classification marking of testing agency exposed to view.

C. Do not splice structural members between supports unless otherwise indicated.

D. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

E. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

F. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. NES NER-272 for power-driven fasteners.
2. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
3. 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.

3.2 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 061000
ROUGH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Roof-mounted curbs.

B. Roofing nailers.

C. Roofing cant strips.

D. Concealed wood blocking, nailers, and supports.

1.02 RELATED REQUIREMENTS

A. Section 074113 - Metal Roof Panels: Closure flashings and gutters.

1.03 REFERENCE STANDARDS

A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

B. AWPA U1 - Use Category System: User Specification for Treated Wood.

C. PS 20 - American Softwood Lumber Standard.

1.04 SUBMITTALS

A. Product Data: Provide technical data on wood preservative materials.

1.05 DELIVERY, STORAGE, AND HANDLING

A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.

1. If no species is specified, provide species graded by the agency specified; if no grading agency is specified, provide lumber graded by grading agency meeting the specified requirements.
2. Grading Agency: Grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee at www.alsc.org, and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.

2.02 DIMENSION LUMBER FOR CONCEALED APPLICATIONS

A. Sizes: Nominal sizes as indicated on drawings, S4S.

B. Moisture Content: S-dry or MC19.

C. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:

2.03 ACCESSORIES

A. Fasteners and Anchors:

1. Metal and Finish: Hot-dipped galvanized steel complying with ASTM A153/A153M for high humidity and preservative-treated wood locations, unfinished steel elsewhere.

2.04 FACTORY WOOD TREATMENT

A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific

applications.

PART 3 EXECUTION

3.01 PREPARATION

A. Coordinate installation of rough carpentry members specified in other sections.

3.02 INSTALLATION - GENERAL

A. Select material sizes to minimize waste.

B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.

C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

3.03 BLOCKING, NAILERS, AND SUPPORTS

A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.

B. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.

C. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.

3.04 ROOF-RELATED CARPENTRY

A. Coordinate installation of roofing carpentry with deck construction, framing of roof openings, and roofing assembly installation.

3.05 SITE APPLIED WOOD TREATMENT

A. Apply preservative treatment compatible with factory applied treatment at site-sawn cuts, complying with manufacturer's instructions.

B. Allow preservative to dry prior to erecting members.

3.06 CLEANING

A. Do not leave wood, shavings, sawdust, etc. on the ground or buried in fill.

B. Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION

SECTION 066116
SOLID SURFACING FABRICATIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Window stools.

B. Counter tops with sinks and backsplashes.

1.02 RELATED REQUIREMENTS

A. Section 079200 - Joint Sealants

B. Section 092116 - Gypsum Board Assemblies

C. Section 123200 - Manufactured Wood Casework

D. Section 224000 - Plumbing Fixtures

1.03 REFERENCE STANDARDS

A. ANSI A208.2 - American National Standard for Medium Density Fiberboard for Interior Use; 2009.

B. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.

C. ASTM D5420 - Standard Test Method for Impact Resistance of Flat, Rigid Plastic Specimen by Means of a Striker Impacted by a Falling Weight; 2016

D. ASTM D638 - Standard Test Method for Tensile Properties of Plastics; 2014.

E. ASTM D785 - Standard Test Method for Rockwell Hardness of Plastics and Electrical Insulating Materials; 2008 (Reapproved 2015).

F. ASTM D790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials; 2016.

G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018b.

H. ASTM E228-17 - Standard Test Method for Linear Thermal Expansion of Solid Materials With a Push-Rod Dilatometer; 2017

I. ASTM G155 - Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Nonmetallic Materials; 2013.

J. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015.

K. IAPMO Z124 - Plastic Plumbing Fixtures; 2017.

L. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

M. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials; 2006.

N. NSF 51 - Food Equipment Materials; 2017.

O. SCAQMD 1168 - Adhesive and Sealant Applications; 1989 (Amended 2017).

P. UL 2824 - GREENGUARD Certification Program Method for Measuring Microbial Resistance From Various Sources Using Static Environmental Chambers; Current Edition, Including All Revisions.

Q. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. Product Data: Indicate Product description including solid surface sheets, sinks, bowls and illustrating full range of standard colors, fabrication information and compliance with specified performance requirements. Submit Product data with resistance to list of chemicals.

B. Shop Drawings; Indicate plans, sections, dimensions, component sizes, edge details, thermosetting requirements, fabrication details, attachment provisions, sizes of furring, blocking, including concealed blocking and coordination requirements with adjacent work. Show locations and sizes of cutouts and holes for plumbing fixtures, faucets, soap dispensers, waste receptacles and other items installed in solid surface.

C. Samples: Submit two samples representative of vanity top, counter top, and window stool, 6 x 6 inch in size, illustrating color, texture, and finish.

D. Maintenance Data: Indicate list of approved cleaning materials and procedures required; list of substances that are harmful to the component materials.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years of documented experience.

1.06 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Manufacturer Warranty: Provide manufacturer’s standard warranty for material only for period of 10 years against defects and/or deficiencies in accordance with General Conditions of the Contract. Promptly correct any defects or deficiencies which become apparent within warranty period, to satisfaction of Architect and at no expense to Owner.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design;
   1. Corian® by DuPont

B. Products of following manufacturers are acceptable subject to conformance to requirements of Drawings, Schedules and Specifications:
   1. Samsung Chemical USA
   2. Wilsonart Contract
   3. Avonite
   4. Or equal.

2.02 MATERIALS

A. Performance Design Criteria;
   a.

Item #	Property	Requirement	Test Procedure
1	Tensile Strength	6000 psi min.	ASTM D638
2	Tensile Modulus	1.5 x 10 6 psi min	ASTM D638
3	Tensile Elongation	0.4% min.	ASTM D638
4	Flexural Strength	10000 psi min.	ASTM D790
5	Flexural Modulus	1.2 x 10 6 psi min.	ASTM D790
6	Hardness	>85-Rockwell "M" scale min.	ASTM D785

7	Thermal Expansion	2.2 x 10 -5 in./in./°F	ASTM E228
8	Fungi and Bacteria	Does not support microbial growth	ASTM G21 & G22
9	Microbial Resistance	Highly resistant to mold growth	UL 2824
10	Ball Impact	No fracture - 1/2 lb. Ball: 6mm slab - 36" drop 12mm slab - 144" drop	NEMA LD 3 Method 3.8
11	Weatherability	?E*94<5 in 1,000 hrs	ASTM G155
12	Flammability	Class 1 & A	ASTM E84, NFPA 255, & UL 723
13	Flame Spread	<25	
14	Smoke Developed	<25	
15	Class	A	NFPA 101®, Life Safety Code

b.

B. Solid Surface Material:
   1. Non-porous, homogeneous material maintaining the same composition throughout the part with a composition of acrylic polymer, aluminum trihydrate filler and pigment; not coated, laminated or of composite construction; meeting following criteria:
   2. Flammability: Class 1 and A when tested to UL 723.
   3. Food Equipment Material Compliance: Food Zone to NSF/ANSI 51.
      1) Ensure material has minimum physical and performance properties specified under “Performance/Design Criteria”.
      2) Ensure superficial damage to a depth of 0.010" is repairable by sanding and polishing.
   4. Adhesive for Bonding to Other Products: One component silicone to ASTM C920.
   5. Sealant: A standard mildew-resistant, FDA/UL® [and NSF/ANSI 51 compliant in Food Zone area,] recognized silicone color matched sealant or clear silicone sealants.
   6. Sink/Bowl Mounting Hardware: Manufacturer's approved bowl clips, brass inserts and fasteners for attachment of undermount sinks/bowls.
   7. Heat Reflecting Tape: Manufacturer’s standard aluminum foil tape, with required thickness, for use with cutouts near heat sources.
   8. Insulating Nomex® Fabric: Manufacturer’s standard for use with conductive tape in insulating solid surface material from adjacent heat source.

203 COMPONENTS

A. Window Stools: 1/2" thick solid surfacing material, adhesively joined with inconspicuous seams, edge details as indicated on Drawings. Color selected later by Architect from manufacturer’s full color range.

B. Countertops with Counter Perimeter Frame: Ensure 3/4" thick, moisture resistant;
   1. Cores for counter tops in wet areas having sinks or lavatories are 3/4" thick exterior grade plywood with waterproof adhesive, Fir or Poplar plywood, veneer core only.
   2. MDF core conforming to ANSI/NPA A208.2 balanced design, manufactured from recycled materials, meeting ANSI Standards for emissions, of minimum density of 48 lb/cu ft and surface character to match sample approved by Architect. Ensure fire retardant Product

contains fire-retardant chemicals injected with raw materials during manufacturing and achieves a maximum flame-spread rating of 25 with a maximum smoke development of 200 when tested to ASTM E84.]

2.04 FABRICATION

A. Fabricate components in shop to greatest extent practical to sizes and shapes indicated, in accordance with approved Shop Drawings and solid polymer manufacturer requirements. Form joints between components using manufacturer's standard joint adhesive without conspicuous joints. Provide factory cutouts for plumbing fittings and bath accessories as indicated on Drawings.

B. Where indicated, thermoform corners and edges or other objects to shapes and sizes indicated on Drawings, prior to seaming and joining. Cut components larger than finished dimensions and sand edges to remove nicks and scratches. Heat entire component uniformly prior to forming.

C. Ensure no blistering, whitening and cracking of components during forming.

D. Fabricate backsplashes from solid surfacing material with optional radius cove where counter and backsplashes meet as indicated on Drawings. Backsplashes for most colors may be fabricated by traditional means discussed in K-25294 Backsplashes. Colors with metallic/mica particle or veined colors creating directional aesthetics (K-26833 Directional Aesthetics) may require the techniques in Technical Bulletin K-28235 Thermoformed Backsplash.

E. Fabricate joints between components using manufacturer's standard joint adhesive. Ensure joints are inconspicuous in appearance and without voids. Attach 50 mm (2") wide reinforcing strip of solid polymer material under each joint. Reinforcing strip of solid polymer material is not required when using DuPont™ Joint Adhesive 2.0.

F. Provide holes and cutouts for plumbing and bath accessories as indicated on Drawings.

G. Rout and finish component edges to a smooth, uniform finish. Rout cutouts, then sand edges smooth. Repair or reject defective or inaccurate work.

H. Fabrication Tolerances:
   1. Variation in Component Size: +/-1/8".
   2. Location of Openings: +/-1/8" from indicated location.

2.05 FINISH

A. Color: As indicated on Drawings and selected from Manufacturer's entire range of color options in all grades.

B. Finish: Ensure surfaces have uniform finish:
   1. Matte, with a 60° gloss rating of 5 - 20.
   2. Semi-gloss, with a 60° gloss rating of 25 - 50.
   3. Polished, with a 60° gloss rating of 55 - 80.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verification of Conditions:
   1. Examine substrates and conditions, with fabricator present for compliance with requirements for installation tolerances and other conditions affecting performance of work. Proceed with installation only after unsatisfactory conditions have been corrected.
   2. Verify actual site dimensions and location of adjacent materials prior to commencing work.
   3. Examine cabinets upon which counter tops are to be installed. Verify cabinets are level to within 1/8" in 10' - 0".
   4. Notify Architect in writing of any conditions which would be detrimental to installation.

5. Evaluation and Assessment: Commencement of work implies acceptance of previously completed work.

B. Verify mechanical, electrical, and building items affecting work of this section are placed and ready to receive this work.

3.02 PREPARATION

A. Provide anchoring devices for installation and embedding.

B. Provide templates and rough-in measurements.

3.03 INSTALLATION

A. Install components in accordance with shop drawings and manufacturer's instructions.

B. Rigidly anchor to substrate to prevent misalignment.

C. Install components plumb, level, rigid, scribed to adjacent finishes in accordance with reviewed Shop Drawings and Product installation details.

D. Fabricate field joints using manufacturer's recommended adhesive, with joints being inconspicuous in finished work. Exposed joints/seams are not permitted. Keep components and hands clean when making joints. Reinforce field joints as specified herein. Cut and finish component edges with clean, sharp returns.

E. Route radii and contours to template. Anchor securely to base component or other supports. Align adjacent components and form seams to comply with manufacturer’s written recommendations using adhesive in color to match work. Carefully dress joints smooth, remove surface scratches and clean entire surface.

F. Install countertops with no more than 1/8" sag, bow or other variation from a straight line.

G. Adhere undermount/submount/bevel mount sinks/bowls to countertops using manufacturer's recommended adhesive and mounting hardware.

H. Adhere topmount sinks/bowls to countertops using manufacturer recommended adhesives and color-coordinated silicone sealant. [Secure seam mount bowls and sinks to counter tops using color matched joint adhesive.]

I. Seal between wall and components with joint sealant as specified herein and in Section 079200, as applicable.

J. Provide backsplashes and endsplashes as indicated on Drawings. Adhere to countertops using a standard color-coordinated silicone sealant. Adhere applied sidesplashes to countertops using a standard color-matched silicone sealant. Provide coved backsplashes and sidesplashes at walls and adjacent millwork. Fabricate radius cove at intersection of counters with backsplashes to dimensions shown on reviewed Shop Drawings. Adhere to countertops using manufacturer’s standard color-coordinated joint adhesive.

K. Keep components and hands clean during installation. Remove adhesives, sealants and other stains. Ensure components are clean on date of Substantial Completion of the Work.

L. Coordinate connections of plumbing fixtures with Division 22 4000 - Plumbing Fixtures.

3.04 QUALITY CONTROL

A. Repair minor imperfections and cracked seams and replace areas of severely damaged surfaces in accordance with manufacturer’s “Technical Bulletins”.

B. Non-Conforming Work: Replace damaged work which cannot be satisfactorily repaired, restored or cleaned, to satisfaction of Architect at no cost to Owner.

3.05 CLEANING

A. Remove excess adhesive and sealant from visible surfaces.

B. Clean surfaces in accordance with manufacturer's "Care and Maintenance Instructions".

3.06 PROTECTION

A. Provide protective coverings to prevent physical damage or staining following installation for duration of Project.

B. Protect surfaces from damage until date of Substantial Completion of the Work.

END OF SECTION

SECTION 070150.65
ROOF PATCHING FOR ADDITION OF ROOFTOP EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Patching existing roof where affected by new construction, as required to maintain the system weathertight and existing warranty/guaranty in full force and effect.

1.02 RELATED REQUIREMENTS

A. Division 11 Sections for food service rooftop equipment removal and reinstallation.

1.03 MATERIALS OWNERSHIP

A. Except for items or materials indicated to be reused, reinstalled, or otherwise indicated to remain Owner's property, demolished materials shall become Contractor's property and shall be removed from Project site.

1.04 DEFINITIONS

A. Roofing Terminology: Refer to ASTM D1079 and glossary in NRCA's "The NRCA Roofing and Waterproofing Manual" for definition of terms related to roofing work in this Section.

B. Existing Membrane Roofing System: Roofing membrane, roof insulation, surfacing, and components and accessories between deck and roofing membrane.

C. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and reinstalled.

D. Existing to Remain: Existing items of construction that are not indicated to be removed.

1.05 REFERENCE STANDARDS

A. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board

B. ASTM C1621/C1621M - Standard Test Method for Passing Ability of Self-Consolidating Concrete by J-Ring.

C. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.

D. ASTM C203 - Standard Test Methods for Breaking Load and Flexural Properties of Block-Type Thermal Insulation.

E. ASTM D1079 - Standard Terminology Relating to Roofing and Waterproofing.

F. ASTM D41/D41M - Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing.

G. ASTM D146/D146M - Standard Test Methods for Sampling and Testing Bitumen-Saturated Felts and Woven Fabrics for Roofing and Waterproofing.

H. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension.

I. ASTM D3746 / D3746M - Standard Practice for Evaluating High-Density Rigid Cellular Plastics.

J. ASTM D3960 - Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings.

K. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free.

L. ASTM D5147/D5147M - Standard Test Methods for Sampling and Testing Modified Bituminous Sheet Material.

M. ASTM D6162/D6162M - Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fiber Reinforcements.

N. ASTM D816 - Standard Test Methods for Rubber Cements.

O. ASTM D903 - Standard Test Method for Peel or Stripping Strength of Adhesive Bonds.

P. ASTM E108 - Standard Test Methods for Fire Tests of Roof Coverings.

Q. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

1.06 ACTION SUBMITTALS

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

B. Temporary Roofing: Include Product Data and description of temporary roofing system. If temporary roof will remain in place, submit surface preparation requirements needed to receive permanent roof, and submit a letter from roofing membrane manufacturer stating acceptance of the temporary membrane and that its inclusion will not adversely affect the roofing system's resistance to fire and wind.

1.07 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer

B. Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including exterior and interior finish surfaces, which might be misconstrued as having been damaged by reroofing operations. Submit before Work begins.

1.08 SUBMITTALS

A. Product Data:
   1. Submit product data.
   2. Submit letter indicating that system conforms to requirements of existing roof system manufacturer to maintain existing guaranty/warranty in full force and effect, or that none exists.
   3. Submit a letter identifying that the materials and techniques to be utilized as appropriate for the type of roof system in place.

B. Qualification Data: For Installer including evidence that installer is approved by warrantor of existing roofing system.

1.09 QUALITY ASSURANCE

A. Installer: Experienced in the type of Work required, with minimum five years documented experience and approved by warrantor of existing roofing system.

B. Existing Warranty/Guaranty: Verify the existence of warranties/guarantees on the existing roofing systems with the Owner. Obtain copies and perform patching in accordance with the requirements of same to maintain them in full force and effect.

1.10 PROJECT CONDITIONS

A. Owner will occupy portions of existing building and site. Conduct reroofing so Owner's operations will not be disrupted. Provide Owner with not less than 72 hours' notice of activities that may affect Owner's operations.
   1. Coordinate work activities daily with Owner so Owner can place protective dust or water leakage covers over sensitive equipment or furnishings, shut down HVAC and fire-alarm or -detection equipment if needed, and evacuate occupants from below the work area.
   2. Before working over structurally impaired areas of deck, notify Owner to evacuate occupants from below the affected area. Verify that occupants below the work area have been evacuated before proceeding with work over the impaired deck area.

B. Protect existing building and adjacent work to remain, walkways, site improvements, exterior plantings, and landscaping from damage or soiling from reroofing operations.

C. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities.

D. Limit construction loads on roof to prevent excessive deflection of deck or structural members.

E. Weather Limitations: Install work only under environmental conditions recommended by the flashing materials manufacturer. Proceed with work only when existing and forecasted weather conditions permit Work to proceed without water entering existing roofing system or building.

F. Coordinate Work with other affected mechanical and electrical work associated with roof penetrations.

G. Daily Protection: Coordinate installation of roofing so insulation and other components of roofing system not permanently exposed are not subjected to precipitation or left uncovered at the end of the workday or when rain is forecast.
   1. Provide tie-offs at end of each day's work to cover exposed roofing and insulation with a course of coated roofing sheet set in roofing cement or hot roofing asphalt with joints and edges sealed.
   2. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing.
   3. Remove temporary plugs from roof drains at end of each day.
   4. Remove and discard temporary seals before beginning work on adjoining roofing.

H. Hazardous Materials: It is not expected that hazardous materials such as asbestos-containing materials will be encountered in the Work.
   1. Hazardous materials will be removed by Owner before start of the Work. Existing roof will be left no less watertight than before removal.
   2. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Owner.

1.11 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces by methods and with materials so as not to void existing roofing system warranty. Notify warrantor before proceeding.
   1. Notify warrantor of existing roofing system on completion of reroofing, and obtain documentation verifying that existing roofing system has been inspected and warranty remains in effect. Submit documentation at Project closeout.
      a. Warrantor of Existing Roof: Tremco, Inc., Beachwood, OH, (800) 562-2728, www.tremcoroofing.com
      b. Warranty Reference Number: 94795

PART 1 PRODUCTS

2.01 MATERIALS - GENERAL

A. Provide materials recommended by roofing system manufacturer for intended use; compatible with components of new membrane roofing system.

B. Use materials and techniques required to maintain existing warranty/guaranty in effect, when applicable.

2.02 INFILL MATERIALS

A. Wood Components:
   1. Reuse of Existing Wood Nailers: Permitted where type, size and securement are in accordance with Factory Mutual Loss Prevention Data Bulletin 1-49; and existing wood

nailers exhibit no signs of deterioration or other conditions detrimental to securement of new roofing system in conformance with specified requirements.

B. Insulation and Membrane Roofing:
   1. Roof Insulation: Provide roof insulation product in thicknesses as follows:
      a. Polyisocyanurate board insulation, ASTM C1289 Type II Class 1 CFC- and HCFC-free, with recycled content glass-fiber mat facer on both major surfaces.
         1) Basis of design product: Tremco, Trisotech Insulation.
            (a) Compressive Strength, ASTM C1621/C1621M ,:Grade 2: 20 psi (138 kPa).
            (b) Conditioned Thermal Resistance at 75 deg. F (24 deg. C): 14.4 at 2.5 inches (50.8 mm) thick
   2. Cover Board:
      a. Gypsum panel, glass-mat-faced, primed, ASTM C1177/C1177M.
         1) Basis of design product: Tremco/GP Gypsum DensDeck Prime.
            (a) Thickness: 1/2 inch (12 mm).
   3. Roof Insulation Adhesive:
      a. Urethane adhesive, bead-applied, low-rise two-component solvent-free low odor, formulated to adhere roof insulation to substrate.
         1) Basis of design product: Tremco, Low Rise Foam Insulation Adhesive.
            (a) Flame Spread Index, ASTM E84: 10.
            (b) Smoke Developed Index, ASTM E84: 30.
            (c) Volatile Organic Compounds (VOC), maximum, ASTM D3960: 0 g/L.
            (d) Tensile Strength, minimum, ASTM D412: 250 psi (1724 kPa).
            (e) Peel Adhesion, minimum, ASTM D903: 17 lbf/in (2.98 kN/m).
            (f) Flexibility, 70 deg. F (39 deg. C), ASTM D816: Pass.
   4. Primer:
      a. Primer Asphalt: Asphalt primer, ASTM D41/D41M, low-VOC.
         1) Basis of design product: Tremco, TREMprime LV.
            (a) Volatile Organic Compounds, maximum, ASTM D3960: 350 g/L.
            (b) Total solids, ASTM D41/D41M: 45 percent.
   5. MB Base Sheets:
      a. SBS/SEBS-modified asphalt-coated composite polyester and glass-fiber reinforced sheet, smooth surfaced, designed for heat-welded applications, ASTM D6162/D6162M Type III Grade S.
         1) Basis of design product: Tremco, POWERply SBS Base HW (Heat Weld).
            (a) Tensile Strength at 77 deg. F (25 deg. C), minimum, ASTM D5147/D5147M: 275 lbf/in (48 kN/m), machine direction; 275 lbf/in (48 kN/m), cross machine direction .
            (b) Tear Strength at 77 deg. F (25 deg. C), minimum, ASTM D5147/D5147M: 380 lbf (85 N), machine direction; 380 lbf (85 N), cross machine direction .
            (c) Elongation at 77 deg. F (25 deg. C), minimum, ASTM D5147/D5147M : 3 percent.
            (d) Low Temperature Flex, ASTM D5147/D5147M: -20 deg. F (-30 deg. C).
            (e) Thickness, ASTM D5147/D5147M: 0.090 inch (2.3 mm).
   6. MB SBS Cap Sheets:
      a. SBS/SIS/SEBS-modified asphalt-coated composite polyester and glass fiber reinforced sheet, granular surfaced, heat weldable, ASTM D6162/D6162M Type III Grade G.
         1) Basis of design product: Tremco, POWERply SBS Deluxe HW (Heat Weld).
            (a) Exterior Fire-Test Exposure, ASTM E108: Class A.

(b) Tensile Strength at 77 deg. F (25 deg. C), minimum, ASTM D5147/D5147M: Machine direction 275 lbf/in (48 kN/m); Cross machine direction 275 lbf/in (48 kN/m).
(c) Tear Strength at 77 deg. F (25 deg. C), minimum, ASTM D5147/D5147M: Machine direction, 380 lbf (85 N); Cross machine direction 380 lbf (85 N).
(d) Elongation at 77 deg. F (25 deg. C), minimum, ASTM D5147/D5147M: Machine direction, 3 percent; Cross machine direction, 3 percent.
(e) Low Temperature Flex, maximum, ASTM D5147/D5147M : -22 deg. F (-30 deg. C).
(f) Thickness, minimum, ASTM D5147/D5147M: 0.140 inch (3.5 mm).

203 AUXILIARY REROOFING MATERIALS

A. General: Auxiliary reroofing preparation materials recommended by roofing system manufacturer for intended use and compatible with components of existing and new membrane roofing system.

B. Fasteners: Capped head, factory-coated steel fasteners, listed in FM Approval's "Approval Guide."

C. Metal Flashing Sheet: Provide metal flashing of same metal, weight or thickness, and finish as required to match existing metal flashing.

D. Flashing Backer Sheet:
   a. SBS/SEBS-modified asphalt-coated composite polyester and glass-fiber reinforced sheet, smooth surfaced, designed for heat-welded applications, ASTM D6162/D6162M Type III Grade S.
      1) Basis of design product: Tremco, POWERply SBS Base HW (Heat Weld).
         (a) Tensile Strength at 77 deg. F (25 deg. C), minimum, ASTM D5147/D5147M: 275 lbf/in (48 kN/m), machine direction; 275 lbf/in (48 kN/m), cross machine direction .
         (b) Tear Strength at 77 deg. F (25 deg. C), minimum, ASTM D5147/D5147M: 380 lbf (85 N), machine direction; 380 lbf (85 N), cross machine direction .
         (c) Elongation at 77 deg. F (25 deg. C), minimum, ASTM D5147/D5147M: 3 percent.
         (d) Low Temperature Flex, ASTM D5147/D5147M: -20 deg. F (-30 deg. C).
         (e) Thickness, ASTM D5147/D5147M: 0.090 inch (2.3 mm).

E. Flashing Cap Sheet: SBS/SIS/SEBS-modified asphalt-coated composite polyester and glass fiber reinforced sheet, granular surfaced, heat weldable, ASTM D6162/D6162M Type III Grade G.
      1) Basis of design product: Tremco, POWERply SBS Deluxe HW (Heat Weld).
         (a) Exterior Fire-Test Exposure, ASTM E108: Class A.
         (b) Tensile Strength at 77 deg. F (25 deg. C), minimum, ASTM D5147/D5147M: Machine direction 275 lbf/in (48 kN/m); Cross machine direction 275 lbf/in (48 kN/m).
         (c) Tear Strength at 77 deg. F (25 deg. C), minimum, ASTM D5147/D5147M: Machine direction, 380 lbf (85 N); Cross machine direction 380 lbf (85 N).
         (d) Elongation at 77 deg. F (25 deg. C), minimum, ASTM D5147/D5147M: Machine direction, 3 percent; Cross machine direction, 3 percent.
         (e) Low Temperature Flex, maximum, ASTM D5147/D5147M: -22 deg. F (-30 deg. C).
         (f) Thickness, minimum, ASTM D5147/D5147M: 0.140 inch (3.5 mm).

2. Reinforcing Fabrics: Woven Glass Fiber Mesh, Vinyl-Coated: Non-shrinking, non-rotting, vinyl-coated woven glass mesh for reinforcing flashing seams, membrane laps, and other roof system detailing.
    a. Basis of design product: Tremco, BURmesh.
        1) Tensile strength, 70 deg. F, min ASTM D146/D146M: Warp, 65 lbf/in (285 N); fill, 75 lbf/in (310 N).
        2) Color: Aqua green
3. Walkway Materials: Walkway pads, ceramic-granule-surfaced reinforced asphaltic composition slip-resisting pads, manufactured as a traffic pad for foot traffic, 1/2 inch (13 mm) thick minimum.
    a. Basis of design product: Tremco, Trem-Tred.
        1) Flexural Strength at max. load, minimum, ASTM C203: 218 psi (1.5 kPa).
        2) Granule adhesion (weight loss), maximum, ASTM D4977/D4977M: 1.1 gram.
        3) Impact Resistance at 77 deg. F (25 deg. C), ASTM D3746 / D3746M: No Damage to Roof.
        4) Pad Size: 36 by 48 inch (914 by 1220 mm).
4. Walkway Cold Applied Adhesive: Roof Cement, Asphalt-Based: ASTM D4586/D4586M, Type II, Class I, fibrated roof cement formulated for use in installation and repair of asphalt ply and modified bitumen roofing plies and flashings; UL-classified for fire resistance.
    a. Basis of design product: Tremco, ELS.
        1) Volatile Organic Compounds (VOC), maximum, ASTM D3960 190 g/L.
        2) Non-Volatile Matter, ASTM D4586/D4586M: 85 percent.
        3) Resistance to sag ASTM D4586/D4586M: 1/8 in. (3 mm).

PART 1 EXECUTION

3.01 PREPARATION

A. Protect existing membrane roofing system.
    1. Loosely lay 1-inch (25-mm) minimum thick, molded expanded polystyrene (MEPS) insulation over the roofing membrane in and around work areas, access pathways and storage areas. Loosely lay 15/32-inch (12-mm) plywood or OSB panels over MEPS. Extend MEPS past edges of plywood or OSB panels a minimum of 1 inch (25 mm).
    2. Limit traffic and material storage to areas of existing roofing membrane that have been protected.

B. Coordinate with Owner to shut down air-intake equipment in the vicinity of the Work. Cover air-intake louvers before proceeding with work that could affect indoor air quality or activate smoke detectors in the ductwork.

C. During patching operations, have sufficient and suitable materials on-site to facilitate rapid installation of temporary protection in the event of unexpected rain.

D. Maintain roof drains in functioning condition to ensure roof drainage at end of each workday. Prevent debris from entering or blocking roof drains and conductors.

E. Verify that rooftop utilities and service piping have been shut off before beginning the Work.

3.02 REMOVAL

A. Cut back roof membrane and underlying materials including: cover board, insulation to straight line; remove materials to existing deck or to suitable substrate.

B. If unsuitable deck/substrate conditions are encountered, notify the Architect and obtain direction before proceeding.

3.03 INSTALLATION OF SBS MODIFIED BITUMINOUS MEMBRANE ROOFING

A. Cut insulation and cover board to exactly fill void to top of existing roof membrane and install in Tremco Low Rise Foam Insulation Adhesive in beads 6 inches on center. Provide cants and insulate curbs as required to provide sound, level substrate for flashing.

B. Prime contact surface, with Tremprime LV as recommended by system manufacturer.

C. Install one ply of Tremco Powerply SBS Base HW. Install one ply of Powerply SBS Heat Weld Deluxe, lap existing roofing membrane 6 inches. (150 mm) Use largest size flashing sheets practical. Lap joints 2 inches (50 mm). Offset joints in each layer 4 inches.

D. Install cants, saddles, crickets, tapered edge strips, and other insulation shapes as indicated/required to provide positive slope to drainage.

E. Provide all auxiliary materials and accessory items as required for a complete, weathertight installation.

3.04 NEW BASE FLASHINGS

A. Insulate the outside of the new HVAC unit curbs. New insulation is to be fastened or adhered for a secure attachment.

B. Install cants, saddles, crickets, tapered edge strips, and other insulation shapes as indicated/required around the perimeter of the new curbs.

C. Prime contact surface, with Tremprime LV as recommended by system manufacturer.

D. IInstall one ply of Tremco Powerply SBS Base HW. Install one ply of Powerply SBS Heat Weld Deluxe. Vertical and toe laps are to be stripped 6 inches with BURmesh and Alumination 301 (150 mm). (100 mm)

E. Install .040 Aluminum 5” counterflashing at all curbs, screwed 6 inches on center with fastener and washer.

F. Install Tremco Trem-tread walk-way pads at all RTU serviceable sides (removable panels). Walkway pads are to be installed with Tremco ELS.

3.05 PROTECTION OF INSTALLED CONSTRUCTION

A. Install temporary protective sheeting over uncovered deck surfaces.
   1. Turn sheeting up and over parapets, roof edge and curbing. Retain sheeting in position with weights or temporary fasteners.
   2. Provide for surface drainage from sheeting to existing drainage facilities.

B. Do not permit traffic over unprotected or repaired deck surface.

C. Roof equipment not in use or roofing materials stored on roof must be placed above structural column lines, on roof protection consisting of molded expanded polystyrene (MEPS) insulation covered with plywood or OSB panels.

D. Provide watertight cut off (night tie-in) at the end of each day's Work.

3.06 DISPOSAL

1. Collect demolished materials and place in containers. Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on-site.
2. Storage or sale of demolished items or materials on-site is not permitted.

B. Transport and legally dispose of demolished materials off Owner's property.

3.07 FIELD QUALITY CONTROL

A. Roofing Inspector: Contractor shall engage a qualified roofing inspector full-time on site to perform roof tests and inspections and to prepare start up, interim, and final reports. Roofing

Inspector's quality assurance inspections shall comply with criteria established in NRCA's "Quality Control and Quality-assurance Guidelines for the Application of Membrane Roofing Systems."

B. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation at commencement and upon completion
   1. Notify Architect and Owner 48 hours in advance of date and time of inspection.

END OF SECTION

SECTION 071113
BITUMINOUS DAMPPROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Bituminous dampproofing.

B. Protection boards.

C. Drainage panels.

1.02 REFERENCE STANDARDS

A. ASTM D1187/D1187M - Standard Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal.

B. ASTM D1227 - Standard Specification for Emulsified Asphalt Used as a Protective Coating for Roofing.

C. NRCA (WM) - The NRCA Waterproofing Manual.

1.03 SUBMITTALS

A. Product Data: Provide properties of primer, bitumen, and mastics.

B. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this section with at least three years of documented experience.

1.05 FIELD CONDITIONS

A. Maintain ambient temperatures above 40 degrees F for 24 hours before and during application until dampproofing has cured.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design: W.R. Meadows, Inc..

B. Other Acceptable Bituminous Dampproofing Manufacturers:
   1. Karnak Corporation; .
   2. Mar-Flex Systems, Inc: .
   3. Or equal.

2.02 BITUMINOUS DAMPPROOFING

A. Bituminous Dampproofing: Cold-applied water-based emulsion; asphalt with mineral colloid or chemical emulsifying agent; with or without fiber reinforcement; asbestos-free; suitable for application on vertical and horizontal surfaces.
   1. Composition - Vertical Application: ASTM D1227 Type III or ASTM D1187/D1187M Type I.
   2. Composition - Horizontal and Low-Slope Application: ASTM D1227 Type II or III.
   3. VOC Content: Not more than permitted by local, State, and federal regulations.
   4. Applied Thickness: 1/16 inch, minimum, wet film.
   5. Products:
      a. W. R. Meadows, Inc; Sealmastic Emulsion Type I (spray-grade).
      b. Or equal.

B. Primers, Mastics, and Related Materials: Type as recommended by dampproofing manufacturer.

2.03 ACCESSORIES

A. Drainage Panel: 1/4 inch thick formed plastic, embossed with cover sheet.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions are acceptable prior to starting this work.

B. Verify substrate surfaces are durable, free of matter detrimental to adhesion or application of dampproofing system.

C. Verify that items penetrating surfaces to receive dampproofing are securely installed.

3.02 PREPARATION

A. Protect adjacent surfaces not designated to receive dampproofing.

B. Clean and prepare surfaces to receive dampproofing in accordance with manufacturer's instructions.

C. Do not apply dampproofing to surfaces unacceptable to manufacturer.

D. Apply mastic to seal penetrations, small cracks, or minor honeycombs in substrate.

3.03 APPLICATION

A. Foundation Walls: Apply two coats of asphalt dampproofing.

B. Perform this work in accordance with manufacturer's instructions and NRCA (WM) applicable requirements.

C. Prime surfaces in accordance with manufacturer's instructions and NRCA (WM) applicable requirements.

D. Apply bitumen with mop.

E. Seal items watertight with mastic, that project through dampproofing surface.

F. Place protection board directly over dampproofing, butt joints, and adhere to tacky dampproofing.

G. Scribe and cut boards around projections, penetrations, and interruptions.

END OF SECTION

SECTION 071616 – CRYSTALLINE WATERPROOFING

PART 1 – GENERAL

1.1 SUMMARY

A. Furnishing of all labor, materials, services and equipment necessary for the supply and installation of cementitious crystalline waterproofing to concrete substrates, above-grade or below-grade, on either dry or wet side of substrates, as indicated on drawings and as specified herein.

B. Related Sections:

1. Section 031513 – Waterstops for Concrete Joints
2. Section 033000 – Cast-In-Place Concrete

1.2 REFERENCES

A. The following standards are referenced herein.

1. American Society for Testing and Materials (ASTM)
2. Army Corps of Engineers (CRD)
3. American National Standards Institute (ANSI)
4. NSF International
5. European Standards (EN)
6. RILEM
7. Drinking Water Inspectorate (DWI)

1.3 SYSTEM DESCRIPTION

A. Concrete waterproofing and protection system shall be of the crystalline type that is a blend of Portland cement, fine treated silica sand and active proprietary chemicals. When mixed with water and applied as a cementitious coating, the active chemicals diffuse into the concrete and cause a catalytic reaction which generates a non-soluble crystalline structure within the pores and capillary tracts of concrete. This crystalline system causes the concrete to become sealed against the penetration of liquids from any direction, and protects the concrete from deterioration due to harsh environmental conditions. The system is used for above or below-grade walls and slabs, including liquid retaining structures and where enhanced chemical resistance is required.

1.4 SYSTEM PERFORMANCE REQUIREMENTS

A. Testing Requirements: Crystalline waterproofing system shall have been tested in accordance with the following standards and conditions, and the testing results shall meet or exceed the performance requirements as specified herein.

B. Independent Laboratory: Testing shall have been performed by an accredited independent laboratory meeting the requirements of ASTM E 329 or other applicable international standard for certification of testing laboratories. Testing laboratory shall have obtained all control and treated concrete samples.

C. Crystalline Penetration*:* Crystallizing capability of waterproofing material shall be evidenced by independent SEM (Scanning Electron Microscope) photographs. Crystal growth 12 inches (30 cm) from the surface of the coating shall be evident with 1000X magnification 1 year after application of the coating and exposure of the sample to normal weathering.

D. Permeability: Independent testing shall be performed according to U.S. Army Corps of Engineers CRD C48 “Permeability of Concrete”. Concrete samples shall have design strength of 2000 psi (14 MPa) and thickness of 2 inches (50 mm). Treated samples shall have two coats of crystalline waterproofing applied per manufacturer’s directions. Samples to be pressure tested to 175 psi (405 foot head of water) or 1.2 MPa (123.4 m head of water). Control samples shall leak and treated samples, after crystalline growth has occurred, shall exhibit no measurable leakage.

E. Permeability - Negative Side Application: Independent testing shall be performed according to EN 12390–8 or other recognized direct pressure test. Concrete samples shall have a design strength of 25 MPa (3600 psi). Treated samples shall be exposed to water pressure on the side opposite to the crystalline coating. Coated samples shall exhibit a greater than 90% reduction in depth of water penetration as compared to the control samples.

F. Chemical Resistance: Independent testing shall be performed according to ASTM C 267 “Chemical Resistance of Mortars” and ASTM C 39 “Compressive Strength of Cylindrical Concrete Specimens”. Concrete samples (treated and untreated) shall have design strength of 4000 psi (27.6 MPa). Treated samples shall have two coats of crystalline waterproofing applied per manufacturer’s directions. Untreated and treated specimens must be immersed for a minimum of 84 days in following chemical solutions: hydrochloric acid (3.5 pH), brake fluid, transformer oil, ethylene glycol, toluene, caustic soda. Treated specimens shall exhibit no detrimental effects after exposure, and shall have an average of 17% increase in compressive strength versus untreated control specimens.

G. Acid Resistance: Independent testing shall be performed to determine “Sulfuric Acid Resistance of Concrete Specimens”. Treated concrete samples shall be tested against untreated control samples. All samples shall be immersed in 5% sulfuric acid and weighed weekly for 10 weeks. Untreated samples shall exhibit at least 8 times more mass loss than treated samples.

H. Carbonation Resistance Testing: Independent testing shall be performed according to RILEM CPC-18 or other recognized accelerated carbonation test. Concrete samples shall have a 0.5 w/cm ratio or be approximately 30 MPa (4500 psi) in strength. Coated samples shall have crystalline coating applied one day after casting and all samples to be cured for 7 days prior to carbonation. After 91 days exposure to CO_2 the coated samples shall show a 35% or greater reduction in carbonation depth as compared to the control samples.

I. Potable Water Approval: Waterproof material shall have a current, valid approval certificate from NSF (NSF 61), DWI, or other recognized certification agency.

1.5 SUBMITTALS

A. General: Submit listed submittals in accordance with conditions of the Contract and with Division 1 Submittal Procedures Section.

B. Product Data: Submit product data, including manufacturer's specifications, installation instructions, and general recommendations for waterproofing applications.

C. Test Reports: Submit for acceptance, complete test reports from approved independent testing laboratories certifying that waterproofing system conforms to performance characteristics and testing requirements specified herein.

D. Manufacturer's Certification: Provide document signed by manufacturer or manufacturer's representative certifying that the materials to be installed comply with the requirements of this specification.

E. Manufacturer's Field Report: Provide copy of report from manufacturer's representative confirming that the surfaces to which waterproofing material is to be applied are in a condition suitable to receive same.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer shall be ISO 9001 registered, and shall have no less than 10 years experience in manufacturing the cementitious crystalline waterproofing materials for the required work. Manufacturer must be capable of providing field service representation during construction phase. Manufacturers who cannot provide ongoing field support or the performance test data specified herein will not be considered for the project.

B. Applicator: Waterproofing applicator shall be experienced in the installation of cementitious crystalline waterproofing materials as demonstrated by previous successful installations, and shall be approved by the manufacturer in writing.

C. Pre-Installation Conference: Prior to installation of waterproofing, conduct meeting with waterproofing applicator, Architect/Engineer, owner's representative, and waterproofing manufacturer's representative to verify and review the following:

1. Project requirements for waterproofing as set out in Contract Document.
2. Manufacturer's product data including application instructions.
3. Substrate conditions, and procedures for substrate preparation and waterproofing installation.

D. Technical Consultation: The waterproofing manufacturer's representative shall provide technical consultation on waterproofing application and provide on-site support as needed.

1.7 DELIVERY, STORAGE AND HANDLING

A. Ordering: Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.

B. Delivery: Deliver packaged waterproofing materials to project site in original undamaged containers, with manufacturer's labels and seals intact.

C. Storage: Store waterproofing materials in dry, enclosed location, at a minimum temperature of 45ºF (7ºC).

1.8 PROJECT CONDITIONS

A. Compliance: Comply with manufacturer's product data regarding condition of substrate to receive waterproofing, weather conditions before and during installation, and protection of the installed waterproofing system.

1.9 WARRANTY

A. Manufacturer's Warranty: Manufacturer shall provide standard product warranty executed by authorized company official.

B. Applicator's Warranty: Applicator shall warrant the waterproofing installation against defects caused by faulty workmanship or materials for a period of typically 2 years from Date of Substantial Completion. The warranty will cover the surfaces treated and will bind the applicator to repair, at his expense, any and all leaks through the treated surfaces which are not due to structural weaknesses or other causes beyond applicator's control such as fire, earthquake, tornado and hurricane. The warranty shall read as follows:

1. Warranty: The applicator warrants that, upon completion of the work, surfaces treated with cementitious crystalline waterproofing will be and will remain free from water leakage resulting from defective workmanship or materials for a period of 2 years from Date of Substantial Completion. In the event that water leakage occurs within the warranty period from such causes, the applicator shall, at his sole expense, repair, replace or otherwise correct such defective workmanship or materials. Applicator shall not be liable for consequential damages and applicator's liability shall be limited to repair, replacement or correcting of defective workmanship or materials. Applicator shall have no responsibility with respect to water leakage or other defects caused by structural failure or movement of the structure, or any other causes beyond Applicator's control.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Basis-of-Design: Subject to compliance with the requirements, provide product by the following:

1. Xypes Chemcial Corporation
2. Or approved euqal

B. Products: Crystalline waterproofing materials as follows:

1. Xypex Concentrate or approved equal
2. Xypex Modified or approved equal
3. Xypex Patch'n Plug or approved equal

C. Source Quality: Obtain all crystalline waterproofing products from a single manufacturer.

2.2 MIXES

A. General: Mix waterproofing material by volume with clean, potable water. Mix waterproofing material in quantities that can be applied within 20 to 30 minutes from time of mixing. As mixture thickens, stir frequently, but do not add additional water. Do not mix bonding agents or admixtures with crystalline waterproofing materials.

B. Brush Application Mix: Measure dry powder and place in mixing container. Measure water and mix into the dry powder with a paddle on a slow speed electric drill (250 RPM) or other type mixer which is acceptable to manufacturer. Mixing proportions shall be as follows:

Coverage Proportions (by volume)
1.5 lb./sq. yd. (0.8 kg/m^2) 5 powder to 2 water
2.0 lb./sq. yd. (1.0 kg/m^2) 3 powder to 1 water

C. Spray Application Mix: Mixing shall be same as specified for brush application except that mixture shall be thinner. Use following proportions as a guide only. Adjust proportions to match type of spray equipment and pressures used. Mixing proportions shall be as follows:

Coverage Proportions (by volume)
1.5 lb./sq. yd. (0.8 kg/m^2) 5 powder to 3 water

D. Dry-Pac Mix: Using a trowel, mix 1 part clean water with 6 parts Concentrate powder for 10 to 15 seconds. It is acceptable that lumps may be present in mixture. Mix only as much as can be applied in15 minutes.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Site Visit: Prior to waterproofing installation, arrange visit to project site with waterproofing manufacturer's representative. Representative shall inspect and certify that concrete surfaces are in acceptable condition to receive waterproofing treatment.

B. Verification of Substrates: Verify that concrete surfaces are sound and clean, and that form release agents and materials used to cure the concrete are fully removed.

C. Examination for Defects: Examine surfaces to be waterproofed for defects such as honeycombing, rock pockets, faulty construction joints and cracks. Such defects to be repaired in accordance to manufacturer's product data and 3.02 below.

3.2 PREPARATION

A. Surface Preparation: Smooth surfaces (e.g. where steel forms are used) or surfaces covered with form oil or other contaminants shall be cleaned, water-blasted, lightly sand-blasted, or acid etched as necessary to provide a clean absorbent surface. The surface must also have an open capillary system to provide "tooth and suction" for the Crystalline treatment. A minimum of CSP-3 per the International Concrete Repair Institute Concrete Surface Profile Chips or other equivalent standard is required. Surfaces to be acid-etched shall be should be saturated with water before application of the acid. After acid etching flush concrete thoroughly with clean water. Horizontal surfaces shall have a rough wood float or broom finish. Where a smooth trowel finish is required on horizontal surface, crystalline waterproofing material shall be applied by dry shake method at time of concrete finishing in accordance with manufacturer's product data.

B. Repair of Defects: Concrete defects shall be repaired in accordance with manufacturer's technical literature including relevant Method Statements. Procedures are generally as follows:

1. Cracks and Faulty Construction Joints:
    a. Chip out cracks, faulty construction joints and other defects to a depth of 1.5 inches (37 mm) and a width of one inch (25 mm). A “V” shaped slot is not acceptable. The slot may be saw cut instead of chipped but ensure that the slot is dovetailed or otherwise shaped such that there will be mechanical interlock of materials placed into the slot at a later stage.
    b. Clean slot of debris and dust. Soak area with water and remove excess surface water. Apply a slurry coat of Concentrate at the rate of 1.5 lb./sq. yd. (0.8 kg/m^2) to the slot.
    c. While slurry coat is still tacky, fill cavity with Dry-Pac. Compress tightly into cavity using pneumatic packer or block and hammer.
    d. This step may be omitted if the area filled with Dry-Pac will be subsequently covered with Crystalline coating. Wet Dry-Pac surface lightly with water, then apply a slurry coat of Concentrate at a coverage rate of 1.5 – 2 lb./sq. yd. (0.8 – 1 kg/m^2) over the repaired area to 6” (150 mm) on either side of slot.

2. Rock Pockets, Honeycombing or other defective concrete: All areas of poor concrete consolidation (honeycomb or rock pockets) shall be repaired.

C. Wetting Concrete: Manufacturer requires a saturated surface dry (SSD) substrate. Concrete surfaces must be thoroughly saturated with clean water prior to the application so as to aid the proper diffusion of the Xypex chemistry and to ensure the growth of the crystalline formation deep within the pores of the concrete. Remove excess water before the application such that there is no glistening water on the surface. If concrete dries out before application, it must be re-wetted.

3.3 APPLICATION

A. Construction Joints: In addition to specified waterstops, apply one coat of Concentrate slurry at a rate of 2 lb./sq. yd. (1 kg/m^2) to joint surfaces between concrete pours. Moisten surfaces prior to slurry application. Apply slurry and keep moist for 12 hours then allow slurry to set or dry. Where joint surfaces are not accessible prior to pouring new concrete, contact Manufacturer’s Technical Services Representative for assistance.

B. Sealing Strips: Where hydrostatic conditions exist, sealing strips shall also be applied at construction joints by filling grooves that are created along the joints. Dimensions of the grooves shall be 1 inch (25 mm) wide and 1.5 inches (37 mm) deep. If grooves are not pre-formed then chip grooves to those dimensions. Fill the groves as follows:

1. Apply slurry coat of Concentrate slurry to slot in accordance with manufacturer’s instructions or recommendations.
2. While slurry coat is still tacky, fill slot with Concentrate Dry-Pac.
3. Compact tightly using pneumatic packer or hammer and block.
4. This step may be omitted if the area filled with Dry-Pac will be subsequently covered with Crystalline coating. Wet Dry-Pac surface lightly with water, then apply a slurry coat of Concentrate at a coverage rate of 1.5 – 2 lb./sq. yd. (0.8 – 1 kg/m^2) over sealing strip and extending to 6” (150 mm) on either side.

C. Form Tie Holes: Form tie holes shall be waterproofed in accordance with manufacturer’s technical literature including relevant Method Statements. Procedures are generally as follows:

1. Prepare the tie hole to create a straight sided void with a profile of at least ICRI CSP-3. For through element ties holes such as those created by taper ties the prepared void is to be at least 5” (125 mm) deep. For cone ties the void is to be to the bottom of the cone.
2. Clean and profile the area to a 12 inch (300 mm) diameter around the tie hole to an ICRI CSP-3 profile.
3. For through-element tie holes create a solid plug of material at the bottom of the profiled hole using Patch’n Plug leaving at least 4” (100 mm) of empty tie hole from the top of the plug to the surface of the concrete element.
4. Apply a coat of Concentrate slurry at a rate of 1.5 lb./sq. yd. (0.8 kg/m^2) to the inside of the tie hole and to a 12” (300 mm) diameter area around the hole.
5. Fill and compact the tie hole with Concentrate Dry-Pac.
6. This step may be omitted if the area filled with Dry-Pac will be subsequently covered with Crystalline coating. Wet Dry-Pac surface lightly with water, then apply a slurry coat of Concentrate at a coverage rate of 1.5 - 2 lb./sq. yd. (0.8 - 1 kg/m^2) over the repaired area to a 12” (300 mm) diameter area around the filled void.

D. Surface Application: After repairs, surface preparation, treatment of construction joints and sealing strip placement have been completed in accordance with manufacturer’s product data and as specified herein, apply Crystalline treatment to concrete surfaces with semi-stiff bristle brush, push broom (for large horizontal surfaces), or suitable spray equipment. The Crystalline coating must be uniformly applied and should be just under 1/16” (1.25 mm) thick.

Application rates and locations shall be as indicated in the drawings and in accordance with manufacturer’s product data. When brushing, work slurry well into surface of the concrete, filling surface pores and hairline cracks. When spraying, hold nozzle close enough to ensure that slurry is forced into pores and hairline cracks.

1. First Coat (of one or two coat application): Apply Concentrate slurry coat to locations indicated on drawings in accordance with manufacturer’s product data.

2. Second Coat (of two coat application): Where indicated on drawings or as required by manufacturer’s product data, apply Modified or Concentrate slurry coat after the first coat of Concentrate has reached an initial set but while it is still “green” (less than 48 hours). Curing by misting the coating with water should be done between coats. Ensure first coat is in SSD condition before application of the second coat.

E. Sandwich (Topping) Application: When treated structural slabs are to receive a concrete or other topping, place the topping while waterproofing material is still “green” (less than 48 hours) but after it has reached an initial set. The preferred time frame is 12 to 24 hours after the installation of Crystalline coating. Curing by misting the coating with water should be done between application of coating and installation of concrete overlay. Ensure coating is in SSD condition prior to placement of concrete.

3.4 CURING

A. General: Begin curing as soon as Crystalline coating has hardened sufficiently so as not to be damaged by a fine spray. Cure crystalline treatment with a mist fog spray of clean water three times a day for 2 to 3 days. Wet burlap and some specialty curing blankets are also effective for curing during the prescribed period. In warm climates, more than three sprayings per day may be necessary to prevent excessive drying of coating.

B. Air Circulation: Do not lay plastic sheeting directly on the waterproofing coating as air contact is required for proper curing. If poor air circulation exists in treated areas, it may be necessary to provide fans or blown air to aid in curing of waterproofing treatment.

C. Holding Structures: For water holding structures such as swimming pools, reservoirs, water treatment tanks and wet wells, cure crystalline treatment for three days and then allow treatment to set for 12 days before filling. For structures holding hot or corrosive liquids, cure waterproofing treatment for three days and allow to set for 18 days before filling.

D. Protection: During the curing period, protect treated surfaces from damage by wind, sun, rain, puddling of water and temperatures below 36°F (2°C). If plastic sheeting is used for protection, it must be raised off of the waterproofing coating to allow sufficient air circulation.

3.5 INTERFACE WITH OTHER MATERIALS

A. Backfilling: Do not backfill for 36 hours after application. If backfill takes place within seven days after application, then backfill material shall be moist so as not to draw moisture from waterproof coating.

B. Paint, Epoxy or Similar Coatings: Do not proceed with surface preparation or application of paint or other coatings until waterproofing treatment has cured and set for a minimum of 21 days. Light abrasive blasting or washing the crystalline surface with a 3 - 5% acid solution followed by a rigorous rinse with clean water is recommended before applying the coating. Be sure to flush all acid off the surface. Alternately, removal of the Crystalline coating by high pressure washing or abrasive blasting following full curing is acceptable. Consult epoxy and paint manufacturer for additional coating instructions and restrictions.

C. Grout, Cement Parge Coat, Plaster or Stucco: It is recommended that any other cementitious system be applied over the crystalline coating after the crystalline has completely set but while it is still “green” (12 to 48 hours). The 12 to 24 hour window is considered ideal. Contact your manufacturer’s Technical Services Representative regarding surface preparation and other procedures for installations of other materials onto crystalline coatings older than 48 hours. Alternately, removal of the crystalline coating by high pressure washing or abrasive blasting following full 21 day curing is acceptable. Use of a polymer additive to help improve bond in the over coating mortar mix should be considered.

D. Responsibility to Ensure Compatibility: Manufacturer makes no representations or warranties regarding compatibility of crystalline treatment with coatings, plasters, stuccos, tiles or other surface-applied materials. It shall be the responsibility of the installer of the surface-applied material that is to be applied over the crystalline waterproofing treatment, to take whatever measures are necessary, including testing, to ensure acceptance by or adhesion to the waterproofing treatment.

3.6 FIELD QUALITY CONTROL

A. Observation: Do not conceal installed waterproofing system before it has been observed by Architect/Engineer, waterproofing manufacturer's representative and other designated entities.

B. Testing for Tanks and Foundation Works

1. Testing: Fill tanks or, for foundation works, shut off dewatering system as soon as practical so that the structure shall be exposed to its normal service conditions. Examine for leaks.
2. Monitoring:

a. Actively leaking cracks and joints shall be left to self-heal for as long as practical. Depending on job site and ambient conditions crack healing can be expected to take several days to weeks.
b. Any crack or joints that do not heal in the allowable time frame shall be repaired by the general contractor.
c. Moving cracks shall be repaired using polyurethane injection or other appropriate method.

3. Repair: Use manufacturer's repair procedures to seal any static crack or joint that does not self-heal. See Method Statements or contact manufacturer's Technical Services Representative for appropriate repair procedures.

3.7 CLEANING AND PROTECTION

A. Cleaning: Clean spillage and soiling from adjacent surfaces using appropriate cleaning agents and procedures.

B. Protection: Take measures to protect completed crystalline coating until the coating is hard enough to not be damaged. In normal conditions protect from pedestrian traffic for 3 days and vehicular traffic for 7 days. If coatings will be exposed to ongoing vehicular traffic or other abrasive environments consult manufacturer's Technical Services.

END OF SECTION 071616

SECTION 072100
THERMAL INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Board insulation at cavity wall construction, perimeter foundation wall, over roof deck, over roof sheathing, and exterior wall behind [_____] wall finish.

1.02 RELATED REQUIREMENTS

A. Section 053100 - Metal Deck: Requirements for installation of roof insulation.

B. Section 072500 - Weather Barriers: Separate air barrier and vapor retarder materials.

1.03 REFERENCE STANDARDS

A. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.

B. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

1.04 SUBMITTALS

A. Product Data: Provide data on product characteristics, performance criteria, and product limitations.

B. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

C. Manufacturer's Installation Instructions: Include information on special environmental conditions required for installation and installation techniques.

1.05 FIELD CONDITIONS

A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

PART 2 PRODUCTS

2.01 APPLICATIONS

A. Insulation at Perimeter of Foundation: Extruded polystyrene (XPS) board.

B. Insulation Inside Masonry Cavity Walls: Extruded polystyrene (XPS) board.

C. Insulation Over Roof Deck: Polyisocyanurate board.

2.02 FOAM BOARD INSULATION MATERIALS

A. Extruded Polystyrene (XPS) Board Insulation: Complies with ASTM C578 with either natural skin or cut cell surfaces.
   1. Flame Spread Index (FSI): Class A - 0 to 25, when tested in accordance with ASTM E84.
   2. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
   3. Type and Thermal Resistance, R-value: Type IV, 5.0 (0.88) per 1 inch thickness at 75 degrees F mean temperature.
   4. Board Edges: Square.
   5. Type and Water Absorption: Type IV, 0.3 percent by volume, maximum, by total immersion.
   6. Manufacturers:
      a. Dow Chemical Company; STYROFOAM CAVITYMATE Ultra.
      b. Kingspan Insulation LLC; GreenGuard XPS Type IV, 25 psi.
      c. Owens Corning Corporation; FOAMULAR Extruded Polystyrene (XPS) Insulation.

d. Or equal.

B. Composite Polyisocyanurate (ISO) Board Insulation Faced with Plywood: Rigid cellular foam, complying with ASTM C1289.
   1. Classifications:
      a. Type V: Faced with oriented strand board (OSB) or plywood on one major surface of core foam and glass fiber reinforced cellulosic felt or uncoated or coated polymer-bonded glass fiber mat facer on other major surface of core foam.
         1) Compressive Strength: 16 psi, minimum.
         2) Thermal Resistance, R-value: At 1-1/2 inch thick; 6.2 at 75 degrees F.
   2. Flame Spread Index (FSI): Class A - 0 to 25, when tested in accordance with ASTM E84.
   3. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
   4. Board Size: 48 inch by 96 inch.
   5. Plywood Thickness: 5/8 inch.
   6. Insulation Board Thickness: 5 1/2 inch.
   7. Board Edges: Square.
   8. Manufacturers:
      a. Atlas Roofing Corporation; ACFoam Nail Base Roof Insulation Panels.
      b. Hunter Panels; Xci Ply.
      c. Rmax; Nail Base 3.
      d. Or equal.

2.03 ACCESSORIES

A. Tape joints of rigid insulation in accordance with roofing and insulation manufacturers' instructions.

B. Insulation Fasteners: Appropriate for purpose intended and approved by roofing manufacturer.
   1. Length as required for thickness of insulation material and penetration of deck substrate.

C. Adhesive: Type recommended by insulation manufacturer for application.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation and adhesive.

B. Verify substrate surfaces are flat, free of honeycomb, fins, irregularities, or materials or substances that may impede adhesive bond.

3.02 BOARD INSTALLATION AT FOUNDATION PERIMETER

A. Install boards horizontally on foundation perimeter.
   1. Place boards to maximize adhesive contact.
   2. Install in running bond pattern.
   3. Butt edges and ends tightly to adjacent boards and to protrusions.

B. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

3.03 BOARD INSTALLATION AT CAVITY WALLS

A. Install boards to fit snugly between wall ties.
   1. Place membrane surface against adhesive.
   2. Place membrane surface facing out, and tape seal board joints.

B. Install boards horizontally on walls.
   1. Place boards to maximize adhesive contact.
   2. Install in running bond pattern.

3. Butt edges and ends tightly to adjacent boards and to protrusions.

C. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

D. Place 6 inch wide polyethylene sheet at perimeter of wall openings, from adhesive vapor retarder bed to door frames, and tape seal in place to ensure continuity of vapor retarder and air seal.

3.04 BOARD INSTALLATION OVER STEEP SLOPE ROOF SHEATHING OR ROOF STRUCTURE

A. Installation of board insutlation over steep slope roof structure is specified in Section 061000.

3.05 PROTECTION

A. Do not permit installed insulation to be damaged prior to its concealment.

END OF SECTION

SECTION 072500
WEATHER BARRIERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Water-Resistive Barrier: Under exterior wall cladding, over sheathing or other substrate; not air tight or vapor retardant.

B. Vapor Retarders: Materials to make exterior walls, joints between exterior walls and roof, and joints around frames of openings in exterior walls water vapor resistant and air tight.

1.02 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete: Vapor retarder under concrete slabs on grade.

1.03 DEFINITIONS

A. Weather Barrier: Assemblies that form either water-resistive barriers, air barriers, or vapor retarders.

B. Vapor Retarder: Air tight barrier made of material that is relatively water vapor impermeable, to the degree specified, with sealed seams and with sealed joints to adjacent surfaces.

1. Water Vapor Permeance: For purposes of conversion, 57.2 ng/(Pa s sq m) = 1 perm.

1.04 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency.

B. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.

C. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials.

1.05 SUBMITTALS

A. Product Data: Provide data on material characteristics.

B. ABAA Field Quality Control Submittals: Submit third-party reports of testing and inspection required by ABAA QAP.

C. Manufacturer's Installation Instructions: Indicate preparation.

D. ABAA Manufacturer Qualification: Submit documentation of current evaluation of proposed manufacturer and materials.

E. ABAA Installer Qualification: Submit documentation of current contractor accreditation and current installer certification; keep copies of each contractor accreditation and installer certification on site during and after installation, and present on-site documentation upon request.

1.06 QUALITY ASSURANCE

A. Air Barrier Association of America (ABAA) Quality Assurance Program (QAP); www.airbarrier.org/#sle:

1. Installer Qualification: Use accredited contractor, certified installers, evaluated materials, and third-party field quality control audit.
2. Manufacturer Qualification: Use evaluated materials from a single manufacturer regularly engaged in air barrier material manufacture, and use secondary materials approved in writing by primary material manufacturer.

1.07 MOCK-UP

A. Install air barrier, vapor retarder, and water-resistive barrier materials in mock-up specified in Section 042000 - Unit Masonry.

1.08 FIELD CONDITIONS

A. Maintain temperature and humidity recommended by the materials manufacturers before, during and after installation.

PART 2 PRODUCTS

2.01 WEATHER BARRIER ASSEMBLIES

A. Exterior Vapor Retarder:
   1. On outside surface of inside wythe of masonry cavity wall use vapor retarder coating.

2.02 VAPOR RETARDER MATERIALS (AIR BARRIER AND WATER-RESISTIVE)

A. Vapor Retarder Coating: Liquid applied, resilient, UV-resistant coating and associated joint treatment.
   1. Water Vapor Permeance: 1.0 perm, maximum, when tested in accordance with ASTM E96/E96M.
   2. VOC Content: Less than 50 g per L when tested in accordance with 40 CFR 59, Subpart D (EPA Method 24).
   3. Suitable for use on concrete, masonry, plywood and gypsum sheathing.
   4. Joint Preparation Treatment: Coating manufacturer's recommended method, either tape or reinforcing mesh saturated with coating material.
   5. Manufacturers:
      a. Carlisle Coatings and Waterproofing, Inc; Barriseal-R.
      b. Henry Company; Air-Bloc 16MR.
      c. W.R. Meadows, Inc; Air-Shield LM or Air-Shield LM (All Season).
      d. Or equal.
   6. Joint Filler: As recommended by coating manufacturer and suitable to the substrate.

2.03 ACCESSORIES

A. Sealants, Tapes, and Accessories for Sealing Weather Barrier and Sealing Weather Barrier to Adjacent Substrates: As specified or as recommended by weather barrier manufacturer.

B. Flexible Flashing: Self-adhesive sheet flashing complying with ASTM D1970/D1970M, except slip resistance requirement is waived if not installed on a roof.
   1. Composition: Butyl rubber sheet laminated to elasticized polyethylene sheet.
   2. Thickness: 70 mil, 0.070 inch, nominal.

C. Liquid Flashing: One part, fast curing, non-sag, elastomeric, gun grade, trowelable liquid flashing.
   1. Manufacturers:
      a. BASF Corporation; MasterSeal AWB 900.
      b. Master Wall Inc; SuperiorFlash.
      c. Pecora Corporation; XL-Flash.
      d. Or equal.

D. Thinners and Cleaners: As recommended by material manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces and conditions are ready to accept the work of this section.

3.02 PREPARATION

A. Remove projections, protruding fasteners, and loose or foreign matter that might interfere with proper installation.

3.03 INSTALLATION

A. Install materials in accordance with manufacturer's instructions.

B. Vapor Retarders: Install continuous air tight barrier over surfaces indicated, with sealed seams and with sealed joints to adjacent surfaces.

C. Apply sealants and adhesives within recommended application temperature ranges. Consult manufacturer if temperature is out of this range.

D. Coatings:
   1. Prepare substrate in manner recommended by coating manufacturer; treat joints in substrate and between dissimilar materials as recommended by manufacturer.
   2. Use flashing to seal to adjacent construction and to bridge joints.

E. Openings and Penetrations in Exterior Weather Barriers:
   1. Install flashing over sills, covering entire sill frame member, extending at least 5 inches onto weather barrier and at least 6 inches up jambs; mechanically fasten stretched edges.
   2. At openings to be filled with frames having nailing flanges, seal head and jamb flanges using a continuous bead of sealant compressed by flange and cover flanges with sealing tape at least 4 inches wide; do not seal sill flange.
   3. At openings to be filled with non-flanged frames, seal weather barrier to each side of opening framing, using flashing at least 9 inches wide, covering entire depth of framing.
   4. At head of openings, install flashing under weather barrier extending at least 2 inches beyond face of jambs; seal weather barrier to flashing.
   5. At interior face of openings, seal gap between window/door frame and rough framing, using joint sealant over backer rod.
   6. Service and Other Penetrations: Form flashing around penetrating item and seal to weather barrier surface.

3.04 FIELD QUALITY CONTROL

A. Do not cover installed weather barriers until required inspections have been completed.

B. Obtain approval of installation procedures by the weather barrier manufacturer based on a mock-up installed in place, prior to proceeding with remainder of installation.

C. Take digital photographs of each portion of the installation prior to covering up.

3.05 PROTECTION

A. Do not leave materials exposed to weather longer than recommended by manufacturer.

END OF SECTION

SECTION 072700 - AIR BARRIERS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The General Conditions, Supplementary Conditions, Instructions to Bidders, and Division 01-General Requirements shall be read in conjunction with and govern this section.

B. Read this Specification as a whole by all parties concerned. Each Section may contain more or less than the complete Work of any trade. The Contractor is solely responsible to make clear to the installing Subcontractor the extent of their Work.

1.2 SUMMARY

A. This Section includes requirements for supplying labor, materials, tools, and equipment to complete the Work as shown on the Drawings Architectural Division as specified herein including, but not limited to, the following:
   1. Adhesive/Primer
   2. Self-Adhered Air and Vapor Barrier
   3. Sealant

1.3 RELATED REQUIREMENTS

A. DIVISION 03 – Concrete Section

B. DIVISION 04 – Masonry Section 04 20 00 – Unit Masonry

C. DIVISION 06 – Wood, Plastics, and Composites Section 06 16 00 Sheathing

1.4 REFERENCES

A. American Architectural Manufacturers Association (AAMA):
   1. AMMA 2400-02, Standard Practice for Installation of Windows with a MountingFlange in Stud Frame Construction

B. American Society for Testing and Materials (ASTM):
   1. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials
   2. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials
   3. ASTM E1677, Standard Specification for Air Barrier (AB) Material or Systemfor Low-Rise Framed Building Walls
   4. ASTM D1970, Standard Specification for Self-Adhering Polymer ModifiedBituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection
   5. ASTM E2112, Standard Practice for Installation of Exterior Windows, Doors and Skylights
   6. ASTM E2178 - Standard Test Method for Air Permeance of Building Materials

C. National Fire and Protection Agency (NFPA):
   1. NFPA 285 - Standard Fire Test Method for Evaluation Of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components

D. US Green Building Council (USGBC), Leadership in Energy and Environmental Design (LEED):
   1. LEED Reference Guide, Version 4.0, and USGBC Project Calculation Spreadsheet. Web Site http://www.usgbc.org

1.5 ADMINISTRATIVE REQUIREMENTS

A. Pre-installation meetings:
   1. When required, and with prior notice, an Air Barrier Manufacturer representative will meet with the necessary parties at the jobsite to review and discuss project conditions as it relates to the integrity of the assembly.

1.6 SUBMITTALS

A. Provide the following requested information in accordance with Section 013300 Submittal Procedures.

B. Action Submittals:
   1. Product Data:
      a. Air Barrier Manufacturer's guide specification
      b. Air Barrier Manufacturer's technical data sheets
      c. Air Barrier Manufacturer's details
   2. Certificates:
      a. Product certification confirming assembly components are supplied and warranted by a single source Air Barrier Manufacturer
      b. Declaration Status: LBC Red List Free
   3. Tests and Evaluation Reports:
      a. NFPA 285 wall assembly compliance:
         1. Air Barrier Manufacturer statement that anticipated wall assembly complies with NFPA 285
   4. Sample warranty as specified

1.7 QUALITY ASSURANCE

A. Single Source Responsibility:
   1. Obtain air barrier, flashings, sealants, primers, mastics, and adhesives from a single Air Barrier Manufacturer regularly engaged in the manufacturing and supply of the specified products.
   2. Verify product compliance with federal, state, and local regulations.

B. Manufacturer Qualifications:
   1. Air Barrier Manufacturer must not issue warranties for terms longer than they have been manufacturing and supplying specified products for similar scope of Work.

C. Installer Qualifications:
   1. Perform Work in accordance with Air Barrier Manufacturer published literature and as specified in this section.
   2. Maintain one (1) copy of Air Barrier Manufacturer's instructions on site.
   3. Allow the Air Barrier Manufacturer representative site access during installation.
   4. Contact the Air Barrier Manufacturer a minimum of two weeks prior to scheduling a meeting.

1.8. DELIVERY, STORAGE, AND HANDLING

A. Delivery of Materials:
   1. Deliver materials to the jobsite in undamaged and clearly marked containers and/or wrapping indicating the name of the Air Barrier Manufacturer and product.

B. Storage of Materials:
   1. Store materials as recommended by the Air Barrier Manufacturer and conform to applicable safety regulatory agencies. Refer to all applicable data including, but not limited to, Safety Data Sheets, Product Data sheets, product labels, and specific instructions for personal

protection.
2. Keep solvents away from open flame or excessive heat.
3. Store rolled materials on end.

C. Handling:
1. Product requirements may vary. Refer to Air Barrier Manufacturer’s published literature.

1.9. SITE CONDITIONS

A. Environmental Requirements:
1. Do not perform Work during rain or inclement weather.
2. Do not perform Work on frost covered substrates or surfaces that are wet to touch.
3. Product requirements may vary. Refer to Air Barrier Manufacturer’s published literature.

B. Protection:
1. It is the responsibility of the installing Subcontractor to protect all surfaces not included in scope of Work from damage.
2. Protect top and backside of substrate walls against bulk water during and after application of air barrier.

C. Complete preparation Work prior to installing the air barrier assembly.

D. Ground electrical equipment during operations.

1.10. WARRANTY

A. Manufacturer's Single Source Warranty; choose from the following:
1. Provide Air Barrier Manufacturer’s standard 10 year material warranty.

PART 2 - PRODUCTS

2.01. MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product by the following:
1. Henry Company
a. Blueskin SA – Self Adhered Water Resistive Air Barrier
2. Or approved equal.

2.02. MATERIALS

A. Obtain air barrier and auxiliary materials as a single-source from the Air Barrier Manufacturer to ensure compatibility and compliance with the following requirements:
1. Minimum Application Temperature: 41°F (5 °C)
2. Service Temperature: -40 °F to 158 °F (-40 °C to 70 °C)
3. Water Vapor Permeance (ASTM E96 Method B): 0.08 Perms
4. Air Permeance (ASTM E2178): <0.0002 cfm/ft2 (0.0011 L/s.m.2)
5. Air leakage:
a. Assembly (ASTM E2357): Pass
b. Air Leakage Rate (CAN/ULC-S742) Classification A1
6. Nail Sealability (AAMA 711, ASTM D1970 modified): Pass
7. Fire Testing (NFPA 285): Compliant in various wall assemblies
8. Declaration Status: LBC Red List Free

B. Self-Adhered Water Resistive Air Barrier (Basis of Design):

1. Self-adhered water resistive air barrier membrane comprised of rubberized asphalt integrally laminated to a blue engineered thermoplastic film surface; having the following typical physical properties:
    a. Basis of design: Henry Blueskin SA Self-Adhered Water Resistive Air Barrier or approved equal.
    b. Color: Blue
    c. Thickness, nominal: 40 mils (1.0 mm)
    d. Minimum Application Temperature: 41°F (5 °C)
    e. Service Temperature: -40 °F to 158 °F (-40 °C to 70 °C)
    f. Water Vapor Permeance (ASTM E96 Method B): 0.08 Perms
    g. Air Permeance (ASTM E2178): <0.0002 cfm/ft2 (0.0011 L/s.m.2)
    h. Air leakage:
        1. Assembly (ASTM E2357): Pass
        2. Air Leakage Rate (CAN/ULC-S742) Classification A1
    i. Nail Sealability (AAMA 711, ASTM D1970 modified): Pass
    j. Fire Testing (NFPA 285): Compliant in various wall assemblies
    k. Declaration Status: LBC Red List Free

C. Auxiliary Materials:
1. Adhesives/Primers:
    a. Standard VOC adhesive:
        1. Synthetic rubber based quick setting adhesive; having the following typical physical properties:
            a. Basis of design: Henry Blueskin Adhesive or approved equal.
            b. Color: Blue
    b. Quick setting primers:
        1. Synthetic rubber based quick setting adhesive with low VOC content; having the following typical physical properties:
            a. Basis of design: Henry Blueskin LVC Adhesive or approved equal.
            b. Color: Blue
        2. Synthetic rubber based quick setting spray primer with low VOC content; having the following typical physical properties:
            a. Basis of design: Henry Blueskin LVC Spray Primer or approved equal.
            b. Color: Blue
        3. Polymer emulsion water based quick setting primer with low VOC content; having the following typical physical properties:
            a. Basis of design: Henry Aquatac™ Primer or approved equal.
            b. Color: Aqua

2. Flashings, choose from the following:
    a. Liquid-applied flashing:
        1. Moisture-cure one component elastomeric liquid applied flashing using an STPE (Silyl-Terminated Polyether) polymer, having the following typical properties:
            a. Basis of Design Product: Henry Air-Bloc LF® Liquid Applied Flashing or approved equal.
            b. Color: Blue
    b. Self-Adhered Flashing:
        1. Self-adhered water resistive air barrier membrane comprised of rubberized asphalt and integrally laminated to a blue engineered thermoplastic film surface; having the following typical physical properties:
            a. Basis of design: Henry Blueskin SA Self-Adhered Water Resistive Air Barrier or approved equal.
            b. Color: Blue
        2. UV resistant self-adhered water resistive air barrier membrane comprised of rubberized asphalt and dual-layers of high strength polyolefin with a surface layer metallic aluminum film; having the following typical physical properties:

a. Basis of design: Henry Blueskin Metal Clad Self-Adhered Water Resistive Air Barrier or approved equal.
b. Color: Aluminum foil laminate

3. Sealants:
   a. Moisture cure, medium modulus polymer modified sealing compound, having the following typical properties:
      1. Basis of Design Product: Henry 925 BES Sealant or approved equal.
      2. Complies with Fed. Spec. TT-S-00230C, Type II, Class A.
      3. Complies with ASTM C920, Type S, Grade NS, Class 35.

PART 3 - EXECUTION

2.01. EXAMINATION

A. It is the installing Subcontractor's responsibility to verify the substrate is in accordance with Air Barrier Manufacturer requirements and as specified in this Section prior to installation of air barrier. Commencement of the Work or any parts thereof, indicates installer acceptance of the substrate.
   1. Acceptable substrates include exterior-grade gypsum sheathing, plywood, OSB, pressure treated lumber, fire-treated lumber, precast or cast-in-place concrete, CMU, primed steel, aluminum mill finish, anodized aluminum and galvanized metal.
   2. Verify surfaces are sound, clean and free of frost, oil, grease, dirt, excess mortar or other contaminants.
   3. Substrate must be continuous and secure.
   4. Sheathing fasteners must be installed into solid backing and set flush with sheathing.
   5. Masonry joints must be struck flush.
   6. Concrete surfaces shall be smooth and without large voids, spalled areas or sharp protrusions.
   7. Tie holes/voids in poured concrete to be flush and smooth shall be filled. Allow new concrete to cure a minimum of fourteen (14) days after forms are removed.
   8. Top and backside of substrate walls must be protected against bulk water during and after application of air barrier.
   9. Curing compounds must be resin based without oil, wax or pigments. Substrates must be free of form release agents.
   10. Do not install air barrier over substrates that are wet to touch.

B. Notify Contractor in writing of any conditions that are not acceptable.

C. Do not apply air barrier assembly components until substrate and environmental conditions are in accordance with Air Barrier Manufacturer's published literature.

3.02. PREPARATION

A. Verify surfaces are in accordance with the product specific technical data sheet and as stated in this specification.
B. Protection:
   1. Protect top and backside of substrate walls against bulk water during and after application of air barrier.

3.03. INSTALLATION

A. Environmental Requirements:
   1. Do not perform Work during rain or inclement weather.

2. Do not perform Work on frost covered or wet substrates; can be applied to damp surfaces.
3. Do not perform Work when ambient (air) and substrate temperatures are below 20 degrees F (-7 degrees C).

B. Refer to Air Barrier Manufacturer detail drawings for installation procedures including, but not limited to, the following:
1. Changes in substrate
2. Control joints
3. Crack treatment
4. Inside corners
5. Outside corners
6. Penetrations
7. Rough openings
8. Sheathing Joints

C. Moving Joints:
1. Contact Air Barrier Manufacturer.

D. Contact Air Barrier Manufacturer to coordinate transition of air barrier to adjacent areas including, but not limited to, the following:
1. Roofing
2. Waterproofing
3. Fastener penetrations

E. Adhesive/Primer:
1. Apply adhesive/primer at area of anticipated self-adhered membrane application.
   a. Refer to the product specific technical data sheet for installation instructions and application rates.
2. Allow adhesive/primer to fully cure prior to self-adhered membrane application.
   a. Cured adhesive/primer must be covered with self-adhered membrane in the same working day. Primed surfaces that are not covered within the same day, must be re-primed.

F. Primary Air Barrier:
1. Install self-adhered membrane, in vertical or lateral oriented courses, in a shingle fashion.
2. Overlap adjacent membranes two (2) inches.
3. Peel release paper from leading edge of self-adhered membrane, and align top to verify positioning prior to complete release paper removal and membrane placement.
4. Align and press self-adhered membrane into place from the center of the roll to the outside edges, eliminating entrapped air bubbles and wrinkles.
5. Roll self-adhered membrane and laps with countertop roller immediately after application to obtain thorough adhesion.
6. Seal end of day and permanently exposed reverse laps with building envelope sealant.

3.04. FIELD QUALITY CONTROL

A. Final Observation and Verification:
1. General Contractor, Architect and Air Barrier Manufacturer to complete final observation of air barrier assembly as required by warranty.

3.05. CLEANING

A. As the Work proceeds, and upon completion, promptly clean up and remove from the premises all rubbish and surplus materials resulting from the foregoing Work.

B. Clean soiled surfaces, spatters, and damage to adjacent areas caused by Work of this Section.

C. Check area to ensure cleanliness and remove debris, equipment, and excess material from the site.

END OF SECTION 072700

SECTION 074113 – METAL SOFFITS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal soffit panels.

1.2 PERFORMANCE REQUIREMENTS

A. Hydrostatic-Head Resistance: No water penetration when tested according to ASTM E 2140.

1.3 SUBMITTALS

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

B. Shop Drawings: Show fabrication and installation layouts of soffit panels; details of edge conditions, side-seam joints, panel profiles, corners, anchorages, trim, and accessories; and special details. Distinguish between factory- and field-assembled work.

C. Samples: For each type of exposed finish required.

D. Delegated-Design Submittal: For soffit panel assembly indicated to comply with performance requirements and design criteria, including analysis data and calculations signed and sealed by the qualified professional engineer responsible for their preparation.

E. Coordination Drawings: Plans, drawn to scale, based on input from installers of the items involved.

F. Manufacturer Certificates: Signed by manufacturer certifying that soffit panels comply with energy performance requirements specified in "Performance Requirements" Article.

1. Submit evidence of meeting performance requirements.

G. Product test reports.

H. Field quality-control reports.

I. Maintenance data.

J.

K. Warranties: Samples of special warranties.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

B. Fire-Resistance Ratings: Where indicated, provide soffit panels identical to those of assemblies tested for fire resistance per ASTM E 119 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Combustion Characteristics: ASTM E 136.

C. Pre-installation Conference: Conduct conference at Project site.

1.5 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace soffit panel assemblies that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two (2) 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 soffit panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Finish Warranty Period: Thirty (30) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PANEL MATERIALS

A. Aluminum Sheet: Coil-coated sheet, ASTM B 209, alloy as standard with manufacturer, with temper as required to suit forming operations and structural performance required.

1. Surface: Smooth, flat finish.

2. Concealed Finish: White or light-colored acrylic or polyester backer finish.

B. Panel Sealants:

1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing; 1/2 inch wide and 1/8 inch thick.
2. Joint Sealant: ASTM C 920; as recommended in writing by soffit panel manufacturer.
3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311.

2.2 MISCELLANEOUS METAL FRAMING

A. Miscellaneous Metal Framing, General: ASTM C 645, cold-formed metallic-coated steel sheet, ASTM A 653/A 653M, G40 hot-dip galvanized or coating with equivalent corrosion resistance unless otherwise indicated.

B. Hat-Shaped, Rigid Furring Channels:

1. Nominal Thickness: As required to meet performance requirements.
2. Depth: 7/8 inch minimum.

2.3 MISCELLANEOUS MATERIALS

A. Panel Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide exposed fasteners with heads matching color of soffit panels by means of plastic caps or factory-applied coating. Provide EPDM, PVC, or neoprene sealing washers.

2.4 METAL SOFFIT PANELS

A. General: Provide factory-formed metal soffit panels designed to be installed by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners in side laps. Include accessories required for weathertight installation.

B. Metal Soffit Panels: Match profile and material of soffit panels.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product by the following:

    a. Petersen Aluminum Corporation.
        1) Model PAC-750
    b. Or approved equal.

2. Profile: V groove

3. Material: Aluminum sheet, 0.032 inch thick.

    a. Color: As selected by Architect from manufacturer's full range.

4. Panel Coverage: 12 inches.
5. Panel Height: 0.50 inch.
6. Sealant: Factory applied within interlocking joint.

2.5 ACCESSORIES

A. Soffit Panel Accessories: Matching “J” trim.

2.6 FABRICATION

A. Fabricate and finish soffit panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes and as necessary to fulfill indicated performance requirements. Comply with indicated profiles and with dimensional and structural requirements.

B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

C. Sheet Metal Accessories: Fabricate flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of item indicated.

PART 3 - EXECUTION

3.1 PREPARATION

A. Miscellaneous Framing: Install furring, and other miscellaneous soffit panel support members and anchorage according to soffit panel manufacturer's written instructions.

3.2 METAL SOFFIT PANEL INSTALLATION

A. Metal Soffit Panels: Provide metal soffit panels full width of soffits. Install panels perpendicular to support framing.

1. Flash and seal panels with weather closures where metal soffit panels meet walls and at perimeter of all openings.

3.3 ACCESSORY INSTALLATION

A. General: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal soffit panel assembly including trim, and similar items.

3.4 CLEANING

A. Remove temporary protective coverings and strippable films, if any, as soffit panels are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of soffit panel installation, clean finished surfaces as recommended by soffit panel manufacturer. Maintain in a clean condition during construction.

END OF SECTION 074113

SECTION 075700
COATED FOAMED ROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Retrofit of existing coated foamed roofing.

B. Foamed-in-place insulation.

C. Protective overcoat.

1.02 RELATED REQUIREMENTS

A. Section 053100 - Steel Decking.

B. Section 061000 - Rough Carpentry: Wood nailers and curbs.

C. Section 061000 - Rough Carpentry: Wood cant strips.

D. Section 077100 - Roof Specialties.

1.03 REFERENCE STANDARDS

A. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.

B. ASTM D1621 - Standard Test Method for Compressive Properties Of Rigid Cellular Plastics.

C. ASTM D1622 - Standard Test Method for Apparent Density of Rigid Cellular Plastics.

D. ASTM D1622/D1622M - Standard Test Method for Apparent Density of Rigid Cellular Plastics.

E. ASTM D1623 - Standard Test Method for Tensile And Tensile Adhesion Properties of Rigid Cellular Plastics.

F. ASTM D2842 - Standard Test Method for Water Absorption of Rigid Cellular Plastics.

G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

H. ASTM E108 - Standard Test Methods for Fire Tests of Roof Coverings.

I. FM (AG) - FM Approval Guide.

J. FM 4470 - Approval Standard for Single-Ply, Polymer-Modified Bitumen Sheet, Built-Up Roof (BUR) and Liquid Applied Roof Assemblies for use in Class 1 and Noncombustible Roof Deck Construction.

K. ITS (DIR) - Directory of Listed Products.

L. UL (DIR) - Online Certifications Directory.

M. UL 790 - Standard for Standard Test Methods for Fire Tests of Roof Coverings.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week before starting work of this section.
   1. Review installation procedures and coordination required with related work.

B. Review of Existing Warranty: See details of exsiting warranty as listed in the FIELD CONDITIONS article as herein specified.

1.05 SUBMITTALS

A. Product Data: Provide data on foam insulation and overcoat, physical and chemical properties, preparation of substrate required, product limitations, and cautionary requirements.

B. Samples: Submit two samples, 8 by 8 inch in size, illustrating illustrating color and texture.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

D. Test Reports: Provide test reports indicating that specified requirements are achieved by the products being supplied.

E. Manufacturer's Instructions: Indicate installation requirements and procedures.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

B. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience, and approved by manufacturer.

C. Work of this section to comply with manufacturer's instructions.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original containers, dry and undamaged, with seals and labels intact.

B. Store foamed roofing products in ambient temperatures between 40 degrees F and 80 degrees F.

C. Ensure storage and staging of materials does not exceed static and dynamic load-bearing capacities of roof decking.

1.08 FIELD CONDITIONS

A. Do not install foam insulation during the following conditions:
   1. When ambient temperature is below 50 degrees F or above 110 degrees F.
   2. When relative humidity is above 80 percent.
   3. When wind velocity is above 10 mph.

B. Do not install overcoat during the following conditions:
   1. When ambient temperature is below 40 degrees F.
   2. When wind velocity is above 10 mph.
   3. During periods of precipitation.

C. Schedule applications so that no partially completed sections of roof are left exposed at end of workday.

D. Existing Warranty: The existing coated foamed roof systems have existing warranties. This exsitng roof was provided by Bayer MaterialScience, LLC
   1. East Dover Elementary School - Warranty number 15S-2433. The successor company is Carlisle Roof Foam and Coating (CRFC) Roofing System.
   2. Silver Bay Elementary School - Warranty number 97S-2436. The successor company is Carlisle Roof Foam and Coating (CRFC) Roofing System.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Coated Foamed Roofing:
   1. Carlisle Roof Foam and Coating (CRFC) Roofing System; PremiR+.
   2. Substitutions: Not permitted.

2.02 REGULATORY REQUIREMENTS

A. Comply with applicable building codes for fire resistance rating of roofing system.

B. UL Fire Rated Assembly: Provide products listed and labeled with UL (DIR) and in compliance with Class A fire test rating of roof coverings in compliance with UL 790 or ASTM E108.

C. FM Roof Assembly: Provide products listed and labeled with FM (AG), UL (DIR) or ITS (DIR) having Class 1 roof assembly construction and roof wind rating of 60 in compliance with FM 4470.

203 FOAM INSULATION MATERIALS

A. Foam Insulation: Sprayed polyurethane foam (SPF) type, closed cell; foamed on-site, using blowing agent of water or non-ozone-depleting gas.
   1. Density: 2.5 lbs/cu ft, nominal, in accordance with ASTM D1622.
   2. Tensile Strength: 65 psi, minimum, in accordance with ASTM D1623.
   3. Compressive Strength: 45 psi, minimum, in accordance with ASTM D1621.
   4. Thermal Resistance: R-value of 6.4, minimum, per 1 inch thickness at 75 degrees F mean temperature when tested in accordance with ASTM C518.
   5. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/450, maximum, at 4 inch thick when tested in accordance with ASTM E84.
   6. Water Absorption: Less than 2 percent by volume, maximum, when tested in accordance with ASTM D2842.
   7. Closed Cell Content: At least 90 percent.

B. Substrate Primer: As required by insulation manufacturer.

204 HIGH DENSITY INSULATION/COVER BOARD

A. Cover Board – Glass-mat faced gypsum core cover board that incorporates glass-mat facings on the top and bottom side.
   1. Size: 1/2 inch and 4 feet by 4 feet or 4 feet x 8 feet size boards.
   2. Manufactures:
      a. Georgia-Pacific; DensDeck Gypsum Roof Boards.
      b. Substitutions: Not permitted

B. Rigid Insulation: Rigid insulation panel composed of a high-density (109 psi max), closed-cell polyisocyanurate foam core laminated to coatedglass fiber-mat facer for use as a cover board over wood substrates to comply with local fire codes or to cover surface irregularity resulting from tear-off. Achieves a UL 790 Class A combustible deck assembly rating without the need for fire-rated slip sheets or thermal barrier products.
   1. Size: 2.3 inch thick 4’ x 8’ panel with an R-value of 14.
   2. Manufacturers:
      a. Carlisle Syntec; SecurShield HD FR.
      b. Substitutions: Not permitted

205 OVERCOAT MATERIALS

A. Overcoat: Silicone base and cover coats, color as selected.
   1. Manufacurer:
      a. Carlisle Roof Foam and Coating (CRFC) Roofing System; SeamlesSEAL Ultra Silicone.
      b. Substitutions: Not permitted.

B. Granule Cover: Ceramic coated roofing granules, 11 screen size, color as selected.

206 ACCESSORIES

A. Sheathing Joint Tape: Paper type.

B. Cant Strips: Wood, pressure preservative treated. See Section 061000.

C. Tapered edge sump at roof drains.

D. Fasteners: Fasteners the meet requirements specified by FM (AG).

E. Sealant: Type required or recommended by roofing manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Schedule work after penetrations through roof are complete and perimeter conditions are ready to receive roof system.

B. Verify that deck surface is smooth and dry and deck joints do not exceed 1/16 inch.

3.02 PREPARATION - TO EXISTING ROOF SYSTEM

A. Prepare existing roofing surface by repairing or replacing existing cover board as required.

B. Use materials or substances that will not interfere with total adhesion of foam insulation.

C. Mask off adjacent surfaces that are not scheduled to receive foam.

3.03 INSTALLATION - INSULATION

A. Apply primer and foam insulation in accordance with manufacturer's instructions.

B. Place insulation to 2.3 inch thickness; plus 1/4 inch, minus zero.

C. Place insulation to a thickness to achieve an average thermal resistance R-value of 14.

D. Place cover board over insulation board. Fasten through rigid insulation into metal deck with recommended fasteners at spaceing required by FM (AG).

E. Extend foam 2 inches up vertical intersections, fillet insulation and feather out. Form a cant of foam at perpendicular interruptions.

F. Apply foam to slope to drains minimum 1/8 inch per foot.

G. Surface Flatness: 1/4 inch per 10 feet measured with a straight edge.

H. Apply foam to permit first coat of overcoat application on same day. If this time limit is exceeded, prepare foam skin surface in accordance with manufacturer's instructions.

I. Develop finish skin surface to smooth and unbroken "rough orange peel" texture. Uneven surfaces are not acceptable.

J. As the work of this section proceeds, coordinate the work with installing associated metal flashings specified in Section 077100.

3.04 INSTALLATION - FLASHINGS AND ACCESSORIES

A. Coordinate installation of roof drains and related flashings.

B. Seal flashings and flanges of items penetrating membrane.

3.05 INSTALLATION - OVERCOAT

A. Install overcoat in accordance with manufacturer's instructions.

B. Prepare and seal penetrations through roof with sealant.

C. Apply overcoat in two coats with dissimilar colors for each coat to a total dry film thickness of 25 mils minimum.

D. Extend overcoat to cover foam insulation and extend 2 inches above foam termination on protrusions to a self-terminating, watertight seal.

E. Apply roof surface granules at a rate of 30 to 40 pounds per 100 square feet.

3.06 FIELD QUALITY CONTROL

A. Testing will include verification of insulation properties, thickness, coverage of overcoat, number of coats, and color.

3.07 CLEANING

A. Remove excess insulation or overcoat from finished surfaces.

B. In areas where finished surfaces are soiled by work of this section, consult manufacturer of surfaces for cleaning advice and comply with their documented instructions.

C. Repair or replace defaced or disfigured finishes caused by work of this section.

3.08 PROTECTION

A. Ensure roof surface is free of traffic for minimum three days after overcoat application.

END OF SECTION

SECTION 077100 - ROOF SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Copings.

1.2 PERFORMANCE REQUIREMENTS

A. FM Approvals' Listing: Manufacture and install copings, roof-edge flashings that are listed in FM Approvals' "RoofNav" and approved for windstorm classification, Class 1-105. Identify materials with FM Approvals' markings.

B. SPRI Wind Design Standard: Manufacture and install copings and roof-edge flashings tested according to SPRI ES-1 and capable of resisting the following design pressures:

1. Design Pressure: 104.5 psf.

1.3 SUBMITTALS

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

B. Shop Drawings: For roof specialties. Include plans, elevations, expansion-joint locations, keyed details, and attachments to other work. Distinguish between plant- and field-assembled work.

C. Samples: For each exposed product and for each color and texture specified.

D. Product test reports.

E. Maintenance data.

F. Warranty: Sample of special warranty.

1.4 QUALITY ASSURANCE

A. Preinstallation Conference: Conduct conference at Project site.

1.5 WARRANTY

A. Special Warranty on Painted Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace roof specialties that show evidence of deterioration of factory-applied finishes within 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 EXPOSED METALS

A. Aluminum Sheet: ASTM B 209 (ASTM B 209M), 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.

a. High performance multicoat-cured 70% Kynar 500 Polyvinylidene Fluoride (PVDF) Fluropon coating per manufacturer color samples.

3. Color Anodic Finish, Coil Coated: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.

2.2 CONCEALED METALS

A. Aluminum Sheet (**for PLC-4**): ASTM B 209 (ASTM B 209M), alloy and temper recommended by manufacturer for type of use and structural performance indicated, mill finished.

2.3 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.

C. Elastomeric Sealant: ASTM C 920, elastomeric polymer sealant of type, grade, class, and use classifications required by roofing-specialty manufacturer for each application.

2.4 COPINGS

A. Copings: Manufactured coping system consisting of formed-metal coping cap in section lengths not exceeding 10 feet, 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 product by the following:

a. Perimeter Systems; a division of Southern Aluminum Finishing Company, Inc.
b. Or approved equal.

2. Coping-Cap Material: Formed aluminum:

a. Model: **PLC-4** (Double Slope) or approved equal.
b. Thickness: .050 inch
c. Color: As selected by Architect from manufacturer's full range

3. Corners: Factory mitered and continuously welded.
4. Coping-Cap Attachment Method: Face leg hooked to continuous cleat with back leg fastener exposed, 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.
7. Coping Accessories: Transition Miters and Endcaps.

PART 3 - EXECUTION

3.1 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. Install underlayment with adhesive for temporary anchorage. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches. Roll laps of self-adhering sheet underlayment with roller; cover within 14 days.

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 felt underlayment and cover with a slip sheet.

C. Expansion Provisions: Allow for thermal expansion of exposed roof specialties.

1. Space movement joints at a maximum of 10 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 wood blocking or sheathing not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.

E. Seal joints with 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.

G. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets to be soldered to a width of 1-1/2 inches except reduce pre-tinning where pre-tinned surface would show in completed Work. Tin edges of uncoated copper sheets using solder for copper. Do not use torches for soldering. Heat surfaces to receive solder and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.

3.2 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.

3.3 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 and sealants.

C. Remove temporary protective coverings and strippable films as roof specialties are installed.

END OF SECTION 077100

SECTION 079100
PREFORMED JOINT SEALS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Preformed strip seals.

1.02 RELATED REQUIREMENTS

A. Section 079200 - Joint Sealants: Liquid and mastic joint sealants and their backing materials.

1.03 REFERENCE STANDARDS

1.04 SUBMITTALS

A. Product Data: Manufacturer's technical data sheets for each product, including chemical composition, movement capability, color availability, limitations on application, and installation instructions.

B. Samples for Color Selection: 4 inch long pieces of each color available; at least 2 samples of each color.

C. Installer's Qualification Statement.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing work of the type specified in this section with at least three years of documented experience.

1.06 WARRANTY

A. Correct defective work within a two year period after Date of Substantial Completion.

B. Warranty: Include coverage for installed sealers that fail to achieve watertight seal or exhibit loss of adhesion or cohesion.

PART 2 PRODUCTS

2.01 PREFORMED STRIP SEALS

A. Preformed Strip Seal: Factory formed profile for adhered application to face of joint substrate.
   1. Measure size of existing joints before selecting seal width.
   2. Provide compatible materials for application as recommended by manufacturer.
   3. Applications:
      a. Exterior wall expansion joints.
   4. Manufacturers:
      a. EMSEAL Joint Systems, Ltd; Colorseal.
      b. Willseal LLC; Willseal 600.
      c. Or equal.

2.02 ACCESSORIES

A. Adhesive: As recommended by seal manufacturer.

B. Masking Tape: Self-adhesive, nonabsorbent, non-staining, removable without adhesive residue, and compatible with surfaces adjacent to joints and strip seal.

C. Substrate Cleaner: Non-corrosive, non-staining type recommended by seal manufacturer; compatible with joint forming materials.

D. Primer: Type recommended by seal manufacturer to suit application; non-staining.

E. Backing Tape: Self-adhesive polyethylene tape with surface that seal will not adhere to.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that joints are ready to receive this work.

B. Measure joint dimensions and verify that seal products are of the correct size to properly seal the joints.

3.02 PREPARATION

A. Properly prepare construction components adjacent to the work of this section to prevent damage and disfigurement due to this work.

3.03 INSTALLATION

A. Install in accordance with manufacturer's written instructions.

B. Preformed Strip Seals:

1. Install when ambient temperature is within recommended application temperature range of adhesive, and consult with manufacturer before installing outside this temperature range.
2. Prepare joints and install seals in accordance with manufacturer's written recommendations.
3. Remove loose materials and foreign matter that could impair adhesion.
4. When installing over existing non-functioning sealant, remove portions of existing installation that protrude beyond surface; install backing tape on surface of existing sealant installation to prevent adhesion of strip seal.

3.04 CLEANING

A. Clean adjacent soiled surfaces.

3.05 PROTECTION

A. Protect joints from damage until adhesives have properly cured.

END OF SECTION

SECTION 079113 – BACKER RODS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Application of closed-cell foam backer rod.

1.2 RELATED SECTIONS

A. Section 040120 – Maintenance of Unit Masonry

1.3 REFERENCES

A. ASTM C 1330 - Standard Specification for Cylindrical Sealant Backing.

1.4 SUBMITTALS

A. Comply with Section 013300 - Submittal Procedures.

B. Submit manufacturer's product data and application instructions.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

B. Store materials in a clean, dry area in accordance with manufacturer's instructions.

C. Protect materials during handling and application to prevent damage.

PART 2 PRODUCTS

2.1 MANUFACTURER

A. Basis-of-Design: Subject to compliance with requirements, provide product by the following:

1. W. R. MEADOWS, INC.
    a. Product: Kool-Rod Backer Rod
2. Or Approved equal.

2.2 MATERIALS

A. Performance Based Specification: backer rod joint filler shall be flexible, lightweight, non-staining, polyethylene, and closed cell. It shall be a chemical-resistant, ultraviolet stable, non-absorbent, low density, compressible foam.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine areas to receive backer rod. Notify architect if areas are not acceptable. Do not begin application until unacceptable conditions have been corrected.

3.02 APPLICATION

A. Install backer rod in accordance with manufacturer's instructions.

B. Ensure joint or opening is clean, dry and free of obstructions.

C. Select the proper backer rod diameter and cut to length or use directly from the spool.

D. Uniformly install backer rod with a blunt instrument or roller at a level recommended by the sealant manufacturer, specifier or architect.

E. Seal the concrete with joint sealant.

3.3 PROTECTION

A. Protect pavement joint sealant from traffic until fully cured.

END OF SECTION 079113

SECTION 079200
JOINT SEALANTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nonsag gunnable joint sealants.

B. Joint backings and accessories.

1.02 RELATED REQUIREMENTS

A. Section 079100 - Preformed Joint Seals: Precompressed foam, gaskets, and strip seals.

B. Section 087100 - Door Hardware: Setting exterior door thresholds in sealant.

C. Section 088000 - Glazing: Glazing sealants and accessories.

1.03 REFERENCE STANDARDS

A. ASTM C661 - Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer.

B. ASTM C834 - Standard Specification for Latex Sealants.

C. ASTM C920 - Standard Specification for Elastomeric Joint Sealants.

D. ASTM C1193 - Standard Guide for Use of Joint Sealants.

E. ASTM C1330 - Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants.

F. ASTM C1521 - Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints.

G. SCAQMD 1168 - Adhesive and Sealant Applications.

1.04 SUBMITTALS

A. Product Data for Sealants: Submit manufacturer's technical data sheets for each product to be used, that includes the following.
   1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
   2. List of backing materials approved for use with the specific product.
   3. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
   4. Substrates the product should not be used on.
   5. Substrates for which use of primer is required.
   6. Installation instructions, including precautions, limitations, and recommended backing materials and tools.
   7. Certification by manufacturer indicating that product complies with specification requirements.

B. Product Data for Accessory Products: Submit manufacturer's technical data sheet for each product to be used, including physical characteristics, installation instructions, and recommended tools.

C. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection.

D. Samples for Verification: Where custom sealant color is specified, obtain directions from Architect and submit at least two physical samples for verification of color of each required sealant.

E. Preinstallation Field Adhesion Test Plan: Submit at least two weeks prior to start of installation.

F. Field Quality Control Plan: Submit at least two weeks prior to start of installation.

G. Preinstallation Field Adhesion Test Reports: Submit filled out Preinstallation Field Adhesion Test Reports log within 10 days after completion of tests; include bagged test samples and photographic records.

H. Installation Log: Submit filled out log for each length or instance of sealant installed.

I. Field Quality Control Log: Submit filled out log for each length or instance of sealant installed, within 10 days after completion of inspections/tests; include bagged test samples and photographic records, if any.

1.05 QUALITY ASSURANCE

A. Maintain one copy of each referenced document covering installation requirements on site.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Installer Qualifications: Company specializing in performing the work of this section and with at least three years of documented experience.

D. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

E. Preinstallation Field Adhesion Test Plan: Include destructive field adhesion testing of one sample of each combination of sealant type and substrate, except interior acrylic latex sealants, and include the following for each tested sample.
   1. Identification of testing agency.
   2. Preinstallation Field Adhesion Test Log Form: Include the following data fields, with known information filled out.
      a. Substrate; if more than one type of substrate is involved in a single joint, provide two entries on form, for testing each sealant substrate side separately.
      b. Test date.
      c. Location on project.
      d. Sealant used.
      e. Stated movement capability of sealant.
      f. Test method used.
      g. Date of installation of field sample to be tested.
      h. Date of test.
      i. Copy of test method documents.
      j. Age of sealant upon date of testing.
      k. Test results, modeled after the sample form in the test method document.
      l. Indicate use of photographic record of test.

F. Field Quality Control Plan:
   1. Visual inspection of entire length of sealant joints.
   2. Non-destructive field adhesion testing of sealant joints, except interior acrylic latex sealants.
      a. For each different sealant and substrate combination, allow for one test every 12 inches in the first 10 linear feet of joint and one test every 24 inches thereafter.
      b. If any failures occur in the first 10 linear feet, continue testing at 12 inch intervals at no extra cost to Owner.
   3. Destructive field adhesion testing of sealant joints, except interior acrylic latex sealant.
      a. For each different sealant and substrate combination, allow for one test every 100 feet in the first 1000 linear feet, and one test per 1000 linear feet thereafter, or once

per floor on each elevation.

b. If any failures occur in the first 1000 linear feet, continue testing at frequency of one test per 500 linear feet at no extra cost to Owner.

4. Field testing agency's qualifications.
5. Field Quality Control Log Form: Show same data fields as on Preinstallation Field Adhesion Test Log, with known information filled out and lines for multiple tests per sealant/substrate combinations; include visual inspection and specified field testing; allow for possibility that more tests than minimum specified may be necessary.

G. Field Adhesion Test Procedures:
1. Allow sealants to fully cure as recommended by manufacturer before testing.
2. Have a copy of the test method document available during tests.
3. Take photographs or make video records of each test, with joint identification provided in the photos/videos; for example, provide small erasable whiteboard positioned next to joint.
4. Record the type of failure that occurred, other information required by test method, and the information required on the Field Quality Control Log.
5. When performing destructive tests, also inspect the opened joint for proper installation characteristics recommended by manufacturer, and report any deficiencies.
6. Deliver the samples removed during destructive tests in separate sealed plastic bags, identified with project, location, test date, and test results, to Owner.
7. If any combination of sealant type and substrate does not show evidence of minimum adhesion or shows cohesion failure before minimum adhesion, report results to Architect.

H. Non-Destructive Field Adhesion Test: Test for adhesion in accordance with ASTM C1521, using Nondestructive Spot Method.
1. Record results on Field Quality Control Log.
2. Repair failed portions of joints.

I. Destructive Field Adhesion Test: Test for adhesion in accordance with ASTM C1521, using Destructive Tail Procedure.
1. Sample: At least 18 inch long.
2. Minimum Elongation Without Adhesive Failure: Consider the tail at rest, not under any elongation stress; multiply the stated movement capability of the sealant in percent by two; then multiply 1 inch by that percentage; if adhesion failure occurs before the "1 inch mark" is that distance from the substrate, the test has failed.
3. If either adhesive or cohesive failure occurs prior to minimum elongation, take necessary measures to correct conditions and re-test; record each modification to products or installation procedures.
4. Record results on Field Quality Control Log.
5. Repair failed portions of joints.

J. Field Adhesion Tests of Joints: Test for adhesion using most appropriate method in accordance with ASTM C1521, or other applicable method as recommended by manufacturer.

1.06 WARRANTY

A. Correct defective work within a five year period after Date of Substantial Completion.

B. Warranty: Include coverage for installed sealants and accessories that fail to achieve watertight seal , exhibit loss of adhesion or cohesion, or do not cure.

PART 2 PRODUCTS

2.01 JOINT SEALANT APPLICATIONS

A. Scope:

1. Exterior Joints: Seal open joints, whether or not the joint is indicated on drawings, unless specifically indicated not to be sealed. Exterior joints to be sealed include, but are not limited to, the following items.
    a. Wall expansion and control joints.
    b. Joints between door, window, and other frames and adjacent construction.
    c. Joints between different exposed materials.
    d. Openings below ledge angles in masonry.
    e. Other joints indicated below.
2. Interior Joints: Do not seal interior joints unless specifically indicated to be sealed. Interior joints to be sealed include, but are not limited to, the following items.
    a. Joints between door, window, and other frames and adjacent construction.
    b. Other joints indicated below.
3. Do not seal the following types of joints.
    a. Intentional weepholes in masonry.
    b. Joints indicated to be treated with manufactured expansion joint cover or some other type of sealing device.
    c. Joints where sealant is specified to be provided by manufacturer of product to be sealed.
    d. Joints where installation of sealant is specified in another section.
    e. Joints between suspended panel ceilings/grid and walls.

B. Exterior Joints: Use non-sag polyurethane sealant, unless otherwise indicated.
1. Control and Expansion Joints in Concrete Paving: Self-leveling polyurethane "traffic-grade" sealant.

C. Interior Joints: Use non-sag polyurethane sealant, unless otherwise indicated.
1. Wall and Ceiling Joints in Non-Wet Areas: Acrylic emulsion latex sealant.
2. Joints between Fixtures in Wet Areas and Floors, Walls, and Ceilings: Mildew-resistant silicone sealant; white.
3. Other Floor Joints: Non-sag polyurethane "traffic-grade" sealant.

D. Interior Wet Areas: restrooms; fixtures in wet areas include plumbing fixtures and countertops.

202 JOINT SEALANTS - GENERAL

A. Sealants and Primers: Provide products having lower volatile organic compound (VOC) content than indicated in SCAQMD 1168.

203 NONSAG JOINT SEALANTS

A. Mildew-Resistant Silicone Sealant: ASTM C920, Grade NS, Uses M and A; single component, mildew resistant; not expected to withstand continuous water immersion or traffic.
1. Color: White.
2. Manufacturers:
    a. Pecora Corporation; Pecora 898 NST (Non-Staining Technology).
    b. Sika Corporation; Sikasil GP.
    c. Or equal.

B. Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single or multi-component; not expected to withstand continuous water immersion or traffic.
1. Movement Capability: Plus and minus 25 percent, minimum.
2. Hardness Range: 20 to 35, Shore A, when tested in accordance with ASTM C661.
3. Color: To be selected by Architect from manufacturer's standard range.
4. Service Temperature Range: Minus 40 to 180 degrees F.
5. Manufacturers:

a. Pecora Corporation; Dynatroll II.
b. Sika Corporation; Sikaflex-1c SL.
c. Tremco Commercial Sealants & Waterproofing; Dymeric 240 FC.
d. Or equal.

C. Non-Sag "Traffic-Grade" Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single or multi-component; explicitly approved by manufacturer for continuous water immersion and traffic without the necessity to recess sealant below traffic surface.
1. Movement Capability: Plus and minus 25 percent, minimum.
2. Hardness Range: 40 to 50, Shore A, when tested in accordance with ASTM C661.
3. Color: To be selected by Architect from manufacturer's standard range.
4. Service Temperature Range: Minus 40 to 180 degrees F.
5. Manufacturers:
a. Pecora; Dynatred.
b. Tremco; THC-901.
c. Or equal

D. Acrylic Emulsion Latex: Water-based; ASTM C834, single component, non-staining, non-bleeding, non-sagging; not intended for exterior use.
1. Color: To be selected by Architect from manufacturer's standard range.
2. Grade: ASTM C834; Grade Minus 18 Degrees C (0 Degrees F).
3. Manufacturers:
a. Pecora Corporation; Tilt Seal.
b. Sherwin-Williams Company; 950A Siliconized Acrylic Latex Caulk.
c. Tremco Commercial Sealants & Waterproofing; Tremflex 834.
d. Or equal.

2.04 ACCESSORIES

A. Backer Rod: Cylindrical cellular foam rod with surface that sealant will not adhere to, compatible with specific sealant used, and recommended by backing and sealant manufacturers for specific application.
1. Type for Joints Not Subject to Pedestrian or Vehicular Traffic: ASTM C1330; Type O - Open Cell Polyurethane.
2. Type for Joints Subject to Pedestrian or Vehicular Traffic: ASTM C1330; Type B - Bi-Cellular Polyethylene.
3. Open Cell: 40 to 50 percent larger in diameter than joint width.
4. Closed Cell and Bi-Cellular: 25 to 33 percent larger in diameter than joint width.

B. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.

C. Masking Tape: Self-adhesive, nonabsorbent, non-staining, removable without adhesive residue, and compatible with surfaces adjacent to joints and sealants.

D. Joint Cleaner: Non-corrosive and non-staining type, type recommended by sealant manufacturer; compatible with joint forming materials.

E. Primers: Type recommended by sealant manufacturer to suit application; non-staining.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that joints are ready to receive work.

B. Verify that backing materials are compatible with sealants.

C. Verify that backer rods are of the correct size.

D. Preinstallation Adhesion Testing: Install a sample for each test location indicated in the test plan.
   1. Test each sample as specified in PART 1 under QUALITY ASSURANCE article.
   2. Notify Architect of date and time that tests will be performed, at least 7 days in advance.
   3. Record each test on Preinstallation Adhesion Test Log as indicated.
   4. If any sample fails, review products and installation procedures, consult manufacturer, or take whatever other measures are necessary to ensure adhesion; re-test in a different location; if unable to obtain satisfactory adhesion, report to Architect.
   5. After completion of tests, remove remaining sample material and prepare joint for new sealant installation.

3.02 PREPARATION

A. Remove loose materials and foreign matter that could impair adhesion of sealant.

B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.

C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.

D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.

E. Concrete Floor Joints That Will Be Exposed in Completed Work: Test joint filler in inconspicuous area to verify that it does not stain or discolor slab.

3.03 INSTALLATION

A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.

B. Perform installation in accordance with ASTM C1193.

C. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer, except where specific dimensions are indicated.

D. Install bond breaker backing tape where backer rod cannot be used.

E. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.

F. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.

G. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.

H. Concrete Floor Joint Filler: After full cure, shave joint filler flush with top of concrete slab.

3.04 FIELD QUALITY CONTROL

A. Perform field quality control inspection/testing as specified in PART 1 under QUALITY ASSURANCE article.

B. Non-Destructive Adhesion Testing: If there are any failures in first 100 linear feet, notify Architect immediately.

C. Destructive Adhesion Testing: If there are any failures in first 1000 linear feet, notify Architect immediately.

D. Remove and replace failed portions of sealants using same materials and procedures as indicated for original installation.

E. Repair destructive test location damage immediately after evaluation and recording of results.

3.05 POST-OCCUPANCY

A. Post-Occupancy Inspection: Perform visual inspection of entire length of project sealant joints at a time that joints have opened to their greatest width; i.e. at low temperature in thermal cycle. Report failures immediately and repair.

END OF SECTION

SECTION 080671
DOOR HARDWARE SCHEDULE

PART 1 GENERAL

1.01 SUMMARY

A. This Section references specification sections relating to commercial door hardware at the East Dover Elementary School for the following:
   1. Swinging doors.
   2. Other doors to the extent indicated.

B. Commercial door hardware includes, but is not necessarily limited to, the following:
   1. Mechanical door hardware.
   2. Electromechanical and access control door hardware.
   3. Cylinders specified for doors in other sections.

C. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.
   1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
   2. ICC/IBC - International Building Code.
   3. NFPA 70 - National Electrical Code.
   4. NFPA 80 - Fire Doors and Windows.
   5. NFPA 101 - Life Safety Code.
   6. NFPA 105 - Installation of Smoke Door Assemblies.
   7. State Building Codes, Local Amendments.

D. Standards: Reference Related Sections for requirements regarding compliance with applicable industry standards.

PART 2 PRODUCTS

2.01 SCHEDULED DOOR HARDWARE

A. Refer to “PART 3 – EXECUTION” for required specification sections.

PART 3 EXECUTION

3.01 DOOR HARDWARE SETS

A. The door 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.
   1. Quantities listed are for each pair of doors, or for each single door.
   2. The supplier is responsible for handing and sizing all products.
   3. Where multiple options for a piece of hardware are given in a single line item, the supplier shall provide the appropriate application for the opening.
   4. At existing openings with new hardware the supplier shall field inspect existing conditions prior to the submittal stage to verify the specified hardware will work as required. Provide alternate solutions and proposals as needed.

B. Products listed in the hardware sets shall be supplied by and in accordance with the requirements described in the specification section as noted for each item.
   1. Section 08 71 00 – Door Hardware.

C. Manufacturer’s Abbreviations:

			1. MK - MCKINNEY		
			2. PE - PEMKO		
			3. SU - SECURITRON		
			4. RO - ROCKWOOD		
			5. SA - SARGENT		
			6. PR - DORMAKABA PRECISION		
			7. AW - ARROW LOCK		
			8. HS - HES		
			9. OT - OTHER		
			10. LC - LCN CLOSERS		

HARDWARE SETS

SET: 1.0
DOORS: SV1A

1	CONTINUOUS HINGE	CFM_HD1 PT - DOOR HEIGHT	
1	ELECTRIC POWER TRANSFER	EL-CEPT	
1	FAIL SAFE LOCK	72 8272-24V LNL	US26D
1	CYLINDER CORE (SFIC)	7100CR - MATCH EXISTING	US26D
1	DOOR CLOSER	4040XP EDA	AL
1	DOOR STOP (HD FLOOR)	471	US26D
1	THRESHOLD	279X224AFGT MSES25SS	
1	RAIN GUARD	346C	
1	SWEEP (W/DRIP EDGE)	3452CNB	
1	FRAME HARNESS	QC-C1500P	
1	DOOR HARNESS	QC-C___- LENGTH TO SUIT	
1	DOOR POSTION SWITCH	BY SECURITY - PREP DOOR/FRAME	
1	REMOTE RELEASE DEVICE	BY SECURITY	
1	POWER SUPPLY	AQL4-R8E1	

NOTES:
PERIMETER/MEETING STILE SEALS BY FRAME/DOOR SUPPLIER.
CONNECT LOCK POWER SUPPLY TO FIRE ALARM SYSTEM TO ALLOW EGRESS IN CASE OF A FIRE ALARM.
ELECTRONIC OPERATION (BOTH DIRECTIONS): REMOTE RELEASE DEVICE UNLOCKS BOTH LEVERS OR KEY RETRACTS LATCHBOLT. IN CASE OF POWER LOSS OR FIRE ALARM, DOOR

REMAINS UNLOCKED AND UNLATCHED.			
SET: 2.1			
DOORS: V1C			
1	**CONTINUOUS HINGE**	**CFM_HD1 PT - DOOR HEIGHT**	
1	**ELECTRIC POWER TRANSFER**	**EL-CEPT**	
1	**EXIT DEVICE (RIM, STOREROOM)**	**MLR TDS 2403 CD NO TRIM**	**630**
2	**CYLINDER CORE (SFIC)**	**7100CR - MATCH EXISTING**	**US26D**
2	**CYLINDER (RIM / MORTISE)**	**16RCR / 16CRX16**	**US26D**
1	**FLUSH PULL**	**BY FRP DOOR SUPPLIER**	
1	**DOOR CLOSER**	**4040XP SCUSH**	**AL**
1	**THRESHOLD**	**279X224AFGT MSES25SS**	
1	**RAIN GUARD**	**346C**	
1	**SWEEP (W/DRIP EDGE)**	**3452CNB**	
1	**FRAME HARNESS**	**QC-C1500P**	
1	**DOOR HARNESS**	**QC-C___- LENGTH TO SUIT**	
1	**DOOR POSTION SWITCH**	**BY SECURITY - PREP DOOR/FRAME**	
1	**CARD READER**	**BY SECURITY**	
1	**POWER SUPPLY**	**AQL4-R8E1**	
NOTES: **PERIMETER/MEETING STILE SEALS BY FRAME/DOOR SUPPLIER.** **ELECTRONIC OPERATION: VALID CARD OR KEY RETRACTS LATCHBOLT. FREE EGRESS AT ALL TIMES. IN CASE OF POWER LOSS, DOOR REMAINS LOCKED AND LATCHED.**			
SET: 3.0			
DOORS: V1A, V1B			
1	**CONTINUOUS HINGE**	**CFM_HD1 - DOOR HEIGHT**	
1	**EXIT DEVICE (RIM, EXIT ONLY)**	**2401 CD NO TRIM**	**630**
1	**CYLINDER CORE (SFIC)**	**7100CR - MATCH EXISTING**	**US26D**
1	**CYLINDER (RIM / MORTISE)**	**16RCR / 16CRX16**	**US26D**
1	**FLUSH PULL**	**BY FRP DOOR SUPPLIER**	
1	**DOOR CLOSER**	**4040XP SCUSH**	**AL**
1	**THRESHOLD**	**279X224AFGT MSES25SS**	

1	**RAIN GUARD**	**346C**	
1	**SWEEP (W/DRIP EDGE)**	**3452CNB**	
1	**DOOR POSTION SWITCH**	**BY SECURITY - PREP DOOR/FRAME**	
NOTES: **PERIMETER/MEETING STILE SEALS BY FRAME/DOOR SUPPLIER.**			
SET: 6.3			
DOORS: SV1B			
1	**CONTINUOUS HINGE**	**CFM_HD1 PT - DOOR HEIGHT**	
1	**ELECTRIC POWER TRANSFER**	**EL-CEPT**	
1	**FAIL SECURELOCK**	**72 NAC-82271-24V LNL**	**US26D**
1	**CYLINDER CORE (SFIC)**	**7100CR - MATCH EXISTING**	**US26D**
1	**DOOR CLOSER**	**4040XP EDA**	**AL**
1	**DOOR STOP**	**403 (OR) 441CU**	**US26D**
1	**GASKETING (HEAD/JAMB)**	**S88BL**	
1	**FRAME HARNESS**	**QC-C1500P**	
1	**DOOR HARNESS**	**QC-C___- LENGTH TO SUIT**	
1	**DOOR POSTION SWITCH**	**BY SECURITY - PREP DOOR/FRAME**	
1	**REMOTE RELEASE DEVICE**	**BY SECURITY**	
1	**POWER SUPPLY**	**AQL4-R8E1**	
NOTES: **ELECTRONIC OPERATION: REMOTE RELEASE DEVICE UNLOCKS SECURE SIDE LEVER OR KEY RETRACTS LATCHBOLT. FREE EGRESS AT ALL TIMES. IN CASE OF POWER LOSS, DOOR REMAINS LOCKED AND LATCHED.**			
SET: 7.1			
DOORS: 380A			
3	**HINGE (HEAVY WEIGHT)**	**T4A3786**	**US26D**
1	**CLASSROOM SECURITY LOCK**	**72 8238 LNL**	**US26D**
2	**CYLINDER CORE (SFIC)**	**7100CR - MATCH EXISTING**	**US26D**
1	**DOOR CLOSER**	**4040XP REG**	**AL**
1	**DOOR STOP**	**403 (OR) 441CU**	**US26D**

3	**SILENCER**	**608 (OR) 609**	
SET: 8.0			
DOORS: 003A, 004A, 005A, 005B, 006A, A1			
1	**ELECTRIC STRIKE**	**9600**	**630**
1	**SMART PAC BRIDGE RECTIFIER**	**2005M3**	
1	**DOOR POSTION SWITCH**	**BY SECURITY - PREP DOOR/FRAME**	
1	**MOTION SENSOR (REX)**	**BY SECURITY**	
1	**CARD READER**	**BY SECURITY**	
1	**LOCK / STRIKE POWER**	**BY SECURITY**	
NOTES: **BALANCE OF EXISTING HARDWARE TO REMAIN.** **COORDINATE NEW HARDWARE REQUIREMENTS WITH EXISTING CONDITIONS.** **ELECTRICIAN TO PROVIDE A DISCONNECT DEVICE AT TOP OF REMOVABLE MULLION.** **ELECTRONIC OPERATION: VALID CARD RELEASES ELECTRIC STRIKE OR KEY RETRACTS LATCHBOLT. FREE EGRESS AT ALL TIMES. IN CASE OF POWER LOSS, DOOR REMAINS LOCKED AND LATCHED.**			

END OF SECTION

SECTION 080672
DOOR HARDWARE SCHEDULE

PART 1 GENERAL

1.01 SUMMARY

A. This Section references specification sections relating to commercial door hardware at High School East for the following:
   1. Swinging doors.
   2. Other doors to the extent indicated.

B. Commercial door hardware includes, but is not necessarily limited to, the following:
   1. Mechanical door hardware.
   2. Electromechanical and access control door hardware.
   3. Cylinders specified for doors in other sections.

C. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.
   1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
   2. ICC/IBC - International Building Code.
   3. NFPA 70 - National Electrical Code.
   4. NFPA 80 - Fire Doors and Windows.
   5. NFPA 101 - Life Safety Code.
   6. NFPA 105 - Installation of Smoke Door Assemblies.
   7. State Building Codes, Local Amendments.

D. Standards: Reference Related Sections for requirements regarding compliance with applicable industry standards.

PART 2 PRODUCTS

2.01 SCHEDULED DOOR HARDWARE

A. Refer to “PART 3 – EXECUTION” for required specification sections.

PART 3 EXECUTION

3.01 DOOR HARDWARE SETS

A. The door 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.
   1. Quantities listed are for each pair of doors, or for each single door.
   2. The supplier is responsible for handing and sizing all products.
   3. Where multiple options for a piece of hardware are given in a single line item, the supplier shall provide the appropriate application for the opening.
   4. At existing openings with new hardware the supplier shall field inspect existing conditions prior to the submittal stage to verify the specified hardware will work as required. Provide alternate solutions and proposals as needed.

B. Products listed in the hardware sets shall be supplied by and in accordance with the requirements described in the specification section as noted for each item.
   1. Section 08 71 00 – Door Hardware.

C. Manufacturer’s Abbreviations:

			1. MK - MCKINNEY		
			2. PE - PEMKO		
			3. SU - SECURITRON		
			4. RO - ROCKWOOD		
			5. SA - SARGENT		
			6. PR - DORMAKABA PRECISION		
			7. AW - ARROW LOCK		
			8. HS - HES		
			9. OT - OTHER		
			10. LC - LCN CLOSERS		

HARDWARE SETS

SET: 1.1
DOORS: SV1A

1	**CONTINUOUS HINGE**	**CFM_HD1 PT - DOOR HEIGHT**		**PE**
1	**ELECTRIC POWER TRANSFER**	**EL-CEPT**		**SU**
1	**FAIL SAFE LOCK**	**72 8272-24V LNL**	**US26D**	**SA**
1	**CYLINDER CORE (SFIC)**	**7100CR - MATCH EXISTING**	**US26D**	**AW**
1	**DOOR CLOSER**	**4040XP SCUSH**	**AL**	**LC**
1	**THRESHOLD**	**279X224AFGT MSES25SS**		**PE**
1	**RAIN GUARD**	**346C**		**PE**
1	**SWEEP (W/DRIP EDGE)**	**3452CNB**		**PE**
1	**FRAME HARNESS**	**QC-C1500P**		**MK**
1	**DOOR HARNESS**	**QC-C___- LENGTH TO SUIT**		**MK**
1	**DOOR POSTION SWITCH**	**BY SECURITY - PREP DOOR/FRAME**		**OT**
1	**REMOTE RELEASE DEVICE**	**BY SECURITY**		**OT**
1	**POWER SUPPLY**	**AQL4-R8E1**		**SU**

NOTES:
PERIMETER/MEETING STILE SEALS BY FRAME/DOOR SUPPLIER.
CONNECT LOCK POWER SUPPLY TO FIRE ALARM SYSTEM TO ALLOW EGRESS IN CASE OF A FIRE ALARM.
ELECTRONIC OPERATION (BOTH DIRECTIONS): REMOTE RELEASE DEVICE UNLOCKS BOTH LEVERS OR KEY RETRACTS LATCHBOLT. IN CASE OF POWER LOSS OR FIRE ALARM, DOOR REMAINS UNLOCKED AND UNLATCHED.

SET: 2.1

DOORS: V1D				
1	**CONTINUOUS HINGE**	**CFM_HD1 PT - DOOR HEIGHT**		**PE**
1	**ELECTRIC POWER TRANSFER**	**EL-CEPT**		**SU**
1	**EXIT DEVICE (RIM, STOREROOM)**	**MLR TDS 2403 CD NO TRIM**	**630**	**PR**
2	**CYLINDER CORE (SFIC)**	**7100CR - MATCH EXISTING**	**US26D**	**AW**
2	**CYLINDER (RIM / MORTISE)**	**16RCR / 16CRX16**	**US26D**	**AW**
1	**FLUSH PULL**	**BY FRP DOOR SUPPLIER**		**OT**
1	**DOOR CLOSER**	**4040XP SCUSH**	**AL**	**LC**
1	**THRESHOLD**	**279X224AFGT MSES25SS**		**PE**
1	**RAIN GUARD**	**346C**		**PE**
1	**SWEEP (W/DRIP EDGE)**	**3452CNB**		**PE**
1	**FRAME HARNESS**	**QC-C1500P**		**MK**
1	**DOOR HARNESS**	**QC-C___- LENGTH TO SUIT**		**MK**
1	**DOOR POSTION SWITCH**	**BY SECURITY - PREP DOOR/FRAME**		**OT**
1	**CARD READER**	**BY SECURITY**		**OT**
1	**POWER SUPPLY**	**AQL4-R8E1**		**SU**
NOTES: **PERIMETER/MEETING STILE SEALS BY FRAME/DOOR SUPPLIER.** **ELECTRONIC OPERATION: VALID CARD OR KEY RETRACTS LATCHBOLT. FREE EGRESS AT ALL TIMES. IN CASE OF POWER LOSS, DOOR REMAINS LOCKED AND LATCHED.**				
SET: 3.0				
DOORS: V1A, V1B, V1C				
1	**CONTINUOUS HINGE**	**CFM_HD1 - DOOR HEIGHT**		**PE**
1	**EXIT DEVICE (RIM, EXIT ONLY)**	**2401 CD NO TRIM**	**630**	**PR**
1	**CYLINDER CORE (SFIC)**	**7100CR - MATCH EXISTING**	**US26D**	**AW**
1	**CYLINDER (RIM / MORTISE)**	**16RCR / 16CRX16**	**US26D**	**AW**
1	**FLUSH PULL**	**BY FRP DOOR SUPPLIER**		**OT**
1	**DOOR CLOSER**	**4040XP SCUSH**	**AL**	**LC**
1	**THRESHOLD**	**279X224AFGT MSES25SS**		**PE**
1	**RAIN GUARD**	**346C**		**PE**
1	**SWEEP (W/DRIP EDGE)**	**3452CNB**		**PE**
1	**DOOR POSTION SWITCH**	**BY SECURITY - PREP DOOR/FRAME**		**OT**
NOTES: **PERIMETER/MEETING STILE SEALS BY FRAME/DOOR SUPPLIER.**				

SET: 6.3				
DOORS: SV1B				
1	**CONTINUOUS HINGE**	**CFM_HD1 PT - DOOR HEIGHT**		**PE**
1	**ELECTRIC POWER TRANSFER**	**EL-CEPT**		**SU**
1	**FAIL SECURELOCK**	**72 NAC-82271-24V LNL**	**US26D**	**SA**
1	**CYLINDER CORE (SFIC)**	**7100CR - MATCH EXISTING**	**US26D**	**AW**
1	**DOOR CLOSER**	**4040XP EDA**	**AL**	**LC**
1	**DOOR STOP**	**403 (OR) 441CU**	**US26D**	**RO**
1	**GASKETING (HEAD/JAMB)**	**S88BL**		**PE**
1	**FRAME HARNESS**	**QC-C1500P**		**MK**
1	**DOOR HARNESS**	**QC-C___- LENGTH TO SUIT**		**MK**
1	**DOOR POSTION SWITCH**	**BY SECURITY - PREP DOOR/FRAME**		**OT**
1	**REMOTE RELEASE DEVICE**	**BY SECURITY**		**OT**
1	**POWER SUPPLY**	**AQL4-R8E1**		**SU**
NOTES: **ELECTRONIC OPERATION: REMOTE RELEASE DEVICE UNLOCKS SECURE SIDE LEVER OR KEY RETRACTS LATCHBOLT. FREE EGRESS AT ALL TIMES. IN CASE OF POWER LOSS, DOOR REMAINS LOCKED AND LATCHED.**				
SET: 14.0				
DOORS: 120C				
6	**HINGE (HEAVY WEIGHT)**	**T4A3786**	**US26D**	**MK**
1	**DUST PROOF STRIKE**	**570**	**US26D**	**RO**
2	**FLUSH BOLT (MANUAL)**	**555 (OR) 557**	**US26D**	**RO**
1	**STOREROOM LOCK**	**72 8204 LNL**	**US26D**	**SA**
1	**CYLINDER (RIM / MORTISE)**	**16RCR / 16CRX**	**US26D**	**AW**
1	**DOOR CLOSER**	**4040XP REG**	**AL**	**LC**
2	**KICK PLATE**	**K1050 10" CSK BEV**	**US32D**	**RO**
2	**DOOR STOP**	**403 (OR) 441CU**	**US26D**	**RO**
2	**SILENCER**	**608 (OR) 609**		**RO**
SET: 14.1				
DOORS: 120A, 120B				
3	**HINGE (HEAVY WEIGHT)**	**T4A37S86**	**US26D**	**MK**
1	**STOREROOM LOCK**	**72 8204 LNL**	**US26D**	**SA**
1	**CYLINDER CORE (SFIC)**	**7100CR - MATCH EXISTING**	**US26D**	**AW**

1	**DOOR STOP**	**403 (OR) 441CU**	**US26D**	**RO**
3	**SILENCER**	**608 (OR) 609**		**RO**

END OF SECTION

SECTION 080673
DOOR HARDWARE SCHEDULE

PART 1 GENERAL

1.01 SUMMARY

A. This Section references specification sections relating to commercial door hardware at Silver Bay Elementary School for the following:
   1. Swinging doors.
   2. Other doors to the extent indicated.

B. Commercial door hardware includes, but is not necessarily limited to, the following:
   1. Mechanical door hardware.
   2. Electromechanical and access control door hardware.
   3. Cylinders specified for doors in other sections.

C. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.
   1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
   2. ICC/IBC - International Building Code.
   3. NFPA 70 - National Electrical Code.
   4. NFPA 80 - Fire Doors and Windows.
   5. NFPA 101 - Life Safety Code.
   6. NFPA 105 - Installation of Smoke Door Assemblies.
   7. State Building Codes, Local Amendments.

D. Standards: Reference Related Sections for requirements regarding compliance with applicable industry standards.

PART 2 PRODUCTS

2.01 SCHEDULED DOOR HARDWARE

A. Refer to “PART 3 – EXECUTION” for required specification sections.

PART 3 EXECUTION

3.01 DOOR HARDWARE SETS

A. The door 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.
   1. Quantities listed are for each pair of doors, or for each single door.
   2. The supplier is responsible for handing and sizing all products.
   3. Where multiple options for a piece of hardware are given in a single line item, the supplier shall provide the appropriate application for the opening.
   4. At existing openings with new hardware the supplier shall field inspect existing conditions prior to the submittal stage to verify the specified hardware will work as required. Provide alternate solutions and proposals as needed.

B. Products listed in the hardware sets shall be supplied by and in accordance with the requirements described in the specification section as noted for each item.
   1. Section 08 71 00 – Door Hardware.

C. Manufacturer’s Abbreviations:

			1. MK - MCKINNEY		
			2. PE - PEMKO		
			3. SU - SECURITRON		
			4. RO - ROCKWOOD		
			5. SA - SARGENT		
			6. PR - DORMAKABA PRECISION		
			7. AW - ARROW LOCK		
			8. HS - HES		
			9. OT - OTHER		
			10. LC - LCN CLOSERS		

HARDWARE SETS

SET: 1.0
DOORS: SV1A

1	CONTINUOUS HINGE	CFM_HD1 PT - DOOR HEIGHT		PE
1	ELECTRIC POWER TRANSFER	EL-CEPT		SU
1	FAIL SAFE LOCK	72 8272-24V LNL	US26D	SA
1	CYLINDER CORE (SFIC)	7100CR - MATCH EXISTING	US26D	AW
1	DOOR CLOSER	4040XP EDA	AL	LC
1	DOOR STOP (HD FLOOR)	471	US26D	RO
1	THRESHOLD	279X224AFGT MSES25SS		PE
1	RAIN GUARD	346C		PE
1	SWEEP (W/DRIP EDGE)	3452CNB		PE
1	FRAME HARNESS	QC-C1500P		MK
1	DOOR HARNESS	QC-C___- LENGTH TO SUIT		MK
1	DOOR POSTION SWITCH	BY SECURITY - PREP DOOR/FRAME		OT
1	REMOTE RELEASE DEVICE	BY SECURITY		OT
1	POWER SUPPLY	AQL4-R8E1		SU

NOTES:
PERIMETER/MEETING STILE SEALS BY FRAME/DOOR SUPPLIER.
CONNECT LOCK POWER SUPPLY TO FIRE ALARM SYSTEM TO ALLOW EGRESS IN CASE OF A FIRE ALARM.
ELECTRONIC OPERATION (BOTH DIRECTIONS): REMOTE RELEASE DEVICE UNLOCKS BOTH

LEVERS OR KEY RETRACTS LATCHBOLT. IN CASE OF POWER LOSS OR FIRE ALARM, DOOR REMAINS UNLOCKED AND UNLATCHED.				
SET: 2.0				
DOORS: V1A				
1	**CONTINUOUS HINGE**	**CFM_HD1 PT - DOOR HEIGHT**		**PE**
1	**ELECTRIC POWER TRANSFER**	**EL-CEPT**		**SU**
1	**EXIT DEVICE (RIM, STOREROOM)**	**MLR TDS 2403 CD NO TRIM**	**630**	**PR**
2	**CYLINDER CORE (SFIC)**	**7100CR - MATCH EXISTING**	**US26D**	**AW**
2	**CYLINDER (RIM / MORTISE)**	**16RCR / 16CRX16**	**US26D**	**AW**
1	**FLUSH PULL**	**BY FRP DOOR SUPPLIER**		**OT**
1	**DOOR CLOSER**	**4040XP EDA**	**AL**	**LC**
1	**DOOR STOP (HD FLOOR)**	**471**	**US26D**	**RO**
1	**THRESHOLD**	**279X224AFGT MSES25SS**		**PE**
1	**RAIN GUARD**	**346C**		**PE**
1	**SWEEP (W/DRIP EDGE)**	**3452CNB**		**PE**
1	**FRAME HARNESS**	**QC-C1500P**		**MK**
1	**DOOR HARNESS**	**QC-C___- LENGTH TO SUIT**		**MK**
1	**DOOR POSTION SWITCH**	**BY SECURITY - PREP DOOR/FRAME**		**OT**
1	**CARD READER**	**BY SECURITY**		**OT**
1	**POWER SUPPLY**	**AQL4-R8E1**		**SU**
NOTES: **PERIMETER/MEETING STILE SEALS BY FRAME/DOOR SUPPLIER.** **ELECTRONIC OPERATION: VALID CARD OR KEY RETRACTS LATCHBOLT. FREE EGRESS AT ALL TIMES. IN CASE OF POWER LOSS, DOOR REMAINS LOCKED AND LATCHED.**				
SET: 3.0				
DOORS: V1B				
1	**CONTINUOUS HINGE**	**CFM_HD1 - DOOR HEIGHT**		**PE**
1	**EXIT DEVICE (RIM, EXIT ONLY)**	**2401 CD NO TRIM**	**630**	**PR**
1	**CYLINDER CORE (SFIC)**	**7100CR - MATCH EXISTING**	**US26D**	**AW**

1	CYLINDER (RIM / MORTISE)	16RCR / 16CRX16	US26D	AW
1	FLUSH PULL	BY FRP DOOR SUPPLIER		OT
1	DOOR CLOSER	4040XP SCUSH	AL	LC
1	THRESHOLD	279X224AFGT MSES25SS		PE
1	RAIN GUARD	346C		PE
1	SWEEP (W/DRIP EDGE)	3452CNB		PE
1	DOOR POSTION SWITCH	BY SECURITY - PREP DOOR/FRAME		OT

NOTES:
PERIMETER/MEETING STILE SEALS BY FRAME/DOOR SUPPLIER.

SET: 4.0
DOORS: V1C

1	CONTINUOUS HINGE	CFM_HD1 PT - DOOR HEIGHT		PE
1	ELECTRIC POWER TRANSFER	EL-CEPT		SU
1	EXIT DEVICE (RIM, STOREROOM)	MLR TDS 2403 CD NO TRIM	630	PR
2	CYLINDER CORE (SFIC)	7100CR - MATCH EXISTING	US26D	AW
2	CYLINDER (RIM / MORTISE)	16RCR / 16CRX16	US26D	AW
1	DOOR PULL	BF257 MTG-TYPE 12	US32D	RO
1	DOOR CLOSER	4040XP EDA	AL	LC
1	DOOR STOP	403 (OR) 441CU	US26D	RO
1	FRAME HARNESS	QC-C1500P		MK
1	DOOR HARNESS	QC-C___- LENGTH TO SUIT		MK
1	DOOR POSTION SWITCH	BY SECURITY - PREP DOOR/FRAME		OT
1	CARD READER	BY SECURITY		OT
1	POWER SUPPLY	AQL4-R8E1		SU

NOTES:
PERIMETER/MEETING STILE SEALS BY FRAME/DOOR SUPPLIER.
COORDINATE HARDWARE REQUIREMENTS WITH BULLET RESISTANT ALUMINUM DOOR SUPPLIER.
ELECTRONIC OPERATION: VALID CARD OR KEY RETRACTS LATCHBOLT. FREE EGRESS AT ALL TIMES. IN CASE OF POWER LOSS, DOOR REMAINS LOCKED AND LATCHED.

SET: 5.0				
DOORS: V1D				
1	**CONTINUOUS HINGE**	**CFM_HD1 - DOOR HEIGHT**		**PE**
1	**EXIT DEVICE (RIM, EXIT ONLY)**	**2401 CD NO TRIM**	**630**	**PR**
1	**CYLINDER CORE (SFIC)**	**7100CR - MATCH EXISTING**	**US26D**	**AW**
1	**CYLINDER (RIM / MORTISE)**	**16RCR / 16CRX16**	**US26D**	**AW**
1	**DOOR PULL**	**BF257 MTG-TYPE 12**	**US32D**	**RO**
1	**DOOR CLOSER**	**4040XP EDA**	**AL**	**LC**
1	**DOOR STOP**	**403 (OR) 441CU**	**US26D**	**RO**
1	**DOOR POSTION SWITCH**	**BY SECURITY - PREP DOOR/FRAME**		**OT**
NOTES: **PERIMETER/MEETING STILE SEALS BY FRAME/DOOR SUPPLIER.** **COORDINATE HARDWARE REQUIREMENTS WITH BULLET RESISTANT ALUMINUM DOOR SUPPLIER.**				
SET: 6.0				
DOORS: SV1B				
1	**CONTINUOUS HINGE**	**CFM_HD1 PT - DOOR HEIGHT**		**PE**
1	**ELECTRIC POWER TRANSFER**	**EL-CEPT**		**SU**
1	**FAIL SECURELOCK**	**72 NAC-82271-24V LNL**	**US26D**	**SA**
1	**CYLINDER CORE (SFIC)**	**7100CR - MATCH EXISTING**	**US26D**	**AW**
1	**DOOR CLOSER**	**4040XP SCUSH**	**AL**	**LC**
1	**GASKETING (HEAD/JAMB)**	**S88BL**		**PE**
1	**FRAME HARNESS**	**QC-C1500P**		**MK**
1	**DOOR HARNESS**	**QC-C___- LENGTH TO SUIT**		**MK**
1	**DOOR POSTION SWITCH**	**BY SECURITY - PREP DOOR/FRAME**		**OT**
1	**REMOTE RELEASE DEVICE**	**BY SECURITY**		**OT**
1	**POWER SUPPLY**	**AQL4-R8E1**		**SU**
NOTES: **ELECTRONIC OPERATION: REMOTE RELEASE DEVICE UNLOCKS SECURE SIDE LEVER OR KEY RETRACTS LATCHBOLT. FREE EGRESS AT ALL TIMES. IN CASE OF POWER LOSS, DOOR REMAINS LOCKED AND LATCHED.**				

END OF SECTION

SECTION 080674 – DOOR HARDWARE (EDE)

PART 1 - GENERAL

1.1 SUMMARY

A. This Section references specification sections relating to commercial door hardware for the following:
   1. Swinging doors.
   2. Other doors to the extent indicated.

B. Commercial door hardware includes, but is not necessarily limited to, the following:
   1. Mechanical door hardware.
   2. Electromechanical and access control door hardware.
   3. Cylinders specified for doors in other sections.

C. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.
   1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
   2. ICC/IBC - International Building Code.
   3. NFPA 70 - National Electrical Code.
   4. NFPA 80 - Fire Doors and Windows.
   5. NFPA 101 - Life Safety Code.
   6. NFPA 105 - Installation of Smoke Door Assemblies.
   7. State Building Codes, Local Amendments.

D. Standards: Reference Related Sections for requirements regarding compliance with applicable industry standards.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. Refer to “PART 3 – EXECUTION” for required specification sections.

PART 3 - EXECUTION

3.1 DOOR HARDWARE SETS

A. The door 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.
   1. Quantities listed are for each pair of doors, or for each single door.
   2. The supplier is responsible for handing and sizing all products.
   3. Where multiple options for a piece of hardware are given in a single line item, the supplier shall provide the appropriate application for the opening.
   4. At existing openings with new hardware the supplier shall field inspect existing conditions prior to the submittal stage to verify the specified hardware will work as required. Provide alternate solutions and proposals as needed.

B. Products listed in the hardware sets shall be supplied by and in accordance with the requirements described in the specification section as noted for each item.
   1. Section 08 71 00 – Door Hardware.

C. Manufacturer’s Abbreviations:

1. RO - Rockwood
2. MK - McKinney
3. PE - Pemko
4. SU - Securitron
5. PR - dormakaba Precision
6. SA - SARGENT
7. AW - Arrow Lock
8. HS - HES
9. FO - Folger Adam
10. OT - Other
11. LC - LCN Closers

Hardware Sets

Set: 020

Doors: 365B, STG-1, STG-2

3	Filler Plate (frame)	DFF_ - SIZE TO SUIT	USP	RO
1	Continuous Hinge	CFM_HD1 - DOOR HEIGHT		PE
1	Exit Device (rim, clrm sec)	FL 2110 4908A	630	PR
1	Cylinder Core (SFIC)	7100CR - MATCH EXISTING	US26D	AW
1	Cylinder (rim / mortise)	16RCR / 16CRx	US26D	AW
1	Door Closer	4040XP SCUSH	AL	LC
1	Kick Plate	K1050 10" CSK BEV	US32D	RO
1	Gasketing (head/jamb)	S773BL		PE

Notes:
All existing openings need to be verified in the field
Field adjust, repair, and refinish existing frame to like new condition and provide any necessary filler plates for proper installation and function of new door(s) and hardware and verify all strike locations. Custom Strike as required GC and Supplier responsible for coordinating this. Existing doors to be adjusted for proper operation.

Set: 021

Doors: 368, EL-1, EL-2

3	Filler Plate (frame)	DFF_ - SIZE TO SUIT	USP	RO
1	Continuous Hinge	CFM_HD1 - DOOR HEIGHT		PE
1	Storeroom Lock	72 8204 LNL	US26D	SA
1	Cylinder (rim / mortise)	16RCR / 16CRx	US26D	AW
1	Door Closer	4040XP REG (or) EDA	AL	LC
1	Kick Plate	K1050 10" CSK BEV	US32D	RO
1	Door Stop	403 (or) 441CU	US26D	RO
1	Gasketing (head/jamb)	S88BL		PE

Notes:
All existing openings need to be verified in the field
Field adjust, repair, and refinish existing frame to like new condition and provide any necessary filler plates for proper installation and function of new door(s) and hardware and verify all strike locations. Custom Strike as required GC and Supplier responsible for coordinating this. Existing doors to be adjusted for proper operation.

Set: 023

Doors: 322, 323, 324, 325, 326, 327, 328, 329, 330, 331, 350, 351, 352, 353, 367, 376, BR-1, GR-1

3	Filler Plate (frame)	DFF_ - SIZE TO SUIT	USP	RO
1	Continuous Hinge	CFM_HD1 - DOOR HEIGHT		PE
1	Classroom Security Lock	72 8238 LNL	US26D	SA
2	Cylinder Core (SFIC)	7100CR - MATCH EXISTING	US26D	AW
1	Door Closer	4040XP REG (or) EDA	AL	LC
1	Kick Plate	K1050 10" CSK BEV	US32D	RO
1	Door Stop	403 (or) 441CU	US26D	RO
1	Gasketing (head/jamb)	S88BL		PE

Notes:
All existing openings need to be verified in the field
Field adjust, repair, and refinish existing frame to like new condition and provide any necessary filler plates for proper installation and function of new door(s) and hardware and verify all strike locations. Custom Strike as required GC and Supplier responsible for coordinating this. Existing doors to be adjusted for proper operation.

Set: 025

Doors: FR-1, FR-2

3	Filler Plate (frame)	DFF_ - SIZE TO SUIT	USP	RO
1	Continuous Hinge	CFM_HD1 - DOOR HEIGHT		PE
1	Privacy Lock	49 8265 LNL	US26D	SA
1	Door Closer	4040XP REG (or) EDA	AL	LC
1	Kick Plate	K1050 10" CSK BEV	US32D	RO
1	Door Stop	403 (or) 441CU	US26D	RO
1	Gasketing (head/jamb)	S88BL		PE

Notes:
All existing openings need to be verified in the field
Field adjust, repair, and refinish existing frame to like new condition and provide any necessary filler plates for proper installation and function of new door(s) and hardware and verify all strike locations. Custom Strike as required GC and Supplier responsible for coordinating this. Existing doors to be adjusted for proper operation.

Set: 032

Doors: 365A, GYM-1, GYM-2, GYM-3, GYM-4

6	Filler Plate (frame)	DFF_ - SIZE TO SUIT	USP	RO
2	Continuous Hinge	CFM_HD1 - DOOR HEIGHT		PE
1	Mullion (keyed)	FLKR822	689	PR
2	Exit Device (rim, clrm sec)	FL 2110 4908A	630	PR
3	Cylinder Core (SFIC)	7100CR - MATCH EXISTING	US26D	AW
3	Cylinder (rim / mortise)	16RCR / 16CRx	US26D	AW
2	Door Closer	4040XP SCUSH	AL	LC
2	Kick Plate	K1050 10" CSK BEV	US32D	RO
1	Gasketing (head/jamb)	S88BL		PE
2	Astragal (split)	297AS		PE

Notes:
All existing openings need to be verified in the field
Field adjust, repair, and refinish existing frame to like new condition and provide any necessary filler plates for proper installation and function of new door(s) and hardware and verify all strike locations. Custom Strike as required GC and Supplier responsible for coordinating this. Existing doors to be adjusted for proper operation.

END OF SECTION 080674

SECTION 080675 – DOOR HARDWARE (HSE)

PART 1 - GENERAL

1.1 SUMMARY

A. This Section references specification sections relating to commercial door hardware for the following:
   1. Swinging doors.
   2. Other doors to the extent indicated.

B. Commercial door hardware includes, but is not necessarily limited to, the following:
   1. Mechanical door hardware.
   2. Electromechanical and access control door hardware.
   3. Cylinders specified for doors in other sections.

C. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.
   1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
   2. ICC/IBC - International Building Code.
   3. NFPA 70 - National Electrical Code.
   4. NFPA 80 - Fire Doors and Windows.
   5. NFPA 101 - Life Safety Code.
   6. NFPA 105 - Installation of Smoke Door Assemblies.
   7. State Building Codes, Local Amendments.

D. Standards: Reference Related Sections for requirements regarding compliance with applicable industry standards.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. Refer to “PART 3 – EXECUTION” for required specification sections.

PART 3 - EXECUTION

3.1 DOOR HARDWARE SETS

A. The door 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.
   1. Quantities listed are for each pair of doors, or for each single door.
   2. The supplier is responsible for handing and sizing all products.
   3. Where multiple options for a piece of hardware are given in a single line item, the supplier shall provide the appropriate application for the opening.
   4. At existing openings with new hardware the supplier shall field inspect existing conditions prior to the submittal stage to verify the specified hardware will work as required. Provide alternate solutions and proposals as needed.

B. Products listed in the hardware sets shall be supplied by and in accordance with the requirements described in the specification section as noted for each item.
   1. Section 08 71 00 – Door Hardware.

C. Manufacturer’s Abbreviations:

1. RO - Rockwood
2. MK - McKinney
3. PE - Pemko
4. SU - Securitron
5. PR - dormakaba Precision
6. SA - SARGENT
7. AW - Arrow Lock
8. HS - HES
9. FO - Folger Adam
10. OT - Other
11. LC - LCN Closers

Hardware Sets

Set: 001

Doors: 11, 12.1, 21, 31, 32, 5, 6, 6B.1, 7A.1, 20, 18, 29, 30, 10, 8.1

1	Continuous Hinge	CFM_HD1 - DOOR HEIGHT		PE
1	Exit Device (rim, storeroom)	2403 CD No Trim	630	PR
2	Cylinder Core (SFIC)	7100CR - MATCH EXISTING	US26D	AW
2	Cylinder (rim / mortise)	16RCR / 16CRx	US26D	AW
1	Flush Pull	BY FRP DOOR SUPPLIER		OT
1	Door Closer	4040XP SCUSH	AL	LC
1	Threshold	279x224AFGT MSES25SS		PE
1	Rain Guard	346C		PE
1	Gasketing (head/jamb)	S773BL		PE
1	Sweep (w/drip edge)	3452CNB		PE
1	Door Postion Switch	BY SECURITY - PREP DOOR/FRAME		OT

Notes:
All existing openings need to be verified in the field
Field adjust, repair, and refinish existing frame to like new condition and provide any necessary filler plates for proper installation and function of new door(s) and hardware and verify all strike locations. Custom Strike as required GC and Supplier responsible for coordinating this. Existing doors to be adjusted for proper operation.

Set: 009

Doors: 16.1, 27.1, 28

2	Continuous Hinge	CFM_HD1 - DOOR HEIGHT		PE
1	Mullion (keyed)	KR822	689	PR
1	Exit Device (rim, exit only)	2401 CD No Trim	630	PR
1	Exit Device (rim, storeroom)	2403 CD No Trim	630	PR
4	Cylinder Core (SFIC)	7100CR - MATCH EXISTING	US26D	AW

4	Cylinder (rim / mortise)	16RCR / 16CRx	US26D	AW
2	Flush Pull	BY FRP DOOR SUPPLIER		OT
2	Door Closer	4040XP SCUSH	AL	LC
1	Threshold	272A MSES25SS		PE
1	Gasketing (head/jamb)	S773BL		PE
1	Gasketing (mullion)	5110BL		PE
2	Sweep (w/drip edge)	3452CNB		PE

Notes:
All existing openings need to be verified in the field
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Set: 011

Doors: 27.2, 27A.1, 27A.2, 6B.2, 7A.2, 8.2

2	Continuous Hinge	CFM_HD1 - DOOR HEIGHT		PE
1	Mullion (keyed)	KR822	689	PR
2	Exit Device (rim, exit only)	2401 CD No Trim	630	PR
3	Cylinder Core (SFIC)	7100CR - MATCH EXISTING	US26D	AW
3	Cylinder (rim / mortise)	16RCR / 16CRx	US26D	AW
2	Flush Pull	BY FRP DOOR SUPPLIER		OT
2	Door Closer	4040XP SCUSH	AL	LC
1	Threshold	272A MSES25SS		PE
1	Gasketing (head/jamb)	S773BL		PE
1	Gasketing (mullion)	5110BL		PE
2	Sweep (w/drip edge)	3452CNB		PE

Notes:
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Set: 012

Doors: 14, 23, 9

1	Continuous Hinge	CFM_HD1 - DOOR HEIGHT		PE
1	Storeroom Lock	72 8204 LNL	US26D	SA
1	Cylinder Core (SFIC)	7100CR - MATCH EXISTING	US26D	AW
1	Door Closer	4040XP SCUSH	AL	LC
1	Threshold	279x224AFGT MSES25SS		PE
1	Gasketing (head/jamb)	S773BL		PE
1	Sweep (w/drip edge)	3452CNB		PE

Notes:
All existing openings need to be verified in the field
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Set: 012A

Doors: 13, 15, 17, 19, 25, 7

2	Continuous Hinge	CFM_HD1 - DOOR HEIGHT		PE
1	Dust Proof Strike	570	US26D	RO
1	Flush Bolt (manual)	555 (or) 557	US26D	RO
1	Storeroom Lock	72 8204 LNL	US26D	SA
1	Cylinder Core (SFIC)	7100CR - MATCH EXISTING	US26D	AW
2	Door Closer	4040XP SCUSH	AL	LC
1	Threshold	279x224AFGT MSES25SS		PE
1	Gasketing (head/jamb)	S773BL		PE
2	Sweep (w/drip edge)	3452CNB		PE
1	Astragal	357SP		PE
1	Astragal	S771C		PE

Notes:
All existing openings need to be verified in the field
Field adjust, repair, and refinish existing frame to like new condition and provide any necessary filler plates for proper installation and function of new door(s) and hardware and verify all strike locations. Custom Strike as required GC and Supplier responsible for coordinating this. Existing doors to be adjusted for proper operation.

Set: 014

Doors: 2.2

2	Continuous Hinge	CFM_HD1 - DOOR HEIGHT		PE
1	Mullion (keyed)	KR822	689	PR
1	Exit Device (rim, exit only)	2401 CD No Trim	630	PR
1	Exit Device (rim, storeroom)	2403 CD No Trim	630	PR
4	Cylinder Core (SFIC)	7100CR - MATCH EXISTING	US26D	AW
4	Cylinder (rim / mortise)	16RCR / 16CRx	US26D	AW
2	Flush Pull	BY FRP DOOR SUPPLIER		OT
2	Door Closer	4040XP SCUSH	AL	LC
1	Threshold	272A MSES25SS		PE
1	Rain Guard	346C		PE
1	Gasketing (mullion)	5110BL		PE
2	Sweep (w/drip edge)	3452CNB		PE
1	Door Postion Switch	BY SECURITY - PREP DOOR/FRAME		OT

Notes:
Perimeter/meeting stile seals by frame/door supplier.

Set: 015

Doors: 22

1	Continuous Hinge	CFM_HD1 - DOOR HEIGHT		PE
1	Storeroom Lock	72 8204 LNL	US26D	SA
1	Cylinder Core (SFIC)	7100CR - MATCH EXISTING	US26D	AW
1	Door Closer	4040XP SCUSH	AL	LC
1	Threshold	279x224AFGT MSES25SS		PE
1	Rain Guard	346C		PE
1	Sweep (w/drip edge)	3452CNB		PE
1	Door Postion Switch	BY SECURITY - PREP DOOR/FRAME		OT

Notes:
Perimeter/meeting stile seals by frame/door supplier.

Set: 015A

Doors: 26

2	Continuous Hinge	CFM_HD1 - DOOR HEIGHT		PE
1	Dust Proof Strike	570	US26D	RO
2	Flush Bolt (manual)	555 (or) 557	US26D	RO
1	Storeroom Lock	72 8204 LNL	US26D	SA
1	Cylinder Core (SFIC)	7100CR - MATCH EXISTING	US26D	AW
2	Door Closer	4040XP SCUSH	AL	LC
1	Threshold	279x224AFGT MSES25SS		PE
1	Rain Guard	346C		PE
2	Sweep (w/drip edge)	3452CNB		PE
2	Door Postion Switch	BY SECURITY - PREP DOOR/FRAME		OT

Notes:
Perimeter/meeting stile seals by frame/door supplier.

Set: 016

Doors: 2.1, 24.1, 24.3

2	Continuous Hinge	CFM_HD1 - DOOR HEIGHT		PE
1	Mullion (keyed)	KR822	689	PR
2	Exit Device (rim, exit only)	2401 No Trim	630	PR
1	Cylinder Core (SFIC)	7100CR - MATCH EXISTING	US26D	AW
1	Cylinder (rim / mortise)	16RCR / 16CRx	US26D	AW
2	Door Closer	4040XP SCUSH	AL	LC

1	Threshold	272A MSES25SS		PE
1	Rain Guard	346C		PE
1	Gasketing (mullion)	5110BL		PE
2	Sweep (w/drip edge)	3452CNB		PE
1	Door Postion Switch	BY SECURITY - PREP DOOR/FRAME		OT

Notes:
Perimeter/meeting stile seals by frame/door supplier.

Set: 017

Doors: 1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 3.1, 3.2, 3.3, 3.4

1	Continuous Hinge	CFM_HD1 - DOOR HEIGHT		PE
1	Exit Device (rim, exit only)	2401 No Trim	630	PR
1	Door Closer	4040XP SCUSH	AL	LC
1	Threshold	279x224AFGT MSES25SS		PE
1	Rain Guard	346C		PE
1	Sweep (w/drip edge)	3452CNB		PE
1	Door Postion Switch	BY SECURITY - PREP DOOR/FRAME		OT

Notes:
Perimeter/meeting stile seals by frame/door supplier.

Set: 020

Doors: GYM-2, GYM-3, GYM-4, GYM-5, S-7

3	Filler Plate (frame)	DFF_ - SIZE TO SUIT	USP	RO
1	Continuous Hinge	CFM_HD1 - DOOR HEIGHT		PE
1	Exit Device (rim, clrm sec)	FL 2110 4908A	630	PR
1	Cylinder Core (SFIC)	7100CR - MATCH EXISTING	US26D	AW
1	Cylinder (rim / mortise)	16RCR / 16CRx	US26D	AW
1	Door Closer	4040XP SCUSH	AL	LC
1	Kick Plate	K1050 10" CSK BEV	US32D	RO
1	Gasketing (head/jamb)	S773BL		PE

Notes:
All existing openings need to be verified in the field
Field adjust, repair, and refinish existing frame to like new condition and provide any necessary filler plates for proper installation and function of new door(s) and hardware and verify all strike locations. Custom Strike as required GC and Supplier responsible for coordinating this. Existing doors to be adjusted for proper operation.

Set: 021

Doors: E-1, M-6, M-8, N-1, N-3, S-6, W-4

3	Filler Plate (frame)	DFF_ - SIZE TO SUIT	USP	RO
1	Continuous Hinge	CFM_HD1 - DOOR HEIGHT		PE
1	Storeroom Lock	72 8204 LNL	US26D	SA
1	Cylinder (rim / mortise)	16RCR / 16CRx	US26D	AW
1	Door Closer	4040XP REG (or) EDA	AL	LC
1	Kick Plate	K1050 10" CSK BEV	US32D	RO
1	Door Stop	403 (or) 441CU	US26D	RO
1	Gasketing (head/jamb)	S88BL		PE

Notes:
All existing openings need to be verified in the field
Field adjust, repair, and refinish existing frame to like new condition and provide any necessary filler plates for proper installation and function of new door(s) and hardware and verify all strike locations. Custom Strike as required GC and Supplier responsible for coordinating this. Existing doors to be adjusted for proper operation.

Set: 023

Doors: E-10, E-11, E-12, E-13, E-15, E-16, E-18, E-2, E-6, E-7A, E-7B, E-7C, E-8, E-9, M-1, M-12, M-2, M-3, M-5, N-12, N-2, N-4, N-5, N-6, N-7, N-8, N-I0, S-2, S-3, S-4, S-8, W-10, W-11, W-12, W-13, W-14, W-15, W-17, W-19, W-1A, W-2, W-21, W-5, W-6, W-7, W-8, W-9

3	Filler Plate (frame)	DFF_ - SIZE TO SUIT	USP	RO
1	Continuous Hinge	CFM_HD1 - DOOR HEIGHT		PE
1	Classroom Security Lock	72 8238 LNL	US26D	SA
2	Cylinder Core (SFIC)	7100CR - MATCH EXISTING	US26D	AW
1	Door Closer	4040XP REG (or) EDA	AL	LC
1	Kick Plate	K1050 10" CSK BEV	US32D	RO
1	Door Stop	403 (or) 441CU	US26D	RO
1	Gasketing (head/jamb)	S88BL		PE

Notes:
All existing openings need to be verified in the field
Field adjust, repair, and refinish existing frame to like new condition and provide any necessary filler plates for proper installation and function of new door(s) and hardware and verify all strike locations. Custom Strike as required GC and Supplier responsible for coordinating this. Existing doors to be adjusted for proper operation.

Set: 027

Doors: M-4, S-5

3	Filler Plate (frame)	DFF_ - SIZE TO SUIT	USP	RO
1	Continuous Hinge	CFM_HD1 - DOOR HEIGHT		PE
1	Storeroom Lock	72 8204 LNL	US26D	SA
1	Cylinder (rim / mortise)	16RCR / 16CRx	US26D	AW
1	Door Closer	4040XP CUSH	AL	LC
1	Kick Plate	K1050 10" CSK BEV	US32D	RO
1	Gasketing (head/jamb)	S88BL		PE

Notes:
All existing openings need to be verified in the field
Field adjust, repair, and refinish existing frame to like new condition and provide any necessary filler plates for proper installation and function of new door(s) and hardware and verify all strike locations. Custom Strike as required GC and Supplier responsible for coordinating this. Existing doors to be adjusted for proper operation.

Set: 028

Doors: M-10, W-1.1

3	Filler Plate (frame)	DFF_ - SIZE TO SUIT	USP	RO
1	Continuous Hinge	CFM_HD1 - DOOR HEIGHT		PE
1	Exit Device (rim, passage)	FL 2114 4914A	630	PR
1	Door Closer	4040XP REG (or) EDA	AL	LC
1	Kick Plate	K1050 10" CSK BEV	US32D	RO
1	Door Stop	403 (or) 441CU	US26D	RO
1	Gasketing (head/jamb)	S88BL		PE

Notes:
All existing openings need to be verified in the field
Field adjust, repair, and refinish existing frame to like new condition and provide any necessary filler plates for proper installation and function of new door(s) and hardware and verify all strike locations. Custom Strike as required GC and Supplier responsible for coordinating this. Existing doors to be adjusted for proper operation.

Set: 028A

Doors: W-1.2, W-1.3, W-1.4, W-16A.1, W-16A.2, W-16A.3, W-16A.4, W-16A.5, W-16B, W-16C, W-1B.1, W-1B.2, W-1B.3

3	Filler Plate (frame)	DFF_ - SIZE TO SUIT	USP	RO
1	Continuous Hinge	CFM_HD1 - DOOR HEIGHT		PE
1	Exit Device (rim, passage)	FL 2114 4914A	630	PR
1	Door Closer	4040XP CUSH	AL	LC
1	Kick Plate	K1050 10" CSK BEV	US32D	RO
1	Gasketing (head/jamb)	S88BL		PE

Notes:
All existing openings need to be verified in the field
Field adjust, repair, and refinish existing frame to like new condition and provide any necessary filler plates for proper installation and function of new door(s) and hardware and verify all strike locations. Custom Strike as required GC and Supplier responsible for coordinating this. Existing doors to be adjusted for proper operation.

Set: 030

Doors: 12.2, 12.3, 12.4, 12.5, 12.6, 12.7, 16.2, 16.3, 16.4, 16.5

1	Continuous Hinge	CFM_HD1 - DOOR HEIGHT		PE
1	Exit Device (rim, exit only)	2401 CD No Trim	630	PR

1	Cylinder Core (SFIC)	7100CR - MATCH EXISTING	US26D	AW
1	Cylinder (rim / mortise)	16RCR / 16CRx	US26D	AW
1	Flush Pull	BY FRP DOOR SUPPLIER		OT
1	Door Closer	4040XP SCUSH	AL	LC
1	Threshold	279x224AFGT MSES25SS		PE
1	Gasketing (head/jamb)	S773BL		PE
1	Sweep (w/drip edge)	3452CNB		PE

Notes:
All existing openings need to be verified in the field
Field adjust, repair, and refinish existing frame to like new condition and provide any necessary filler plates for proper installation and function of new door(s) and hardware and verify all strike locations. Custom Strike as required GC and Supplier responsible for coordinating this. Existing doors to be adjusted for proper operation.

Set: 032

Doors: CAF-1, CAF-2, GYM-1, GYM-6

6	Filler Plate (frame)	DFF_ - SIZE TO SUIT	USP	RO
2	Continuous Hinge	CFM_HD1 - DOOR HEIGHT		PE
1	Mullion (keyed)	FLKR822	689	PR
2	Exit Device (rim, clrm sec)	FL 2110 4908A	630	PR
3	Cylinder Core (SFIC)	7100CR - MATCH EXISTING	US26D	AW
3	Cylinder (rim / mortise)	16RCR / 16CRx	US26D	AW
2	Door Closer	4040XP SCUSH	AL	LC
2	Kick Plate	K1050 10" CSK BEV	US32D	RO
1	Gasketing (head/jamb)	S88BL		PE
2	Astragal (split)	297AS		PE

Notes:
All existing openings need to be verified in the field
Field adjust, repair, and refinish existing frame to like new condition and provide any necessary filler plates for proper installation and function of new door(s) and hardware and verify all strike locations. Custom Strike as required GC and Supplier responsible for coordinating this. Existing doors to be adjusted for proper operation.

Set: 034

Doors: 1.7, 10, 18, 20, 24.2, 29, 3.5, 30, 6A.7, 8.1

1	Continuous Hinge	CFM_HD1 - DOOR HEIGHT		PE
1	Exit Device (rim, storeroom)	2403 CD No Trim	630	PR
1	Cylinder Core (SFIC)	7100CR - MATCH EXISTING	US26D	AW
1	Cylinder (rim / mortise)	16RCR / 16CRx	US26D	AW
1	Flush Pull	BY FRP DOOR SUPPLIER		OT
1	Door Closer	4040XP SCUSH	AL	LC
1	Threshold	279x224AFGT MSES25SS		PE
1	Rain Guard	346C		PE

1	Sweep (w/drip edge)	3452CNB		PE
1	Door Postion Switch	BY SECURITY - PREP DOOR/FRAME		OT

Notes:
Perimeter/meeting stile seals by frame/door supplier.

Set: 035

Doors: 6A.1, 6A.2, 6A.3, 6A.4, 6A.5, 6A.6, 8.2, 8.3, 8.4, 8.5, 8.6, 8.7

1	Continuous Hinge	CFM_HD1 - DOOR HEIGHT		PE
1	Exit Device (rim, exit only)	2401 CD No Trim	630	PR
1	Cylinder Core (SFIC)	7100CR - MATCH EXISTING	US26D	AW
1	Cylinder (rim / mortise)	16RCR / 16CRx	US26D	AW
1	Flush Pull	BY FRP DOOR SUPPLIER		OT
1	Door Closer	4040XP SCUSH	AL	LC
1	Threshold	279x224AFGT MSES25SS		PE
1	Rain Guard	346C		PE
1	Sweep (w/drip edge)	3452CNB		PE
1	Door Postion Switch	BY SECURITY - PREP DOOR/FRAME		OT

Notes:
Perimeter/meeting stile seals by frame/door supplier.

END OF SECTION 080675

SECTION 080676 – DOOR HARDWARE (SBE)

PART 1 - GENERAL

1.1 SUMMARY

A. This Section references specification sections relating to commercial door hardware for the following:
   1. Swinging doors.
   2. Other doors to the extent indicated.

B. Commercial door hardware includes, but is not necessarily limited to, the following:
   1. Mechanical door hardware.
   2. Electromechanical and access control door hardware.
   3. Cylinders specified for doors in other sections.

C. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.
   1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
   2. ICC/IBC - International Building Code.
   3. NFPA 70 - National Electrical Code.
   4. NFPA 80 - Fire Doors and Windows.
   5. NFPA 101 - Life Safety Code.
   6. NFPA 105 - Installation of Smoke Door Assemblies.
   7. State Building Codes, Local Amendments.

D. Standards: Reference Related Sections for requirements regarding compliance with applicable industry standards.

1.2 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.

1.3 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. Refer to “PART 3 – EXECUTION” for required specification sections.

PART 3 - EXECUTION

3.1 DOOR HARDWARE SETS

A. The door 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.

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3. Where multiple options for a piece of hardware are given in a single line item, the supplier shall provide the appropriate application for the opening.
4. At existing openings with new hardware the supplier shall field inspect existing conditions prior to the submittal stage to verify the specified hardware will work as required. Provide alternate solutions and proposals as needed.

B. Products listed in the hardware sets shall be supplied by and in accordance with the requirements described in the specification section as noted for each item.

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2. MK - McKinney
3. PE - Pemko
4. SU - Securitron
5. PR - dormakaba Precision
6. SA - SARGENT
7. AW - Arrow Lock
8. HS - HES
9. FO - Folger Adam
10. OT - Other
11. LC - LCN Closers

Hardware Sets

Set: 001

Doors: 17, 18, 37, 41

1	Continuous Hinge	CFM_HD1 - DOOR HEIGHT		PE
1	Exit Device (rim, storeroom)	2403 CD No Trim	630	PR
2	Cylinder Core (SFIC)	7100CR - MATCH EXISTING	US26D	AW
2	Cylinder (rim / mortise)	16RCR / 16CRx	US26D	AW
1	Flush Pull	BY FRP DOOR SUPPLIER		OT
1	Door Closer	4040XP SCUSH	AL	LC
1	Threshold	279x224AFGT MSES25SS		PE
1	Rain Guard	346C		PE
1	Gasketing (head/jamb)	S773BL		PE
1	Sweep (w/drip edge)	3452CNB		PE
1	Door Postion Switch	BY SECURITY - PREP DOOR/FRAME		OT

Notes:
All existing openings need to be verified in the field
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proper installation and function of new door(s) and hardware and verify all strike locations. Custom Strike as required GC and Supplier responsible for coordinating this. Existing doors to be adjusted for proper operation.

Set: 009

Doors: 12, 16, 19, 2, 23, 27, 31, 35, 36, 40, 6, 9

2	Continuous Hinge	CFM_HD1 - DOOR HEIGHT		PE
1	Mullion (keyed)	KR822	689	PR
1	Exit Device (rim, exit only)	2401 CD No Trim	630	PR
1	Exit Device (rim, storeroom)	2403 CD No Trim	630	PR
4	Cylinder Core (SFIC)	7100CR - MATCH EXISTING	US26D	AW
4	Cylinder (rim / mortise)	16RCR / 16CRx	US26D	AW
2	Flush Pull	BY FRP DOOR SUPPLIER		OT
2	Door Closer	4040XP SCUSH	AL	LC
1	Threshold	272A MSES25SS		PE
1	Gasketing (head/jamb)	S773BL		PE
1	Gasketing (mullion)	5110BL		PE
2	Sweep (w/drip edge)	3452CNB		PE

Notes:
All existing openings need to be verified in the field
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Set: 012

Doors: 10, 11, 13, 14, 15, 20, 21, 22, 24, 25, 26, 28, 29, 3, 30, 32, 33, 34, 4, 5, 7, 8

1	Continuous Hinge	CFM_HD1 - DOOR HEIGHT		PE
1	Storeroom Lock	72 8204 LNL	US26D	SA
1	Cylinder Core (SFIC)	7100CR - MATCH EXISTING	US26D	AW
1	Door Closer	4040XP SCUSH	AL	LC
1	Threshold	279x224AFGT MSES25SS		PE
1	Gasketing (head/jamb)	S773BL		PE
1	Sweep (w/drip edge)	3452CNB		PE

Notes:
All existing openings need to be verified in the field
Field adjust, repair, and refinish existing frame to like new condition and provide any necessary filler plates for proper installation and function of new door(s) and hardware and verify all strike locations. Custom Strike as required GC and Supplier responsible for coordinating this. Existing doors to be adjusted for proper operation.

Set: 021

Doors: D-15, D-8

3	Filler Plate (frame)	DFF_ - SIZE TO SUIT	USP	RO
1	Continuous Hinge	CFM_HD1 - DOOR HEIGHT		PE
1	Storeroom Lock	72 8204 LNL	US26D	SA
1	Cylinder (rim / mortise)	16RCR / 16CRx	US26D	AW
1	Door Closer	4040XP REG (or) EDA	AL	LC
1	Kick Plate	K1050 10" CSK BEV	US32D	RO
1	Door Stop	403 (or) 441CU	US26D	RO
1	Gasketing (head/jamb)	S88BL		PE

Notes:
All existing openings need to be verified in the field
Field adjust, repair, and refinish existing frame to like new condition and provide any necessary filler plates for proper installation and function of new door(s) and hardware and verify all strike locations. Custom Strike as required GC and Supplier responsible for coordinating this. Existing doors to be adjusted for proper operation.

Set: 023

Doors: D-13, D-16, D-4, D-5, D-9

3	Filler Plate (frame)	DFF_ - SIZE TO SUIT	USP	RO
1	Continuous Hinge	CFM_HD1 - DOOR HEIGHT		PE
1	Classroom Security Lock	72 8238 LNL	US26D	SA
2	Cylinder Core (SFIC)	7100CR - MATCH EXISTING	US26D	AW
1	Door Closer	4040XP REG (or) EDA	AL	LC
1	Kick Plate	K1050 10" CSK BEV	US32D	RO
1	Door Stop	403 (or) 441CU	US26D	RO
1	Gasketing (head/jamb)	S88BL		PE

Notes:
All existing openings need to be verified in the field
Field adjust, repair, and refinish existing frame to like new condition and provide any necessary filler plates for proper installation and function of new door(s) and hardware and verify all strike locations. Custom Strike as required GC and Supplier responsible for coordinating this. Existing doors to be adjusted for proper operation.

Set: 025

Doors: D-10, D-11

3	Filler Plate (frame)	DFF_ - SIZE TO SUIT	USP	RO
1	Continuous Hinge	CFM_HD1 - DOOR HEIGHT		PE
1	Privacy Lock	49 8265 LNL	US26D	SA
1	Door Closer	4040XP REG (or) EDA	AL	LC
1	Kick Plate	K1050 10" CSK BEV	US32D	RO
1	Door Stop	403 (or) 441CU	US26D	RO
1	Gasketing (head/jamb)	S88BL		PE

Notes:

All existing openings need to be verified in the field
Field adjust, repair, and refinish existing frame to like new condition and provide any necessary filler plates for proper installation and function of new door(s) and hardware and verify all strike locations. Custom Strike as required GC and Supplier responsible for coordinating this. Existing doors to be adjusted for proper operation.

Set: 026

Doors: D-12, D-14

6	Filler Plate (frame)	DFF_ - SIZE TO SUIT	USP	RO
2	Continuous Hinge	CFM_HD1 - DOOR HEIGHT		PE
1	Dust Proof Strike	570	US26D	RO
1	Flush Bolt (automatic)	2842 (or) 2942	US26D	RO
1	Storeroom Lock	72 8204 LNL	US26D	SA
1	Cylinder (rim / mortise)	16RCR / 16CRx	US26D	AW
1	Coordinator	2600- LENGTH/BRKTS TO SUIT	Black	RO
2	Door Closer	4040XP REG (or) EDA	AL	LC
2	Kick Plate	K1050 10" CSK BEV	US32D	RO
2	Door Stop	403 (or) 441CU	US26D	RO
1	Gasketing (head/jamb)	S88BL		PE
1	Astragal	357SP		PE
1	Astragal	S771C		PE

Notes:
All existing openings need to be verified in the field
Field adjust, repair, and refinish existing frame to like new condition and provide any necessary filler plates for proper installation and function of new door(s) and hardware and verify all strike locations. Custom Strike as required GC and Supplier responsible for coordinating this. Existing doors to be adjusted for proper operation.

Set: 036

Doors: D-1, D-17, D-2, D-3, D-6, D-7

6	Filler Plate (frame)	DFF_ - SIZE TO SUIT	USP	RO
2	Continuous Hinge	CFM_HD1 - DOOR HEIGHT		PE
2	Exit Device (SVR, classroom)	FL 2208 LBR 4908A	630	PR
2	Cylinder Core (SFIC)	7100CR - MATCH EXISTING	US26D	AW
2	Cylinder (rim / mortise)	16RCR / 16CRx	US26D	AW
2	Door Closer	4040XP SCUSH	AL	LC
2	Kick Plate	K1050 10" CSK BEV	US32D	RO
1	Gasketing (head/jamb)	S88BL		PE
2	Astragal (split)	297AS		PE

Notes:
All existing openings need to be verified in the field
Field adjust, repair, and refinish existing frame to like new condition and provide any necessary filler plates for proper installation and function of new door(s) and hardware and verify all strike locations. Custom Strike as

required GC and Supplier responsible for coordinating this. Existing doors to be adjusted for proper operation.

END OF SECTION 080676

SECTION 081213
HOLLOW METAL FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Non-fire-rated hollow metal frames for non-hollow metal doors.

B. Bullet-resistant hollow metal frames for non-hollow metal doors.

C. Interior glazed borrowed lite frames.

1.02 RELATED REQUIREMENTS

A. Section 081433 - Stile and Rail Wood Doors: Non-hollow metal door for hollow metal frames.

B. Section 087100 - Door Hardware: Hardware, silencers, and weatherstripping.

C. Section 088000 - Glazing: Glazed borrowed lites.

D. Section 099123 - Interior Painting: Field painting.

1.03 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design.

B. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors.

C. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames.

D. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100).

E. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.

F. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

G. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable.

H. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.

I. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete.

J. ASTM C476 - Standard Specification for Grout for Masonry.

K. BHMA A156.115 - American National Standard for Hardware Preparation in Steel Doors and Steel Frames.

L. ICC A117.1 - Accessible and Usable Buildings and Facilities.

M. NAAMM HMMA 830 - Hardware Selection for Hollow Metal Doors and Frames.

N. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames.

O. NAAMM HMMA 840 - Guide Specifications For Receipt, Storage and Installation of Hollow Metal Doors and Frames.

P. NAAMM HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames.

Q. SDI 117 - Manufacturing Tolerances for Standard Steel Doors and Frames.

R. UL 752 - Standard for Bullet-Resisting Equipment.

1.04 SUBMITTALS

A. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes; and one copy of referenced grade standard.

B. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and identifying location of different finishes, if any.

C. Installation Instructions: Manufacturer's published instructions, including any special installation instructions relating to this project.

D. Manufacturer's Certificate: Certification that products meet or exceed specified requirements.

E. Manufacturer's Qualification Statement.

F. Installer's Qualification Statement.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Provide hollow metal frames from SDI Certified manufacturer: www.steeldoor.org/sdicertified.php.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

C. Maintain at project site copies of reference standards relating to installation of products specified.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store in accordance with applicable requirements and in compliance with standards and/or custom guidelines as indicated.

B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Hollow Metal Frames with Integral Casings:
   1. Ceco Door, an Assa Abloy Group company: www.assaabloydss.com/#sle.
   2. Curries, an Assa Abloy Group company: www.assaabloydss.com/#sle.
   3. Republic Doors, an Allegion brand: www.republicdoor.com/#sle.
   4. Or equal.

B. Commercial Security, Detention Security, and Bullet-Resistant Hollow Metal Frames:
   1. Ceco Door, an Assa Abloy Group company: www.assaabloydss.com/#sle.
   2. Republic Doors, an Allegion brand: www.republicdoor.com/#sle.
   3. Security Metal Products Corporation, an ASSA ABLOY Group Company.
   4. Or equal.

2.02 PERFORMANCE REQUIREMENTS

A. Refer to Door and Frame Schedule on the drawings for frame sizes, fire ratings, sound ratings, finishing, door hardware to be installed, and other variations, if any.

B. Door Frame Type: Provide hollow metal door frames with integral casings.

C. Steel Sheet: Comply with one or more of the following requirements; galvannealed steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, commercial steel (CS) Type B, for each.

D. Accessibility: Comply with ICC A117.1 and ADA Standards.

E. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings. Style: Manufacturers standard.

F. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; for instance, an exterior frame that is also indicated as being sound-rated must comply with the requirements specified for exterior frames and for sound-rated frames; where two requirements conflict, comply with the most stringent.

G. Hardware Preparations, Selections and Locations: Comply with BHMA A156.115, NAAMM HMMA 830, NAAMM HMMA 831 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.

H. Frames for Interior Glazing or Borrowed Lites: Construction and face dimensions to match door frames, and as indicated on drawings.

203 HOLLOW METAL DOOR FRAMES WITH INTEGRAL CASINGS

A. Interior Door Frames, Non-Fire Rated: Knock-down type.
   1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
      a. Level 1 - Standard-duty.
      b. Physical Performance Level C, 250,000 cycles; in accordance with ANSI/SDI A250.4.
      c. Frame Metal Thickness: 18 gauge, 0.042 inch, minimum.
   2. Frame Finish: Factory finished.

B. Bullet-Resistant Door Frames: Face welded type.
   1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
      a. Level 4 - Maximum-duty.
      b. Physical Performance Level A, 1,000,000 cycles; in accordance with ANSI/SDI A250.4.
      c. Frame Metal Thickness: 14 gauge, 0.067 inch, minimum.
   2. Commercial Security Rating Impact Testing: Comply with forced entry, static load, and soft or hard body impact testing for Class 4 in accordance with NAAMM HMMA 862 requirements.
   3. Bullet-Resistance: UL 752, Threat Level Rating - Level 3.
   4. Frame Finish: Factory finished.

204 FINISHES

A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.

B. Asphaltic Paint: Asphalting emulsion, water-resistant, resilient coating.
   1. Solids: 60 to 63 percent.
   2. VOC's; None.
   3. Finish: Sem-gloss - nontacky.
   4. Flash Point: None.
   5. Manufacturer:
      a. Royal Coatings, Inc;.
      b. Or equal.

205 ACCESSORIES

A. Silencers: Resilient rubber, fitted into drilled hole; provide three on strike side of single door, three on center mullion of pairs, and two on head of pairs without center mullions.

B. Grout for Frames: Mortar grout complying with ASTM C476 with maximum slump of 4 inches as measured in accordance with ASTM C143/C143M for hand troweling in place; plaster grout and thinner pumpable grout are prohibited.

C. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Verify that finished walls are in plane to ensure proper door alignment.

3.02 PREPARATION

A. Coat inside of frames to be installed in masonry or to be grouted, with asphaltic paint, prior to installation.

3.03 INSTALLATION

A. Install frames in accordance with manufacturer's instructions and related requirements of specified frame standards or custom guidelines indicated.

B. Coordinate frame anchor placement with wall construction.

C. Grout frames in masonry construction, using hand trowel methods; brace frames so that pressure of grout before setting will not deform frames.

D. Comply with glazing installation requirements of Section 088000.11.

E. Install door hardware as specified in Section 087100.
   1. Comply with recommended practice for hardware placement of doors and frames in accordance with ANSI/SDI A250.6 or NAAMM HMMA 861.

3.04 TOLERANCES

A. Clearances Between Door and Frame: Comply with related requirements of specified frame standards or custom guidelines indicated in accordance with SDI 117 or NAAMM HMMA 861.

B. Maximum Diagonal Distortion: 1/16 inch measured with straight edges, crossed corner to corner.

3.05 SCHEDULE

A. Refer to Door and Frame Schedule on the drawings.

END OF SECTION

SECTION 081416 - FLUSH WOOD 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. Interior standard wood veneer flush wood doors.

B. Related Sections:

1. Division 08 Section “Glazing”.
2. Division 08 Section "Door Hardware".

1.3 ACTION SUBMITTALS

A. Product Data: For each type of door indicated. Include factory-finishing specifications.

B. 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 blocking; and other pertinent data.

1. Indicate dimensions and locations of mortises and holes for hardware.
2. Indicate dimensions and locations of cutouts.
3. Indicate requirements for veneer matching.
4. Indicate doors to be factory finished and finish requirements.
5. Indicate fire-protection ratings for fire-rated doors.

C. Samples: Available standard HPDL color and pattern options.

D. Samples for Verifications:
1. Transparent Finish Doors: Each required veneer species and factory finish; minimum 8 by 10 inches corner unit showing construction and finish.
2. Light Opening Moldings: Minimum 6 inches long, for each material, type, and finish required.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

B. Manufacturer warranties transferrable to Owner.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.

B. Quality Standard: In addition to requirements specified, comply with WDMA I.S.1-A, "Architectural Wood Flush Doors”**.**

C. Vendor Qualifications: Certified for chain of custody by an FSC-accredited certification body.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Package factory-finished doors individually in manufacturer’s standard plastic bags, stretch wrap, or cardboard cartons.

B. Store doors inside building in clean, dry location.

C. Mark each door on top rail with opening number used on shop drawings.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weather tight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity at occupancy levels during remainder of construction period.

1.8 MANUFACTUER WARRANTIES

A. Standard manufacturer warranties.

1. Failures include, but are not limited to, the following:

a. Warping (bow, cup, or twist) more than 1/4 inch in 42 by 84 inch section.
b. Telegraphing of core construction in face veneers exceeding 0.01 inch in 3-inch span.

2. Solid Core Doors: Limited lifetime warranty

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design: Subject to compliance with requirements, provide products by the following:

1. VT Industries Inc.
   a. Heritage Collection
2. Or approved equal

2.2 MANUFACTURING STANDARD

A. Interior Wood Doors: Window and Door Manufacturers Association publications ANSI/WDMA I.S. 1A "Industry Standard for Interior Architectural Wood Flush Doors".

B. Acoustical Rating for Solid Core Doors: Where indicated in door schedule on Drawings, provide STC 38 doors supplied with seals and gaskets tested by manufacturer.

2.3 INTERIOR SOLID CORE STANDARD VENEER FLUSH WOOD DOORS FOR TRANSPARENT FINISH

A. Solid Core Standard Veneer Flush Wood Doors

1. WDMA Quality Standard: Standard construction
2. WDMA Performance Level: Heavy Duty
3. Faces:
   a. Veneer Species: Red Oak
   b. Veneer Cut: Plain Sliced
   c. Veneer Leaf Match: Book Match
   d. Veneer Face Match: Running Match
4. Vertical Edges: Match Edge to face
5. Horizontal Edges: Structural Composite Lumber
6. Core: Heavy Duty wood-based particleboard
7. Construction: Five Plies; Stiles and rails are bonded to core, and entire unit is then abrasive planed before veneering.
8. Thickness: 1-3/4 inch.

B. Solid Core Standard Veneer Flush Wood Doors with Glazed Lites

1. Match appearance grade and applicable construction and performance requirements of Solid Core Standard Veneer Flush Wood Doors.
2. Factory Glazing: Refer to Division 08 Section "Glazing" for glass view panels in flush woo doors. Factory install glass as required. Fill glazing bead nail holes in factory finished doors.
3. Metal Glazing Frames: Manufacturer's standard frame formed of 0.048-inch thick, cold rolled steel sheet; powder-coated finish:
   a. Frame Design: #110 Metal Vision Frame Veneer Wrapped

C. Fire-Rated Standard Wood Veneer Solid Core Flush Doors

1. Match appearance, grade and applicable construction and performance requirements of transparent finish flush wood doors.
2. Rating Category B positive Pressure.
3. Core:
   a. 45, 60, 90 – Minute Doors: Mineral Core
4. Vertical Edges:
   a. 45, 60, 90 – Minute Doors: Hardwood Composite Fire Stile
5. Horizontal Edges:
   a. 45, 60, 90 – Minute Doors: Manufacturer's standard construction per label service listing.

D. Fire-Rated Standard Wood Veneer Solid Core Flush Wood Doors with Glazed Lites

1. Match appearance, grade and applicable construction and performance requirements of transparent finish flush wood doors.

2. Factory Glazing: Refer to Section 088000 and 088170 for glass view panels in flush wood doors. Factory install glass in fire rated doors only. Fill glazing bead nail holes in factory finish doors.
3. Glazing: Factory-installed fire-rated safety glass for door rating.
4. Veneer Wrap Bead for Light Openings in Fire-Rated Doors: Manufacturer's standard fire-protection rating indicated. Include concealed metal glazing clips where required for opening size and fire-protection rating indicated.
5. Metal Glazing Frame: Manufacture's standard frame formed of 0.048-inch thick, cold rolled steel sheet; powder coated finish and approved for use in doors of fire-protection rating indicated.

2.4 LOUVERS AND LIGHT FRAMES

A. 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 or less.

1. Subject to compliance, provide product by the following manufacturer:
   a. Anemostat Door Products
      1) Model No. FLDL-UL-SG2
   b. Or approved equal.

2. Metal and Finish:
   a. Material: 18 Gauge Cold Rolled Steel Louver Blades and Inside Frame.
   b. Finish: As selected by Architect from manufacturer's full color range.

B. Metal Frames for Light Opening in Fire Rated Doors: Manufacturer's standard frame formed of 0.048 inch thick, cold rolled steel sheet, with baked enamel or powder coated finish selected by Architect from manufacturer's standard full colors and approved for us in doors of fire-protection rating indicated.

2.5 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
1. Undercut: Maximum 3/8-inch above threshholds.
2. Fire-Rated Doors: Comply with NFPA 80

B. Factory Machining: Machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, BHMA- 156.115-W, and hardware templates.

1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.

C. Openings: Cut and trim openings and install glazing at factory.

2.6 FINISHES

A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.

1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on bottom edges, edges of cutouts, and mortises.

B. Factory finish doors where indicated in schedules or on Drawings as factory finished.

C. Transparent Finish:

1. Grade: Premium.
2. Finish: AWI's, AWMAC's, and WI's "Architectural Woodwork Standards" System 5, conversion varnish; WDMA TR-4 conversion varnish
3. Staining: Match Architect's sample.
4. Sheen: Satin.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and installed door frames, with Installer present, before hanging doors.

1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
2. Reject doors with defects.

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

3.2 INSTALLATION

A. Hardware: For installation, see Division 08 Section "Door Hardware."

B. Installation Instructions: Install doors to comply with manufacturer's written instructions and the referenced quality standard, and as indicated.

1. Install fire rated doors in corresponding fire-rated frames according to NFPA 80.

C. Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors. Machine doors for hardware. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.

1. Clearances: Provide 1/8 inch at heads, jambs, and between pairs of doors. Provide 1/8 inch from bottom of door to top of decorative floor finish or covering unless otherwise indicated. Where threshold is shown or scheduled, provide 1/4 inch from bottom of door to top of threshold unless otherwise indicated.

D. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

E. Wood doors to follow WMDA I.S. 1A and WDMA I.S. 6A standards.

3.3 ADJUSTING AND REPAIR

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Repair of damage or defects is subject to Architects' acceptance, including removal of soiling.

C. Provide new replacement doors for doors that cannot be satisfactorily repaired.

3.4 PROTECTING AND CLEANING

A. Protect installed doors from damage and soiling.

B. Clean doors shortly before inspection for Substantial Completion

END OF SECTION 081416

SECTION 081433
STILE AND RAIL WOOD DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wood doors, stile and rail design; non-fire rated.

1.02 RELATED REQUIREMENTS

A. Section 081113 - Hollow Metal Doors and Frames.

B. Section 087100 - Door Hardware.

C. Section 088000 - Glazing.

1.03 REFERENCE STANDARDS

A. AWI (QCP) - Quality Certification Program; Current Edition.

B. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014, with Errata (2016).

C. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.1; 2016, with Errata (2017).

1.04 SUBMITTALS

A. See Section 013300 - Submittal Procedures.

B. Product Data: Indicate stile and rail core materials and construction; veneer species, type and characteristics.

C. Shop Drawings: Illustrate door opening criteria, elevations, sizes, types, swings, undercuts required, special beveling, special blocking for hardware, factory finishing criteria, identify cutouts for glazing.

D. Samples: Submit two samples of door construction, 8 x 8 inch in size cut from top corner of door.

E. Samples: Submit two samples of door veneer, 8 x 8 inch in size illustrating wood grain, stain color, and sheen.

F. Certificate: Submit labels and certificates required by quality assurance and quality control programs.

G. Manufacturer's Installation Instructions: Indicate special installation instructions.

H. Manufacturer's Qualification Statement.

I. Warranty, executed in Owner's name.

1.05 QUALITY ASSURANCE

A. Maintain one copy of specified door quality standard on site for review during installation and finishing.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section, with not less than three years of documented experience.
   1. Accredited participant in the specified certification program prior to the commencement of fabrication and throughout the duration of the project.

C. Quality Certification:
   1. Comply with AWI (QCP) woodwork association quality certification service/program in accordance with requirements for work specified in this section: www.awiqcp.org/#sle.
   2. Provide labels or certificates indicating that the installed work complies with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade or grades

specified.

3. Provide designated labels on shop drawings as required by certification program.
4. Provide designated labels on installed products as required by certification program.
5. Submit certifications upon completion of installation that verifies this work is in compliance with specified requirements.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Package, deliver, and store doors in accordance with quality standard specified.

B. Protect doors with resilient packaging sealed with heat shrunk plastic. Do not store in damp or wet areas; or in areas where sunlight might bleach veneer. Seal top and bottom edges with tinted sealer if stored more than one week. Break seal on site to permit ventilation.

1.07 WARRANTY

A. Interior Doors: Provide manufacturer's warranty for the life of the installation.

B. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Stile and Rail Wood Doors:

1. Eggers Industries:.
2. Karona, Inc:.
3. Maiman Company:.
4. Marshfield DoorSystems, Inc:.
5. Substitutions: Or equal. See Section 016000 - Product Requirements.

2.02 DOORS

A. Quality Standard: Custom Grade, Heavy Duty performance, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless otherwise indicated.

B. Interior Doors: 1-3/4 inches thick; veneer and lumber stile and rail construction; mortise and tenon joints. Transparent finish.

C. Wood veneer facing with factory transparent finish to match existing adjacent wood doors.

2.03 DOOR FACINGS

A. Veneer Facing for Transparent Finish: Match existing adjacent wood doors.

B. Adhesive: Type II - Water Resistant.

2.04 DOOR CONSTRUCTION

A. Vertical Exposed Edge of Stiles: Of same species as veneer facing.

B. Fit door edge trim to edge of stiles after applying veneer facing.

C. Bond edge banding to cores.

D. Factory machine doors for finish hardware in accordance with hardware requirements and dimensions. Do not machine for surface hardware.

E. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.

F. Glazed Openings: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings.

G. Factory install glazing in doors in compliance with quality standards specified, using manufacturer's standard elastomeric glazing sealant.

2.05 FACTORY FINISHING

A. Finish work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and as follows:
   1. Transparent:
      a. System - 12, Polyurethane, Water-based.
      b. Stain: As selected by Architect.
      c. Sheen: Semigloss.

B. Seal door top edge with color sealer to match door facing.

2.06 ACCESSORIES

A. Hollow Metal Door Frames: As specified in Section 081113.

B. Glazing: As specified in Section 088000.

C. Panel or Glass Retention Molding: Wood of same species as door facing, flat bead stop, with butted corners; prepared for countersink style tamper proof screws.

D. Door Hardware: As specified in Section 087100.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Do not install doors in frame openings that are not plumb or are out of tolerance for size or alignment.

3.02 INSTALLATION

A. Install doors in accordance with manufacturer's instructions and specified quality standards.

B. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.

C. Machine cut for hardware.

D. Coordinate installation of doors with installation of frames and hardware.

3.03 TOLERANCES

A. Comply with specified quality standard for fit, clearance, and joinery tolerances.

B. Maximum Width Distortion (Cup): 1/8 inch measured with straight edge or taut string, edge to edge, over an imaginary 36 by 84 inch surface area.

3.04 ADJUSTING

A. Adjust doors for smooth and balanced door movement.

B. Adjust closers for full closure.

3.05 SCHEDULE - SEE DRAWINGS

END OF SECTION

SECTION 081613
FIBERGLASS DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fiberglass doors.

1.02 RELATED REQUIREMENTS

A. Section 084313 - Aluminum-Framed Storefronts: Exterior storefront and door frames.

B. Section 087100 - Door Hardware.

C. Section 088000 - Glazing.

1.03 REFERENCE STANDARDS

A. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections.

B. ASTM D256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics.

C. ASTM D570 - Standard Test Method for Water Absorption of Plastics.

D. ASTM D638 - Standard Test Method for Tensile Properties of Plastics.

E. ASTM D790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.

F. ASTM D2583 - Standard Test Method for Indentation Hardness of Rigid Plastics by Means of Barcol Impressor.

G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

H. ASTM E2112 - Standard Practice for Installation of Exterior Windows, Doors and Skylights.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Obtain hardware templates from hardware manufacturer prior to starting fabrication.

1.05 SUBMITTALS

A. Product Data: Provide manufacturer's standard details, installation instructions, hardware and anchor recommendations.

B. Shop Drawings: Indicate layout and profiles; include assembly methods.
   1. Indicate product components, including hardware reinforcement locations and preparations, accessories, finish colors, patterns, and textures.
   2. Indicate wall conditions, door and frame elevations, sections, materials, gages, finishes, location of door hardware by dimension, and details of openings; use same reference numbers indicated on drawings to identify details and openings.

C. Selection Samples: Submit two complete sets of color chips, illustrating manufacturer's available finishes, colors, and textures.

D. Verification Samples: Submit door surface samples for each finish specified, 10 inch by 10 inch in size, illustrating finishes, colors, and textures.

E. Door Corner Sample: Submit corner cross sections, 10 inch by 10 inch in size, illustrating construction, finish, color, and texture.

F. Test Reports: Submit certified test reports from qualified independent testing agency indicating doors comply with specified performance requirements.

G. Manufacturer's Qualification Statement.

H. Installer's Qualification Statement.

I. Maintenance Data: Include instructions for repair of minor scratches and damage.

J. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer; include detailed terms of warranty.

K. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. Package products with protective coverings and identify with descriptive labels.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with not less than three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Mark doors with location of installation, door type, color, and weight.

B. Deliver materials in manufacturer’s original, unopened, undamaged containers with identification labels intact.

C. Store materials in original packaging, under cover, protected from exposure to harmful weather conditions and from direct contact with water.
   1. Store at temperature and humidity conditions recommended by manufacturer.
   2. Do not use non-vented plastic or canvas shelters.
   3. Immediately remove wet wrappers.

D. Store in position recommended by manufacturer, elevated minimum 4 inch above grade, with minimum 1/4 inch space between doors.

1.08 FIELD CONDITIONS

A. Do not install doors until structure is enclosed.

B. Maintain temperature and humidity at manufacturer's recommended levels during and after installation of doors.

1.09 WARRANTY

A. Provide five (5) year manufacturer warranty covering materials and workmanship , including degradation or failure due to chemical contact.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fiberglass Composite Doors:
   1. Special-Lite, Inc.
      a. SL-20 FRP, Aluminum Hybrid Door; typical door.
   2. Or equal.

2.02 DOOR AND FRAME ASSEMBLIES

A. Door and Frame Assemblies: Factory-fabricated, prepared and machined for hardware.
   1. Screw-Holding Capacity: Tested to 890 lbs, minimum.
   2. Surface Burning Characteristics: Flame spread index (FSI) of 26 to 75, Class B, and smoke developed index (SDI) of 450 or less, when tested in accordance with ASTM E84.
   3. Sizes: As indicated on drawings.

4. Clearance Between Door and Frame: 1/8 inch, maximum.
5. Clearance Between Meeting Stiles of Pairs of Doors: 1/8 inch, maximum.
6. Clearance Between Bottom of Door and Finished Floor: 3/4 inch, maximum; not less than 1/4 inch clearance to threshold.
7. Provide frame anchors that allow for variation in rough opening size; field cutting of doors or frames to fit is not permitted.

2.03 COMPONENTS

A. Doors: Fiberglass construction with reinforced core.
   1. Thickness: 1-3/4 inch, nominal.
   2. Core Material: poured-in-place polyurethane foam.
   3. Construction:
      a. Fiberglass faces laminated to core with an applied gel coating, or molded in one piece including gel coating on each side.
   4. Face Sheet Texture: Sandstone.
   5. Subframe and Reinforcements: Manufacturer's standard materials.
   6. Waterproof Integrity: Provide factory fabricated edges, cut-outs, and hardware preparations of fiberglass reinforced plastic (FRP); provide cut-outs with joints sealed independently of glazing, louver inserts, or trim.
   7. Hardware Preparations: Factory reinforce, machine, and prepare for door hardware including field installed items; provide solid blocking for each item; field cutting, drilling or tapping is not permitted; obtain manufacturer's hardware templates for preparation as necessary.
   8. Bottom rails must have integral legs for interlocking continuous weather bar with single nylon brush weather stripping or manually adjustable SL-301 door bottom with two nylon brush weather stripping.

2.04 PERFORMANCE REQUIREMENTS

A. Provide door assemblies that have been designed and fabricated in compliance with specified performance requirements.

B. Air Leakage: Maximum of 0.42 cfm/sqft at 6.24 lb/sq ft differential pressure, when tested in accordance with ASTM E283.

C. Thermal Transmittance, Exterior Doors: AAMA 1503, U-value of 0.10, maximum, measured on exterior door in size required for this project.

D. Fiberglass Reinforced Plastic (FRP) Face Sheet Properties:
   1. Izod Impact Resistance: ASTM D256, 7 ft lbf/inch of width, minimum, with notched izod.
   2. Tensile Strength at Break: ASTM D638, 18,000 psi, minimum.
   3. Water Absorption: ASTM D570, 0.16 percent, maximum, after 24 hours at 74 degrees F.
   4. Flexural Strength: ASTM D790, 27,000 psi, minimum.
   5. Barcol Hardness: ASTM D2583, minimum of 40 units.

2.05 FINISHES

A. Abuse resistant engineered surface with protective coating and through-molded color.
   1. Panel Texture: Sandstone.
   2. Color: As selected by Architect from manufacturer's custom line of colors.

2.06 ACCESSORIES

A. Stops for Glazing: Fiberglass, unless otherwise indicated or required by fire rating; provided by door manufacturer to fit factory made openings, with color and texture to match door; fasteners shall maintain waterproof integrity.

1. Exterior Doors: Provide non-removable stops on exterior side with continuous compression gasket weatherseal.
2. Opening Sizes and Shapes: As indicated on drawings.

B. Glazing: As specified in Section 088000.

C. Door Hardware: As specified in Section 087100.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify actual dimensions of openings by field measurements before door fabrication; show recorded measurements on shop drawings.

B. Do not begin installation until substrates have been properly prepared.

C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

B. Clean and prepare substrate in accordance with manufacturer's directions.

C. Protect adjacent work and finish surfaces from damage during installation.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions; do not penetrate frames with anchors.

B. Install exterior doors in accordance with ASTM E2112.

C. Install door hardware as specified in Section 087100.

D. Set units plumb, level, and true-to-line, without warping or racking doors, and with specified clearances; anchor in place.

E. In masonry walls, install frames prior to laying masonry; anchor frames into masonry mortar joints; fill jambs with grout as walls are laid up.

F. Separate aluminum and other metal surfaces from sources of corrosion of electrolytic action at points of contact with other materials.

G. Repair or replace damaged installed products.

3.04 ADJUSTING

A. Lubricate, test, and adjust doors to operate easily, free from warp, twist or distortion, and to fit watertight for entire perimeter.

B. Adjust hardware for smooth and quiet operation.

C. Adjust doors to fit snugly and close without sticking or binding.

3.05 CLEANING

A. Clean installed products in accordance with manufacturer’s instructions prior to owner’s acceptance.

3.06 PROTECTION

A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION

SECTION 083100
ACCESS DOORS AND PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Ceiling mounted access units.

1.02 RELATED REQUIREMENTS

A. Section 092116 - Gypsum Board Assemblies.

1.03 SUBMITTALS

A. Product Data: Provide sizes, types, finishes, hardware, scheduled locations, and details of adjoining work.

B. Shop Drawings: Indicate exact position of each access door and/or panel unit.

C. Manufacturer's Installation Instructions: Indicate installation requirements.

PART 2 PRODUCTS

2.01 ACCESS DOORS AND PANELS ASSEMBLIES

A. Ceiling-Mounted Units:
   1. Location: Where required.
   2. Panel Material: Steel.
   3. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.

2.02 CEILING MOUNTED ACCESS UNITS

A. Manufacturers:
   1. ACUDOR Products Inc.
      a. Ceiling-Mounted Units: ACUDOR GFRG - R.
   2. Milcor, Inc.
   3. Nystrom, Inc.
   4. Or equal.

B. Ceiling Mounted Units: Factory fabricated door and frame, fully assembled units with corner joints welded, filled and ground flush; square and without rack or warp; coordinate requirements with type of installation assembly being used for each unit.
   1. Door Style: Single thickness with rolled or turned in edges.
   2. Frames: 16 gage, 0.0598 inch, minimum thickness.
   3. Single Steel Sheet Door Panels: 1/16 inch, minimum thickness.
   4. Steel Finish: Primed.
   5. Door/Panel Size: 12 by 12 inches.
   6. Hardware:
      a. Hinges for Non-Fire-Rated Units: Concealed, constant force closure spring type.
      b. Latch/Lock: Tamperproof tool-operated cam latch.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that rough openings are correctly sized and located.

B. Begin installation only after substrates have been properly prepared, and if the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to proceeding with this work.

B. Prepare surfaces using methods recommended by manufacturer for applicable substrates in accordance with project conditions.

3.03 INSTALLATION

A. Install units in accordance with manufacturer's instructions.

B. Install frames plumb and level in openings, and secure units rigidly in place.

C. Position units to provide convenient access to concealed equipment when necessary.

END OF SECTION

SECTION 084213.13
SECURITY ALUMINUM ENTRANCES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Bullet Resistant Aluminum Door Assemblies.

1.02 RELATED REQUIREMENTS

A. Section 084313 - Aluminum-Framed Storefronts: Finishes and colors.

B. Section 084333.13 - ALUMINUM-FRAMED SECURITY STOREFRONTS: Ballistic rated storefront framing.

C. Section 087100 - Door Hardware.

D. Section 088000.11 - Glazing. Bullet resistant insulated glass.

1.03 SUBMITTALS

A. Product Data: For each type of door assembly, including manufacturer recommended installation instructions.

B. Shop Drawings: Include plans, elevations, sections, details, attachment to other work and glazing details.

C. Samples: For each exposed finish.

D. Product Test Reports: Indicating compliance with requirements

E. Warranty: Sample of finish warranty

F. Closeout Submittals: Maintenance data.

1.04 DELIVERY, STORAGE AND HANDLING

A. Protect doors, frames, and accessories in accordance with AAMA CW-10 "Care and Handling of Architectural Aluminum from Shop to Site" until Substantial Completion.

1.05 WARRANTY

A. Finish Warranty: Manufacturer’s warranty against deterioration of factory finishes for the period of10 years from the date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURED UNITS

A. Basis of Design: 44/350 Bullet Resistant Door System by Insulgard Security Products.

B. Subject to compliance with requirements, manufacturers of products of equivalent design may be acceptable.
   1. Norshield Security.
   2. U.S. Bullet Proofing; USAD 1000 - Forced Entry/Bullet/Blast Resistant Aluminum Door.
   3. Or equal.

C. Description
   1. Factory fabricated door assembly constructed from either 6105-T5 or 6005-T5 extruded aluminum.
   2. Dimensions: Medium Stile Door.
      a. Top Rail and Stiles: 4-1/2 inches by 2-3/8inches.
      b. Bottom Rail: 8-1/2 inches by 2-3/8 inches.
      c. Glazing Stops: 1 inch face.

202 PERFORMANCE CRITERIA

A. Structural Loading
   1. Wind Loading: As indicated on Drawings.
   2. Deflection Limits
      a. Deflection of any door member in a direction normal to the plane of the wall when subjected to the indicated design loads shall not exceed l/175 of its clear span or ¾ inch, whichever is less.
      b. The deflection shall not exceed 50 percent of the nominal joint width at sealant joints occurring between framing members and adjacent materials, unless otherwise required by sealant manufacturer.
      c. Upon reversal of load direction at magnitudes up to and including 1.5 times design pressures, slippage at fastened and/or clamped connections shall not exceed 1/8 inch.
      d. Glass deflection at full design load shall not exceed 1/100 of its span, or ¾ inch, whichever is less.
      e. Metal panel deflection shall not exceed 1/90 of its span or ¾ inch, whichever is less. The span shall be taken as the lesser of the distances between the horizontal or vertical support members.

B. Thermal Movement
   1. Provide for expansion and contraction of component materials as will be caused by surface temperatures ranging from 20 degrees F to a high temperature of 180 degrees F.
   2. The expansion and contraction caused by temperature differential shall not cause buckling, undue stress on glass, failure of joint seals, undue stress on structural elements, demanding loads on fasteners, reduction of performance, or other detrimental effects.

C. Ballistic Resistant: Level 3 in accordance with UL 752 - Testing for Ballistic Resistance for the complete assembly including framing and glazing.

203 FABRICATION

A. Tolerances: All joints and connections shall be tight, providing hairline joints and true alignment of adjacent members

B. Door corner joinery of extruded and keyed aluminum spline with a continuous 3/8 inch diameter steel tie rod at top and bottom rails.

204 FRAMING FINISH

A. Provide finish for each school as specified in Section 084313.

205 GLAZING

A. Glazing Material:
   1. Ballistic Resistance Level 3 Laminated: As specified in Section 088000.11.

B. Glazing gaskets:
   1. Interior: Closed cell neoprene (40-50 Shore “A” Durometer)
   2. Exterior: Solid neoprene (65-75 Shore “A” Durometer)

206 DOOR HARDWARE

A. Door hardware as specified in Section 087100.

207 ACCESSORIES

A. Anchors: Fully concealed.

PART 3 EXECUTION

3.01 PREPARATION

A. Verify field dimensions of opening prior to fabrication of door assemblies.

B. Coordinate structural requirements to ensure proper attachment and support.

3.02 INSTALLATION

A. Install doors and frames in accordance with manufacturer's recommendations and approved shop drawings.

B. Provide required support and securely fasten and set doors and frames plumb, square, and level without twist or bow.

C. Apply sealant in accordance with door and sealant manufacturer's recommendations as indicated in installation instructions. Wipe off excess, and leave exposed sealant surfaces clean and smooth

3.03 ADJUSTING AND CLEANING

A. Adjust door to provide for weather tightness, and leave doors clean and free of debris.

3.04 PROTECTION

A. Protect doors and glazing from damage during construction operations. If damage occurs, remove and replace as required to provide windows in their original, undamaged condition.

END OF SECTION

SECTION 084313
ALUMINUM-FRAMED STOREFRONTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Aluminum-framed storefront, with vision glass.

B. Aluminum door frames - thermally broken.

C. Weatherstripping.

1.02 RELATED REQUIREMENTS

A. Section 081613 - Fiberglass Doors.

B. Section 087100 - Door Hardware: Hardware items other than specified in this section.

C. 088000.11 - Glazing: Glass and glazing accessories.

1.03 REFERENCE STANDARDS

A. AAMA CW-10 - Care and Handling of Architectural Aluminum From Shop to Site.

B. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections.

C. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix).

D. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures.

E. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

F. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).

G. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.

H. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.

I. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.

1.04 SUBMITTALS

A. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, internal drainage details.

B. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related work, expansion and contraction joint location and details, and field welding required.

C. Samples: Submit two samples 8 by 8 inches in size illustrating finished aluminum surface, glass, glazing materials.

D. Manufacturer's Certificate: Certify that the products supplied meet or exceed the specified requirements.

E. Manufacturer's Qualification Statement.

F. Installer's Qualification Statement.

G. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Handle products of this section in accordance with AAMA CW-10.

B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

1.07 FIELD CONDITIONS

A. Do not install sealants when ambient temperature is less than 40 degrees F. Maintain this minimum temperature during and 48 hours after installation.

1.08 WARRANTY

A. Correct defective Work within a five year period after Date of Substantial Completion.

B. Provide five year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units.

C. Provide five year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

PART 2 PRODUCTS

2.01 BASIS OF DESIGN -- FRAMING FOR INSULATING GLAZING

A. Front-Set Style, Thermally-Broken:
   1. Basis of Design: Special-Lite; SL-450TB and SL-600TB.
      a. Framing for fiberglass doors specified in Section 081613.
   2. Vertical Mullion Dimensions: 2 inches wide by 4-1/2 inches or 6-inches where indicated.

B. Other Manufacturers: Provide either the product identified as "Basis of Design" or an equivalent product of one of the manufacturers listed below:
   1. EFCO, a Pella Company: www.efcocorp.com/#sle.
   2. YKK AP America Inc: www.ykkap.com.
   3. Kawneer: www.kawneer.com.
   4. Or equal.

2.02 ALUMINUM-FRAMED STOREFRONT

A. Aluminum-Framed Storefront: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
   1. Glazing Rabbet: For 1 inch insulating glazing.
   2. Finish Color: As selected by Architect from manufacturer's standard line.
   3. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors and hardware; fasteners and attachments concealed from view; reinforced as required for imposed loads.
   4. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.

5. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
6. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.
7. Movement: Allow for movement between storefront and adjacent construction, without damage to components or deterioration of seals.
8. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.

B. Performance Requirements:
1. Wind Loads: Design and size components to withstand the specified load requirements without damage or permanent set, when tested in accordance with ASTM E330/E330M, using loads 1.5 times the design wind loads and 10 second duration of maximum load.
a. Design Wind Loads: Comply with requirements of ASCE 7.
b. Member Deflection: Limit member deflection to flexure limit of glass in any direction, with full recovery of glazing materials.
2. Water Penetration Resistance: No uncontrolled water on interior face, when tested in accordance with ASTM E331 at pressure differential of 12 psf.
3. Air Leakage: Maximum of 0.06 cu ft/min sq ft of wall area, when tested in accordance with ASTM E283 at 6.24 psf pressure differential across assembly.
4. Condensation Resistance Factor of Framing: 74, minimum, measured in accordance with AAMA 1503.

203 COMPONENTS

A. Aluminum Framing Members: Tubular aluminum sections, thermally broken with interior section insulated from exterior, drainage holes and internal weep drainage system.
1. Framing members for interior applications need not be thermally broken.
2. Glazing Stops: Flush.
3. Cross-Section: As indicated on drawings.

B. Glazing: As specified in Section 088000.11.
1. For Exterior Framing: Type Insulated/Tempered.

204 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M).

B. Fasteners: Stainless steel.

C. Exposed Flashings: Aluminum sheet, 20 gage, 0.032 inch minimum thickness; finish to match framing members.

D. Concealed Flashings: Stainless steel, 26 gage, 0.0187 inch minimum thickness.

E. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.

F. Glazing Accessories: As specified in Section 088000.11.

205 FINISHES

A. High Performance Organic Coatings: AAMA 2604; multiple coats, thermally cured fluoropolymer system.
1. Manufacturers:
a. Arkema, Inc.; Kynar 500.

b. Or equal.

B. Color: As selected by Architect from manufacturer's standard range.

C. Touch-Up Materials: As recommended by coating manufacturer for field application.

2.06 HARDWARE

A. Other Door Hardware: As specified in Section 087100.

B. Weatherstripping: Wool pile, continuous and replaceable; provide on all doors.

C. Sill Sweep Strips: Resilient seal type, retracting, of neoprene; provide on all doors.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify dimensions, tolerances, and method of attachment with other work.

B. Verify that wall openings and adjoining air and vapor seal materials are ready to receive work of this section.

3.02 INSTALLATION

A. Install wall system in accordance with manufacturer's instructions.

B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.

C. Provide alignment attachments and shims to permanently fasten system to building structure.

D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.

E. Provide thermal isolation where components penetrate or disrupt building insulation.

F. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.

G. Where fasteners penetrate sill flashings, make watertight by seating and sealing fastener heads to sill flashing.

H. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

I. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.03 TOLERANCES

A. Maximum Variation from Plumb: 0.06 inch per 3 feet non-cumulative or 0.06 inch per 10 feet, whichever is less.

B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch.

3.04 ADJUSTING

A. Adjust operating hardware for smooth operation.

3.05 CLEANING

A. Remove protective material from pre-finished aluminum surfaces.

B. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths, and take care to remove dirt from corners and to wipe surfaces clean.

3.06 PROTECTION

A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION

SECTION 084333.13
ALUMINUM-FRAMED SECURITY STOREFRONTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Bullet Resistant Aluminum Storefront Framing

1.02 RELATED REQUIREMENTS

A. Section 084213.13 - SECURITY ALUMINUM ENTRANCES. Aluminum storefront doors.

B. Section 084313 - Aluminum-Framed Storefronts: Finishes and colors.

C. Section 088000.11 - Glazing. Bullet resistant insulated glass.

1.03 SUBMITTALS

A. Product Data: For each type of framing and glazing including manufacturer recommended installation instructions.

B. Shop Drawings: Include plans, elevations, sections, details, attachment to other work and glazing details for field-glazed units.

C. Samples: For each exposed finish.

D. Product Test Reports: Indicating compliance with requirements

E. Warranty: Sample of finish warranty

F. Maintenance data.

1.04 DELIVERY, STORAGE AND HANDLING

A. Handle products of this section in accordance with AAMA CW-10.

B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

1.05 WARRANTY

A. Finish Warranty: Manufacturer's warranty against deterioration of factory finishes for the period of 10 years from the date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURED UNITS

A. Basis of Design: Insulgard TH600 Bullet Resistant Architectural Aluminum Framing by Insulgard Security Products; Phone 800.624.6315.
   1. Subject to compliance with requirements, other manufacturers of products of equivalent design may be acceptable.
      a. Norshield Security; NS 7000 Series: www.norshield.net.
      b. U.S. Bullet Proofing; USAW 400 - Fixed Bullet/Blast Resistant Aluminum Curtain wall and Storefront Windows.
      c. Or equal.

B. Description
   1. Factory fabricated framing constructed from either 6105-T5 or 6005-T5 extruded aluminum with integral weep design to allow water to vent to the exterior along horizontal members.
   2. Dimensions:
      a. Head, Jamb, Sill, Mullion and Intermediate Horizontal Members: 2-1/2 inches by 6 inches.

2.02 PERFORMANCE CRITERIA

A. Ballistic Resistant: Level 3 in accordance with UL 752 - Testing for Ballistic Resistance for the complete assembly including framing, glazing and panels.

2.03 FABRICATION

A. Tolerances: All joints and connections shall be tight, providing hairline joints and true alignment of adjacent members

2.04 FRAMING FINISH

A. Provide finish for each school as specified in Section 084313.

2.05 GLAZING

A. Ballistic Resistant Glazing Material:
   1. Ballistic Resistance Level 3 Laminated: As specified in Section 088000.11.

2.06 ACCESSORIES

A. Anchors: Fully concealed in accordance with requirements of delegated design requirements

PART 3 EXECUTION

3.01 PREPARATION

A. Verify field dimensions of opening prior to fabrication of windows.

B. Coordinate structural requirements to ensure proper attachment and support.

3.02 INSTALLATION

A. Install windows in accordance with manufacturer's recommendations and approved shop drawings.

B. Provide required support and securely fasten and set windows plumb, square, and level without twist or bow.

C. Apply sealant in accordance with window and sealant manufacturer's recommendations as indicated in installation instructions. Wipe off excess, and leave exposed sealant surfaces clean and smooth

3.03 PROTECTION

A. Clean and protect windows from damage during construction operations. If damage occurs, remove and replace as required to provide windows in their original, undamaged condition.

END OF SECTION

SECTION 085113 - ALUMINUM 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. This Section includes fixed and/or operable aluminum-framed windows for exterior locations.

1.3 DEFINITIONS

A. Performance class designations according to AAMA/WDMA/CSA 101/I.S.2/A440-05:

1. AW: Architectural.

B. Performance grade number according to AAMA/WDMA/CSA 101/I.S.2/A440-05:

1. Design pressure number in pounds force per square foot (pascals) used to determine the structural test pressure and water test pressure.

C. Structural Test Pressure: For uniform load structural test, is equivalent to 150 percent of the design pressure.

D. Minimum Test Size: Smallest size permitted for performance class (gateway test size) or as specified elsewhere in this section, whichever is more stringent. Products must be tested at minimum test size or at a size larger than minimum test size to comply with requirements for performance class. Downsized test reports will not be considered acceptable.

1.4 PERFORMANCE REQUIREMENTS

A. General: Provide aluminum windows capable of complying with performance requirements indicated, based on testing manufacturer's windows that are representative of those specified, and that are of minimum test size indicated below:

1. Projected Windows: 60” x 144” (F/PO/F/PI).

B. Structural Performance: Provide aluminum windows capable of withstanding the effects of the following loads, based on testing units of the minimum test size specified herein that pass AAMA/WDMA/CSA 101/I.S.2/A440-05, Uniform Load Structural and Uniform Load Deflection Tests:

1. Uniform Load Structural Test: 105 psf (positive and negative).

2. Uniform Load Deflection Test: 70 psf (positive and negative).

1.5 SUBMITTALS

A. Product Data: Include construction details, material descriptions, fabrication methods, dimensions of individual components and profiles, hardware, finishes, and operating instructions for each type of aluminum window indicated.

B. Shop Drawings: Include plans, elevations, sections, details, hardware, attachments to other work, operational clearances, installation details, and the following:

1. Mullion details, including reinforcement and stiffeners.
2. Joinery details.
3. Weather-stripping details.
4. Thermal-break details.
5. Glazing details.

C. Samples for Initial Selection: For units with factory-applied color finishes.

1. Include similar samples of hardware and accessories involving color selection.

D. Maintenance Data: For operable window sash, operating hardware and finishes to include in maintenance manuals.

E. Warranty: Special warranty specified in this Section.

1.6 QUALITY ASSURANCE

A. Product Qualifications: In order to confirm that the proposed product(s) conform to the material and performance requirements contained in these specifications, bidders shall include the following with their bid. Failure to comply with these requirements shall cause the bid to automatically be rejected.

1. Bidder's Acknowledgement: Bidders shall include a letter in their bid stating the manufacturer and series (model) number of the product upon which its bid has been based. Changes in product (manufacturer or series) will not be permitted after the bid.
2. Product Test Reports: Bidders submitting bids based on products other than the Basis of Design product listed in Paragraph 2.1 must also include with their bid comprehensive test reports not more than four years old prepared by a qualified testing agency for each window type being used on the project. Test reports based on the use of downsized test units will not be accepted.
3. Product Details: Bidders submitting bids based on products other than the Basis of Design product listed in Paragraph 2.1 must also include with their bid full size product details showing all frame and sash details, dimensions, thermal break construction, wall thicknesses and joinery. Details must accurately reflect all glazing and hardware options specified herein.

B. Product Requirements: For maximum performance, windows for this project must meet both the testing requirements as contained herein and the minimum material requirements specified. Windows that carry the applicable AAMA rating but do not meet the material thicknesses, depths, etc. shall not be acceptable for use on this project.

C. Installer Qualifications: An installer acceptable to aluminum window manufacturer for installation of units required for this Project.

D. Source Limitations: Obtain aluminum windows through one source from a single manufacturer.

E. Product Options: Drawings indicate size, profiles, and dimensional requirements of aluminum windows and are based on the specific system indicated. Do not modify size and dimensional 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.

F. Fenestration Standard: Comply with AAMA/WDMA/CSA 101/I.S.2/A440-05, "Standard/Specification for Windows, Doors, and Unit Skylights" for definitions and minimum standards of performance, materials, components, accessories, and fabrication. Comply with more stringent requirements if indicated.

1. Provide AAMA-certified aluminum windows.

G. Glazing Publications: Comply with published recommendations of glass manufacturers and with GANA's "Glazing Manual" unless more stringent requirements are indicated.

H. Preinstallation Conference: If requested, conduct conference at project site to review methods and procedures related to aluminum windows including, but not limited to, the following:

1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Review, discuss, and coordinate the interrelationship of aluminum windows with other exterior wall components.
3. Review and discuss the sequence of work required to construct a watertight and weathertight exterior building envelope.
4. Inspect and discuss the condition of substrate and other preparatory work performed by other trades.

1.7 PROJECT CONDITIONS

A. Field Measurements: For retrofit installations, verify aluminum window openings by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish opening dimensions and proceed with fabricating aluminum windows without field measurements. Coordinate wall construction to ensure that actual opening dimensions correspond to established dimensions.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace aluminum windows that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Failure to meet performance requirements.
b. Structural failures including excessive deflection, water leakage, or air infiltration.
c. Faulty operation of movable sash and hardware.
d. Deterioration of metals or other materials beyond that which is normal.
e. Failure of insulating glass.

2. Warranty Period:

a. Window: Ten years from date of Substantial Completion.
b. Insulated Glazing: 10 years from date of Substantial Completion.
c. Painted Metal Finishes:

1) Twenty years from date of Substantial Completion for AAMA 2605 Superior Performance Finishes.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: The basis of design for these specifications is the Series 2542i Projected as manufactured by Architectural Window Manufacturing Corporation, Rutherford, New Jersey.

B. Or approved equal

2.2 MATERIALS

A. Aluminum Extrusions: Alloy and temper recommended by aluminum window manufacturer for strength, corrosion resistance, and application of required finish, but not less than 22,000-psi (150-MPa) ultimate tensile strength, not less than 16,000-psi (110-MPa) minimum yield strength, and not less than 0.125-inch thickness at any location for the main frame and sash members.

B. Frame/Sash Depth: 4 ¼" minimum frame depth; 2 ¼" minimum sash depth.

C. Fasteners: Aluminum, nonmagnetic stainless steel, epoxy adhesive, or other materials warranted by manufacturer to be noncorrosive and compatible with aluminum window members, trim, hardware, anchors, and other components.

1. All fasteners must be concealed except where unavoidable for application of hardware.
2. For application of hardware, where required, use non-magnetic stainless steel phillips machine screws.

D. Anchors, Clips, and Accessories: Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated.

E. Compression-Type Weather Stripping: Provide compressible weather stripping designed for permanently resilient sealing under bumper or wiper action and for complete concealment when aluminum window is closed.

1. Weather-Stripping Material: Manufacturer's standard system and materials complying with AAMA/WDMA/CSA 101/I.S.2/A440-05.

F. Sliding-Type Weather Stripping: Provide woven-pile weather stripping of wool, polypropylene, or nylon pile and resin-impregnated backing fabric. Comply with AAMA 701/702.

1. Weather Seals: Provide weather stripping with integral barrier fin or fins of semirigid, polypropylene sheet or polypropylene-coated material. Comply with AAMA 701/702.

G. Replaceable Weather Seals: Comply with AAMA 701/702.

H. Sealant: For sealants required within fabricated windows, provide window manufacturer's standard, permanently elastic, nonshrinking, and nonmigrating type recommended by sealant manufacturer for joint size and movement.

2.3 WINDOW

A. Window Type: Projected

B. AAMA/WDMA Performance Requirements: Provide aluminum windows of performance indicated that comply with AAMA/WDMA/CSA 101/I.S.2/A440-05.

1. Performance Class and Grade: AW70.

C. Condensation-Resistance Factor (CRF): Provide aluminum windows tested for thermal performance according to AAMA 1503, showing a minimum CRF of 56.

D. Thermal Transmittance: Provide aluminum windows with a whole-window, U-factor maximum indicated at 15-mph (24-km/h) exterior wind velocity and winter condition temperatures when tested using pyrolitic Low-E glass according to AAMA 1503.

1. U-Factor: 0.51 Btu/sq. ft. x h x deg F or less.

E. Air Infiltration: Maximum rate not more than indicated when tested according to AAMA/WDMA/CSA 101/I.S.2/A440-05, Air Infiltration Test.

1. Maximum Rate: 0.10 cfm/sq. ft. of area at an inward test pressure of 6.24 lbf/sq. ft. (300 Pa).

F. Water Resistance: No water leakage as defined in AAMA/WDMA referenced test methods at a water test pressure equaling that indicated, when tested according to AAMA/WDMA 101/I.S.2/NAFS, Water Resistance Test.

1. Test Pressure: 20 percent of positive design pressure, but not less than 15 lbf/sq. ft..

G. Forced-Entry Resistance: Comply with Performance Grade 10 requirements when tested according to ASTM F 588.

H. Life-Cycle Testing: Test according to AAMA 910 and comply with AAMA/WDMA/CSA 101/I.S.2/A440-05.

I. Operating Force and Auxiliary (Durability) Tests: Comply with AAMA/WDMA/CSA 101/I.S.2/A440- 05 for operating window types indicated.

2.4 INSULATED GLAZING

A. Construction: All windows (except those receiving insulated panels) shall be factory glazed with hermetically sealed 1” insulating glass units with a dual seal of polyisobutylene and silicone and a desicant filled aluminum spacer. Exterior lite of glass must be set into a continuous bed of silicone sealant and held in place with removable extruded aluminum snap-in beads. Wrap around (marine) glazing which requires the removal and disassembling of the sash for re-glazing will not be acceptable. Units must be IGCC certified for a CBA rating level

1. Exterior Glazing:
   a. Thickness: 1/4"
   b. Tint: Grey or Bronze
   c. Type: Tempered Glass
   d. Coating: PPG Solarban 60 Low-E (or equal) (#2 Surface)

2. Interior Glazing:
   a. Thickness: 1/4”

b. Tint: Clear
c. Type: Tempered Glass
d. Coating: PPG Solarban 60 Low-E (or equal) (#2 Surface)

B. Insulated (Spandlrel) Panels:

1. Exterior Glazing:
   a. Thickness: 1/4”
   b. Tint: Grey or Bronze
   c. Type: Tempered Glass
   d. Coating: PPG Solarban 60 Low-E (or equal) (#2 Surface)
2. Interior Glazing:
   a. Thickness: 1/4"
   b. Tint: Clear
   c. Type: Tempered Glass with ceramic frit on the #4 surface

C. Insulated Panels (applicable for HSE):

1. Overall thickness: 1-inch
2. Exterior Face: Kynar paint on smooth .032” aluminum.
3. Interior Face: Kynar pain on smooth .032” aluminum.
4. Core: Polyisocyanurate.

2.5 HARDWARE

A. General: Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, carbon steel complying with AAMA 907, or other corrosion-resistant material compatible with aluminum; designed to smoothly operate, tightly close, and securely lock aluminum windows and sized to accommodate sash or ventilator weight and dimensions. Do not use aluminum in frictional contact with other metals.

B. Locks and Latches: Designed to allow unobstructed movement of the sash across adjacent sash in direction indicated and operated from the inside only.

C. Projected Windows: Provide the following operating hardware:

1. Hinge: Concealed stainless steel four-bar friction hinge with adjustable-slide friction shoe; two per ventilator.
2. Lock: Cam-action, white bronze locking handle and keeper (two per ventilator over 42” wide).
3. Limit Device: Integral adjustable stainless steel, stop (two per ventilator).

2.6 INSECT SCREENS

A. General: Design windows and hardware to accommodate screens in a tight-fitting, removable arrangement, with a minimum of exposed fasteners and latches. Locate screens on inside or outside of window, depending on configuration. Provide insect screens on all operable sash.

B. Aluminum Insect Screen Frames: Manufacturer's standard aluminum alloy complying with SMA 1004. Fabricate frames with mitered or coped joints or corner extrusions, concealed fasteners, and removable PVC spline/anchor concealing edge of frame.

1. Extruded-Aluminum Tubular Framing Sections and Cross Braces: Not less than 0.050-inch (1.3-mm) wall thickness.
2. Finish: Match aluminum window members.

2.7 ACCESSORIES

A. Rescue Labels: Not applicable.

2.8 FABRICATION

A. Windows must be flush vent design (overlapping vents will not be acceptable).

B. Fabricate aluminum windows in sizes indicated. Include a complete system for assembling components and anchoring windows.

C. Fabricate aluminum windows that are reglazable without dismantling sash or ventilator framing.

D. Thermally Improved Construction: Fabricate aluminum windows with an integral, concealed (products with exposed thermal barriers will not be acceptable), low-conductance thermal barrier; located between exterior materials and window members exposed on interior side; in a manner that eliminates direct metal-to-metal contact.

1. All exterior aluminum shall be separated from interior aluminum by a rigid, structural thermal barrier. For purposes of this specification, a structural thermal barrier is defined as a system that shall transfer shear during bending and, therefore, promote composite action between the exterior and interior extrusions.
2. No thermal short circuits shall occur between the exterior and interior.
3. The thermal barrier shall be INSULBAR® or equal, and shall consist of two glass reinforced polyamide nylon 6/6 struts mechanically crimped in raceways extruded in the exterior and interior extrusions.
4. Poured and debridged urethane thermal barriers shall not be permitted.

E. Weather Stripping: Provide full-perimeter weather stripping for each operable sash and ventilator.

F. Weep Holes: Provide weep holes and internal passages to conduct infiltrating water to exterior.

G. Mullions: Provide mullions and cover plates as shown, 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, as indicated. Provide mullions and cover plates capable of withstanding design loads of window units.

H. Subframes: Provide subframes with anchors for window units as shown, of profile and dimensions indicated but not less than 0.093-inch thick extruded aluminum. Finish to match window units. Provide subframes capable of withstanding design loads of window units.

I. Factory-Glazed Fabrication: Glaze aluminum windows in the factory where practical and possible for applications indicated. Comply with requirements in Division 08 Section "Glazing" and with AAMA/WDMA/CSA 101/I.S.2/A440-05.

J. Glazing Stops: Provide snap-on glazing stops coordinated with Division 08 Section "Glazing" and glazing system indicated. Provide glazing stops to match sash and ventilator frames.

2.9 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

C. Exterior of Window:

1. High-Performance Organic Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturer’s written instructions.

a. Fluoropolymer Two-Coat System: Manufacturer’s standard two-coat thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 50% polyvinylfluoride resin by weight; complying with AAMA 2604.
b. Color: As selected by Architect from manufacturer’s standard colors. (Note: Exterior color may be different from interior color.)

D. Interior of Window:

1. Baked-Enamel Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Apply baked enamel complying with paint manufacturer's written instructions for cleaning, conversion coating, and painting.

a. Organic Coating: Thermosetting, modified-acrylic enamel primer/topcoat system complying with AAMA 2603 Organic Coating: Thermosetting, modified-acrylic enamel primer/topcoat system complying with AAMA 2603.
2. Color: As selected by Architect from manufacturer’s standard colors. (Note: interior color may be different from exterior color.)

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 work. Verify rough opening dimensions, levelness of sill plate, and operational clearances. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure a coordinated, weathertight window installation.

1. Masonry Surfaces: Visibly dry and free of excess mortar, sand, and other construction debris.
2. Wood Frame Walls: Dry, clean, sound, well nailed, free of voids, and without offsets at joints. Ensure that nail heads are driven flush with surfaces in opening and within 3 inches (76 mm) of opening.
3. Metal Surfaces: Dry; clean; free of grease, oil, dirt, rust, corrosion, and welding slag; without sharp edges or offsets at joints.
4. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with Drawings, Shop Drawings, and manufacturer's written instructions for installing windows, hardware, accessories, and other components.

B. Install windows level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support.

C. Set sill members in bed of sealant or with gaskets, as indicated, for weathertight construction.

D. Install windows and components to drain condensation, water penetrating joints, and moisture migrating within windows to the exterior.

E. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

3.3 FACTORY TESTING

A. One window for each seventy-five manufactured shall be randomly selected by the Owner and Architect to be tested at the manufacturer’s facility for air and water infiltration in order to confirm compliance of the project’s windows with the performance requirements contained in these specifications. Bidders are to include the cost of transportation, food, and lodging for four representatives of the Owner and/or Architect to witness these tests.

3.4 ADJUSTING, CLEANING, AND PROTECTION

A. Adjust operating sashes and ventilators, screens, hardware, and accessories for a tight fit at contact points and weather stripping for smooth operation and weathertight closure. Lubricate hardware and moving parts.

B. Manufacturer shall clean all glass and aluminum prior to shipment.

C. Protection of newly installed windows and/or final cleaning of glass and aluminum to remove any accumulations that may have occurred during the construction period is to be the responsibility of the General Contractor or Owner.

D. Comply with manufacturer’s written recommendations for final cleaning and maintenance.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain window operating system.

END OF SECTION 085113

SECTION 087100
DOOR HARDWARE

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes commercial door hardware for the following:
   1. Swinging doors.
   2. 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. Cylinders specified for doors in other sections.

C. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.
   1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
   2. ICC/IBC - International Building Code.
   3. NFPA 70 - National Electrical Code.
   4. NFPA 80 - Fire Doors and Windows.
   5. NFPA 101 - Life Safety Code.
   6. NFPA 105 - Installation of Smoke Door Assemblies.
   7. State Building Codes, Local Amendments.

D. 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

1.02 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 Submittals.

1.03 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. 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.

E. Each unit to bear third party permanent label demonstrating compliance with the referenced standards.

F. 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.

G. 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

H. At completion of installation, provide written documentation that components were applied to manufacturer's instructions and recommendations and according to approved schedule.

1.04 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".

1.05 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.

1.06 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. Ten years for mortise locks and latches.
   2. Five years for exit hardware.
   3. Twenty five years for manual surface door closer bodies.
   4. Five years for motorized electric latch retraction exit devices.
   5. Two years for electromechanical door hardware.

1.07 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 1 PRODUCTS

2.01 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. Products furnished, but not installed, under this Section include the following. Coordinating, purchasing, delivering, and scheduling remain requirements of this Section.
   1. Permanent cylinders, cores, and keys to be installed by Owner.

D. 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.

202 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 3'6": 4-1/2" standard or heavy weight as specified.
      b. Sizes from 3'7" to 4'0": 5" heavy weight.
   3. 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.
   4. Manufacturers:
      a. Hager Companies (HA) - CB Series.
      b. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK) - MacPro Series.
      c. Stanley Hardware (ST) - CB Series.

B. Continuous Geared Hinges: ANSI/BHMA A156.26 Grade 1-600 certified continuous geared hinge. with minimum 0.120-inch thick extruded 6060 T6 aluminum alloy hinge leaves and a minimum overall width of 4 inches. Hinges are non-handed, reversible and fabricated to template screw locations. Factory trim hinges to suit door height and prepare for electrical cut-outs.
   1. Manufacturers:
      a. Hager Companies (HA).
      b. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE).
      c. Stanley Hardware (ST).

203 POWER TRANSFER DEVICES

A. Electrified Quick Connect Transfer Hinges: Provide electrified transfer hinges with Molex™ standardized plug connectors and sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.
   1. Manufacturers:
      a. Hager Companies (HA) - ETW-QC (# wires) Option.
      b. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK) - QC (# wires) Option.
      c. Stanley Hardware (ST) – C Option.

B. Concealed Quick Connect Electric Power Transfers: Provide concealed wiring pathway housing mortised into the door and frame for low voltage electrified door hardware. Furnish with Molex™ standardized plug connectors and sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets. Connectors plug

directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.

1. Manufacturers:
    a. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE) – EL-CEPT Series.
    b. Securitron (SU) - EL-CEPT Series.
    c. Von Duprin (VD) - EPT-10 Series.

C. Electric Door Wire Harnesses: Provide electric/data transfer wiring harnesses with standardized plug connectors to accommodate up to twelve (12) wires. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Provide sufficient number and type of concealed wires to accommodate electric function of specified hardware. Provide a connector for through-door electronic locking devices and from hinge to junction box above the opening. Wire nut connections are not acceptable. Determine the length required for each electrified hardware component for the door type, size and construction, minimum of two per electrified opening.

1. Provide one each of the following tools as part of the base bid contract:
    a. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK) - Electrical Connecting Kit: QC-R001.
    b. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK) - Connector Hand Tool: QC-R003.
2. Manufacturers:
    a. Hager Companies (HA) - Quick Connect.
    b. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK) – QC-C Series.
    c. Stanley Hardware (ST) – WH Series.

204 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. Door Controls International (DC).
    b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
    c. Trimco (TC).

205 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.

1. Manufacturers:
    a. Arrow (AW).
    b. No Substitution.

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. 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.
4. Keyway: Match Facility Standard.

D. Permanent Cores: Manufacturer's standard; finish face to match lockset; complying with the following:
1. Interchangeable Cores: Core insert, removable by use of a special key; usable with other manufacturers' cylinders.

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. Existing System: Key locks to Owner's existing system.

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).
3. Construction Keys (where required): Ten (10).
4. Construction Control Keys (where required): Two (2).

G. Construction Keying: Provide temporary keyed construction cores.

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.

206 MECHANICAL LOCKS AND LATCHING DEVICES

A. Mortise Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.13, Series 1000, Operational Grade 1 certified. Locksets are to be manufactured with a corrosion resistant steel case and be field-reversible for handing without disassembly of the lock body.
1. Manufacturers:
a. Corbin Russwin Hardware (RU) – ML2000 Series.
b. Sargent Manufacturing (SA) – 8200 Series.
c. Schlage (SC) – L9000 Series.

207 ELECTROMECHANICAL LOCKING DEVICES

A. Electromechanical Mortise Locksets, Grade 1 (Heavy Duty): Subject to same compliance standards and requirements as mechanical mortise locksets, electrified locksets to be of type and design as specified below.
1. Electrified Lock Options: Where indicated in the Hardware Sets, provide electrified options including: outside door lock/unlock trim control, latchbolt and lock/unlock status monitoring, deadbolt monitoring, and request-to-exit signaling. Support end-of-line resistors contained within the lock case. Unless otherwise indicated, provide electrified locksets standard as fail secure.
2. 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.
3. High Security Monitoring: Provide lock bodies which have built-in request to exit monitoring and are provided with accompanying door position switches. Provide a resistor

configuration which is compatible with the access control system.

4. Manufacturers:
   a. Corbin Russwin Hardware (RU) - ML20900 Series.
   b. Sargent Manufacturing (SA) - 8200 Series.
   c. Schlage (SC) - L9000 EL/EU Series including both LX and RX options.

208 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.

B. Standards: Comply with the following:
   1. Strikes for Mortise Locks and Latches: BHMA A156.13.
   2. Strikes for Auxiliary Deadlocks: BHMA A156.36.
   3. Dustproof Strikes: BHMA A156.16.

209 ELECTRIC STRIKES

A. Surface Mounted Rim Electric Strikes: Surface mounted rim exit device electric strikes conforming to ANSI/BHMA A156.31, Grade 1, and UL Listed for both Burglary Resistance and for use on fire rated door assemblies. Construction includes internally mounted solenoid with two heavy-duty, stainless steel locking mechanisms operating independently to provide tamper resistance. Strikes tested for a minimum of 500,000 operating cycles. Provide strikes with 12 or 24 VDC capability supplied standard as fail-secure unless otherwise specified. Option available for latchbolt and latchbolt strike monitoring indicating both the position of the latchbolt and locked condition of the strike. Strike requires no cutting to the jamb prior to installation.
   1. Manufacturers:
      a. HES (HS) - 9500/9600 Series.

B. Provide electric strikes with in-line power controller and surge suppressor by the same manufacturer as the strike with the combined products having a five year warranty.

210 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 hex key dogging device to hold the pushbar and latch in a retracted position. Provide optional keyed cylinder dogging on devices where specified in Hardware Sets.
   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. 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.
6. 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.
7. 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.
8. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2” wide stiles.
9. Rail Sizing: Provide exit device rails factory sized for proper door width application.
10. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.

B. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 certified panic and fire exit hardware devices furnished in the functions specified in the Hardware Sets. Exit device latch to be stainless steel, pullman type, with deadlock feature.
    1. Manufacturers:
        a. Corbin Russwin Hardware (RU) - ED4000 / ED5000 Series.
        b. dormakaba Precision (PR) – Apex 2000 Series.
        c. Sargent Manufacturing (SA) - 80 Series.
        d. Von Duprin (VD) - 35A/98 XP 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. Corbin Russwin Hardware (RU) - 700/900 Series.
        b. Sargent Manufacturing (SA) - 980S Series.
        c. Von Duprin (VD) - 9954 Series.

211 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. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers 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.
    4. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.
    5. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.

6. 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. Corbin Russwin Hardware (RU) - DC6000 Series.
      b. LCN Closers (LC) - 4040XP Series.
      c. Sargent Manufacturing (SA) - 351 Series.
      d. Norton Door Controls (NO) - 7500 Series.

C. Door Closers, Surface Mounted (Cam Action): ANSI/BHMA 156.4, Grade 1 certified surface mounted, high efficiency 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 of the cam and roller design, one piece cast aluminum silicon alloy body with adjustable backcheck and independently controlled valves for closing sweep and latch speed.
   1. Manufacturers:
      a. Corbin Russwin (RU) - DC5000 Series.
      b. LCN Closers (LC) - 4040XPT Series.
      c. Norton Door Controls (NO) - 2800ST Series.
      d. Sargent Manufacturing (SA) - 422 Series.

212 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. Hiawatha, Inc. (HI).
      b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
      c. Trimco (TC).

213 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.

1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NPFA 252, Standard Methods of Fire Tests of Door Assemblies.

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. National Guard Products (NG).
2. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE).
3. Reese Enterprises, Inc. (RE).

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 1 EXECUTION

3.01 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.

3.02 PREPARATION

A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.

B. Wood Doors: Comply with ANSI/DHI A115-W series.

3.03 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:

1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
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 ANSIA117.1 "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.

3.04 FIELD QUALITY CONTROL

A. Field Inspection: Supplier will perform a final inspection of installed door hardware and state in report whether work complies with or deviates from requirements, including whether door hardware is properly installed, operating and adjusted.

3.05 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.

3.06 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.

3.07 DEMONSTRATION

A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.08 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. Refer to Section 080671 through 080678, Door Hardware Sets, for hardware sets for each school/phase of this project.

END OF SECTION

SECTION 088000 - GLAZING

PART 1 - GENERAL

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

B. This Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:

1. Doors

1.2 DEFINITIONS

A. Manufacturer: A firm that produces primary glass or fabricated glass as defined in referenced glazing publications.

B. Deterioration of Coated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in metallic coating.

PERFORMANCE REQUIREMENTS

C. General: Provide glazing systems capable of withstanding normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

D. Glass Design: Glass thicknesses indicated are minimums and are for detailing only. Confirm glass thicknesses by analyzing Project loads and in-service conditions. Provide glass lites for various size openings in nominal thicknesses indicated, but not less than thicknesses and in strengths (annealed or heat treated) required to meet or exceed the following criteria:

1. Glass Thicknesses: Select minimum glass thicknesses to comply with ASTM E 1300, according to the following requirements:
   a. Specified Design Wind Loads: As indicated.
   b. See Editing Instruction No. 6 in the Evaluations before deleting subparagraph above or below. If retaining above, design wind loads must be indicated, preferably on Drawings. If retaining below, basic wind speed, exposure category, and importance factor applicable to Project must be indicated, preferably on Drawings.
   c. Specified Design Wind Loads: Determine design wind loads applicable to Project from basic wind speed indicated in miles per hour (meters per second) at 33 feet (10 m) above grade, according to ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 6.4.2, "Analytic Procedure," based on mean roof heights above grade indicated on Drawings.
   d. Probability of breakage value specified in subparagraph below for vertical glazing is based on a design factor of 2.5 and is the basis for ASTM E 1300 load charts for loads of 60-second duration. Revise if other values and durations are required for Project.

e. Probability of Breakage for Vertical Glazing: 8 lites per 1000 for lites set vertically or not more than 15 degrees off vertical and under wind action.
   1) Load Duration: 60 seconds or less.
f. Maximum Lateral Deflection: For the following types of glass supported on all four edges, provide thickness required that limits center deflection at design wind pressure to 1/50 times the short side length or 1 inch (25 mm), whichever is less.
g. Minimum Glass Thickness for Exterior Lites: Not less than 6 mm.
h. Thickness of Tinted and Heat-Absorbing Glass: Provide the same thickness for each tint color indicated throughout Project.

E. Thermal Movements: Provide glazing that allows for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures acting on glass framing members and glazing components. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

F. Thermal and Optical Performance Properties: Provide glass with performance properties specified based on manufacturer's published test data, as determined according to procedures indicated below:

1. For monolithic-glass lites, properties are based on units with lites 6 mm thick.
2. Center-of-Glass U-Values: NFRC 100 methodology using LBL-35298 WINDOW 4.1 computer program, expressed as Btu/ sq. ft. x h x deg F (W/sq. m x K).
3. Center-of-Glass Solar Heat Gain Coefficient: NFRC 200 methodology using LBL-35298 WINDOW 4.1 computer program.
4. Solar Optical Properties: NFRC 300.

SUBMITTALS

G. Product Data: For each glass product and glazing material indicated.

H. Samples: For the following products, in the form of 12-inch square Samples for glass.

1. Each color of tinted float glass.
2. Coated vision glass.

I. Glazing Schedule: Use same designations indicated on Drawings for glazed openings in preparing a schedule listing glass types and thicknesses for each size opening and location.

J. Product Certificates: Signed by manufacturers of glass and glazing products certifying that products furnished comply with requirements.

K. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

L. Product Test Reports: From a qualified testing agency indicating the following products comply with requirements, based on comprehensive testing of current products:

1. Tinted float glass.
2. Coated float glass.
3. Glazing gaskets.

M. Warranties: Special warranties specified in this Section.

QUALITY ASSURANCE

N. Installer Qualifications: An experienced installer who has completed glazing similar in material, design, and extent to that indicated for this Project; whose work has resulted in glass installations with a record of successful in-service performance; and who employs glass installers for this Project who are certified under the National Glass Association Glazier Certification Program as Level 2 (Senior Glaziers) or Level 3 (Master Glaziers).

O. Installer Qualifications: An experienced installer who has completed glazing similar in material, design, and extent to that indicated for Project and whose work has resulted in construction with a record of successful in-service performance.

P. Source Limitations for Clear Glass: Obtain clear float glass from one primary-glass manufacturer.

Q. Source Limitations for Tinted Glass: Obtain tinted, heat-absorbing, and light-reducing float glass from one primary-glass manufacturer for each tint color indicated.

R. Source Limitations for Coated Glass: Obtain coated glass from one manufacturer for each type of coating and each type and class of float glass indicated.

S. Source Limitations for Glazing Accessories: Obtain glazing accessories from one source for each product and installation method indicated.

T. Glass Product Testing: Obtain glass test results for product test reports in "Submittals" Article from a qualified testing agency based on testing glass products.

1. Glass Testing Agency Qualifications: An independent testing agency with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548.
2. Glass Testing Agency Qualifications: An independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.

U. Fire-Rated Door Assemblies: 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 NFPA 252.

V. Fire-Rated Window Assemblies: 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 NFPA 257.

W. Safety Glass: Category II materials complying with testing requirements in 16 CFR 1201 and ANSI Z97.1.

1. Subject to compliance with requirements, permanently mark safety glass with certification label of Safety Glazing Certification Council or another certification agency acceptable to authorities having jurisdiction.

X. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. GANA Publications: GANA'S "Glazing Manual" and "Laminated Glass Design Guide."

DELIVERY, STORAGE, AND HANDLING

Y. Protect glazing materials according to manufacturer's written instructions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

PROJECT CONDITIONS

Z. 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.

WARRANTY

AA. General Warranty: 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.

BB. Manufacturer's Special Warranty on Coated-Glass Products: Written warranty, made out to Owner and signed by coated-glass manufacturer agreeing to furnish replacements for those coated- glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

PRODUCTS AND MANUFACTURERS

A. Available Products: Subject to compliance with requirements, provide glass by the following but not limited to:

1. Basis of Design: Viracon Insulating Laminated Glass
2. Or approved equal.

MATERIALS

A. Insulating-Glass Unit:
1. Factory-assembled units consisting of dual-sealed lites of glass separated by a dehydrated interspace, with manufacturer’s standard spacer material and construction, per ASTM E 2190.

B. Heat-Treated Float Glass, Fully Tempered:

1. ASTM C 1048; Type I (transparent flat glass); Quality-Q3; Kind FT, of class and condition indicated: where safety glass is indicated. Safety glazing must comply with ANSI Z97.1 and CPSC 16CFR-1201

C. Laminated Glass:

1. ASTM C 1172, with manufacturer’s standard polyvinyl butyral or cured resin interlayer.

GLAZING GASKETS

A. Dense Compression Gaskets: Molded or extruded gaskets of material indicated below, complying with standards referenced with name of elastomer indicated below, and of profile and hardness required to maintain watertight seal:

1. Neoprene, ASTM C 864.
2. EPDM, ASTM C 864.
3. Silicone, ASTM C 1115.
4. Thermoplastic polyolefin rubber, ASTM C 1115.
5. Any material indicated above.

B. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned gaskets of material indicated below; complying with ASTM C 509, Type II, black; and of profile and hardness required to maintain watertight seal:

1. Neoprene.
2. EPDM.
3. Silicone.
4. Thermoplastic polyolefin rubber.
5. Any material indicated above.

MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, 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.

C. Setting Blocks: Elastomeric material with a Shore A durometer hardness of 85, plus or minus 5.

D. Spacers: Elastomeric blocks or continuous extrusions with a Shore A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

FABRICATION OF GLASS AND OTHER GLAZING PRODUCTS

A. Fabricate glass and other glazing products in sizes required to glaze 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 standard, to comply with system performance requirements.

A. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites in a manner that produces square edges with slight kerfs at junctions with indoor and outdoor faces.

B. Grind smooth and polish exposed glass edges.

GLAZING TYPES:

A. **Type G-1 (for all interior doors)**:

1. Overall Unit Thickness: 1/4 inch clear Tempered Glass with VUE-50 on Layer #2

PART 3 - EXECUTION

EXAMINATION

A. Examine framing glazing, 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 system.
3. Minimum required face or edge clearances.
4. Effective sealing between joints of glass-framing members.

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

PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

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. Glazing channel dimensions, as indicated on Drawings, provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.

C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.

E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

G. Provide spacers for glass lites where the length plus width is larger than 50 inches (1270 mm) as follows:

1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
2. Provide 1/8-inch (3-mm) minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

J. 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.

K. 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.

GASKET GLAZING (DRY)

A. Fabricate compression gaskets in lengths recommended by gasket manufacturer to fit openings exactly, with stretch allowance 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. 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. Install gaskets so they protrude past face of glazing stops.

PROTECTION AND CLEANING

A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove them immediately as recommended by glass manufacturer.

C. 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 build-up of dirt, scum, alkaline deposits, or stains; remove as recommended by glass manufacturer.

D. Remove and replace glass that is broken, chipped, cracked, abraded, or damaged in any way, including natural causes, accidents, and vandalism, during construction period.

A. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended by glass manufacturer.

END OF SECTION 088000

SECTION 088000.11
GLAZING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Insulating glass units.

B. Glazing units.

C. Glazing compounds and accessories.

1.02 RELATED REQUIREMENTS

A. Section 079200 - Joint Sealants: Sealants for other than glazing purposes.

B. Section 081113 - Hollow Metal Doors and Frames: Glazed borrowed lites and borrowed lites.

C. Section 081433 - Stile and Rail Wood Doors: Glazed lites in doors.

D. Section 081613 - Fiberglass Doors: Glazed lites in doors.

E. Section 084213.13 - SECURITY ALUMINUM ENTRANCES: Entrance door at security vestibule.

F. Section 084313 - Aluminum-Framed Storefronts: Glazing furnished as part of storefront assembly.

G. Section 084333.13 - ALUMINUM-FRAMED SECURITY STOREFRONTS: Storefront framing for security vestibule.

1.03 REFERENCE STANDARDS

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials.

B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test.

C. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures.

D. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers.

E. ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass.

F. ASTM C1349 - Standard Specification for Architectural Flat Glass Clad Polycarbonate.

G. ASTM C1376 - Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass.

H. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings.

I. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation.

J. GANA (GM) - GANA Glazing Manual.

K. GANA (SM) - GANA Sealant Manual.

L. GANA (LGRM) - Laminated Glazing Reference Manual.

M. IGMA TM-3000 - North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial & Residential Use.

N. NFRC 100 - Procedure for Determining Fenestration Product U-factors.

O. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence.

P. NFRC 300 - Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems.

Q. UL 752 - Standard for Bullet-Resisting Equipment.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by each of the affected installers.

1.05 SUBMITTALS

A. Product Data on Insulating Glass Unit and Glazing Unit Glazing Types: Provide structural, physical and environmental characteristics, size limitations, special handling and installation requirements.

B. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements, and identify available colors.

C. Samples: Submit two samples 12 by 12 inch in sizeof glass units.

D. Manufacturer's Certificate: Certify that glass and glazing products meets or exceeds specified requirements.

E. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016000 - Product Requirements, for additional provisions.

1.06 QUALITY ASSURANCE

A. Perform Work in accordance with GANA (GM), GANA (SM), GANA (LGRM), and IGMA TM-3000 for glazing installation methods. Maintain one copy on site.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

C. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years documented experience.

1.07 FIELD CONDITIONS

A. Do not install glazing when ambient temperature is less than 40 degrees F.

B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.08 WARRANTY

A. Insulating Glass Units: Provide a ten (10) year manufacturer warranty to include coverage for seal failure, interpane dusting or misting, including replacement of failed units.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Float Glass Manufacturers:
   1. AGC Glass Company North America, Inc..
   2. Guardian Industries Corp..
   3. Pilkington North America Inc..
   4. PPG Industries, Inc..
   5. Or equal.

202 PERFORMANCE REQUIREMENTS - EXTERIOR GLAZING ASSEMBLIES

A. Provide type and thickness of exterior glazing assemblies to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of glass.
   1. Design Pressure: Calculated in accordance with ASCE 7.
   2. Comply with ASTM E1300 for design load resistance of glass type, thickness, dimensions, and maximum lateral deflection of supported glass.
   3. Provide glass edge support system sufficiently stiff to limit the lateral deflection of supported glass edges to less than 1/175 of their lengths under specified design load.
   4. Glass thicknesses listed are minimum.

B. Thermal and Optical Performance: Provide exterior glazing products with performance properties as indicated. Performance properties are in accordance with manufacturer's published data as determined with the following procedures and/or test methods:
   1. Center of Glass U-Value: Comply with NFRC 100 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
   2. Center of Glass Solar Heat Gain Coefficient (SHGC): Comply with NFRC 200 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
   3. Solar Optical Properties: Comply with NFRC 300 test method.

203 GLASS MATERIALS

A. Laminated Glass: Float glass laminated in accordance with ASTM C1172.
   1. Laminated Safety Glass: Complies with ANSI Z97.1 - Class B or 16 CFR 1201 - Category I impact test requirements.

204 INSULATING GLASS UNITS

A. Manufacturers:
   1. Basis of Design: AGC Glass Company North America, Inc.; Energy Select 28.
   2. Guardian Industries Corp.
   3. Pilkington North America Inc:.
   4. PPG Industries, Inc.
   5. Or equal.

B. Insulating Glass Units: Types as indicated.
   1. Durability: Certified by an independent testing agency to comply with ASTM E2190.
   2. Coated Glass: Comply with requirements of ASTM C1376 for pyrolytic (hard-coat) or magnetic sputter vapor deposition (soft-coat) type coatings on flat glass; coated vision glass, Kind CV; coated overhead glass, Kind CO; or coated spandrel glass, Kind CS.
   3. Metal Edge Spacers: Aluminum, bent and soldered corners.
   4. Spacer Color: Black.
   5. Edge Seal:
      a. Dual-Sealed System: Provide polyisobutylene sealant as primary seal applied between spacer and glass panes, and silicone, polysulfide, or polyurethane sealant as secondary seal applied around perimeter.
   6. Color: Black.
   7. Purge interpane space with dry air, hermetically sealed.

C. Type IG-2 - Insulating Glass Units: Safety glazing.
   1. Applications:
      a. Glazed lites in exterior doors.
      b. Glazed sidelights and panels next to doors.
      c. Other locations required by applicable federal, state, and local codes and regulations.

d. Other locations indicated on drawings.
2. Space between lites filled with air.
3. Glass Type: Same as float glass except use fully tempered float glass for both outboard and inboard lites.
4. Tint: Clear.
5. Total Thickness: 1 inch.
6. Thermal Transmittance (U-Value), Winter - Center of Glass: 0.29, nominal.
7. Visible Light Transmittance (VLT): 69 percent, nominal.
8. Solar Heat Gain Coefficient (SHGC): 34 percent, nominal.
9. Visible Light Reflectance, Outside: 12 percent, nominal.
10. Glazing Method: Dry glazing method, gasket glazing.

205 GLAZING UNITS

A. Type G-1 - Monolithic Safety Glazing: Non-fire-rated.
1. Applications:
a. Glazed lites in doors, except fire doors.
b. Glazed sidelights to doors, except in fire-rated walls and partitions.
c. Other locations required by applicable federal, state, and local codes and regulations.
d. Other locations indicated on drawings.
2. Glass Type: Fully tempered safety glass as specified.
3. Tint: Clear.
4. Thickness: 1/4 inch, nominal.
5. Visible Light Transmittance (VLT): 89 percent, nominal.
6. Visible Light Reflectance, Outside: 9 percent, nominal.
7. Glazing Method: Dry glazing method, gasket glazing.

B. Type BG-1 - Glass-Clad Polycarbonate Security Glazing: Laminated glass and polycarbonate, 3-Ply; ASTM C1349.
1. Applications: Locations as indicated on drawings.
2. Tint: Clear.
3. Thickness: 1 1/8 inch.
4. Outer Lite: Tempered glass.
5. Interlayer: Polyvinyl butyral (PVB), thickness as required to meet performance criteria.
6. Middle Lite: Polycarbonate.
7. Interlayer , Inboard Side : Polyvinyl butyral (PVB), thickness as required to meet performance criteria.
8. Inside Lite: Polycarbonate.
9. Performance Criteria:
a. Bullet Resistance: Pass UL 752 tests in compliance with ballistic criteria level and weapon description indicated; Level 3 - .44 magnum lead semi-wadcutter gas checked.
10. Glazing Method: As required to meet performance criteria.
11. Manufacturers:
a. Global Security Glazing; UL Level 3 - Secur-Tem + Poly (Basis of Design).
b. Or equal.

206 ACCESSORIES

A. Setting Blocks: Silicone, with 80 to 90 Shore A durometer hardness; ASTM C864 Option II. Length of 0.1 inch for each square foot of glazing or minimum 4 inch by width of glazing rabbet space minus 1/16 inch by height to suit glazing method and pane weight and area.

B. Spacer Shims: Neoprene, 50 to 60 Shore A durometer hardness; ASTM C864 Option II. Minimum 3 inch long by one half the height of the glazing stop by thickness to suit application, self adhesive on one face.

C. Glazing Splines: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C864 Option II; color black.

D. Glazing Clips: Manufacturer's standard type.

PART 3 EXECUTION

3.01 VERIFICATION OF CONDITIONS

A. Verify that openings for glazing are correctly sized and within tolerances, including those for size, squareness, and offsets at corners.

B. Verify that the minimum required face and edge clearances are being provided.

C. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and support framing is ready to receive glazing system.

D. Verify that sealing between joints of glass framing members has been completed effectively.

E. Proceed with glazing system installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Clean contact surfaces with appropriate solvent and wipe dry within maximum of 24 hours before glazing. Remove coatings that are not tightly bonded to substrates.

B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.

C. Prime surfaces scheduled to receive sealant where required for proper sealant adhesion.

3.03 INSTALLATION, GENERAL

A. Install glazing in compliance with written instructions of glass, gaskets, and other glazing material manufacturers, unless more stringent requirements are indicated, including those in glazing referenced standards.

B. Do not exceed edge pressures around perimeter of glass lites as stipulated by glass manufacturer.

C. Set glass lites of system with uniform pattern, draw, bow, and similar characteristics.

D. Set glass lites in proper orientation so that coatings face exterior or interior as indicated.

E. Prevent glass from contact with any contaminating substances that may be the result of construction operations such as, and not limited to the following; weld splatter, fire-safing, plastering, mortar droppings, etc.

3.04 INSTALLATION - DRY GLAZING METHOD (GASKET GLAZING)

A. Application - Exterior and/or Interior Glazed: Set glazing infills from either the exterior or the interior of the building.

B. Place setting blocks at 1/4 points with edge block no more than 6 inch from corners.

C. Rest glazing on setting blocks and push against fixed stop with sufficient pressure on gasket to attain full contact.

D. Install removable stops without displacing glazing gasket; exert pressure for full continuous contact.

3.05 INSTALLATION - WET/DRY GLAZING METHOD (TAPE AND SEALANT)

A. Application - Interior Glazed: Set glazing infills from the interior of the building.

B. Cut glazing tape to length and install against permanent stops, projecting 1/16 inch above sight line.

C. Place setting blocks at 1/4 points with edge block no more than 6 inch from corners.

D. Rest glazing on setting blocks and push against tape to ensure full contact at perimeter of pane or unit.

E. Install removable stops, spacer shims inserted between glazing and applied stops at 24 inch intervals, 1/4 inch below sight line.

F. Fill gaps between pane and applied stop with GC-2 type sealant to depth equal to bite on glazing, to uniform and level line.

G. Carefully trim protruding tape with knife.

3.06 FIELD QUALITY CONTROL

A. See Division 01 section on quality requirements for additional requirements.

B. Glass and Glazing product manufacturers to provide field surveillance of the installation of their products.

C. Monitor and report installation procedures and unacceptable conditions.

3.07 CLEANING

A. See Division 01 section on construction waste management and disposal for additional requirements.

B. Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.

C. Remove non-permanent labels immediately after glazing installation is complete.

D. Clean glass and adjacent surfaces after sealants are fully cured.

E. Clean glass on both exposed surfaces not more than 4 days prior to Date of Substantial Completion in accordance with glass manufacturer's written recommendations.

3.08 PROTECTION

A. After installation, mark pane with an 'X' by using removable plastic tape or paste; do not mark heat absorbing or reflective glass units.

B. Remove and replace glass that is damaged during construction period prior to Date of Substantial Completion.

END OF SECTION

SECTION 088723 – SAFETY FILMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Clear and Tinted Window Safety films.

1.2 RELATED SECTIONS

A. Section 084000 – Entrances and Storefronts.
B. Section 085000 - Windows.

1.3 REFERENCES

A. American National Standards Institute (ANSI):
   1. ANSI Z97.1 - Safety Glazing Materials Used In Buildings - Safety Performance Specifications and Methods of Test.

B. ASTM International (ASTM):
   1. ASTM E 308 – Standard Recommended Practice for Spectrophotometry and Description of Color in CIE 1931 System
   2. ASTM E 903 – Standard methods of Test for Solar Absorbance, Reflectance and Transmittance of Materials Using Integrating Spheres.
   3. ASTM D 882 – Standard Test Method for Tensile Properties of Thin Plastic Sheeting.
   4. ASTM D 1044 – Standard Method of Test for Resistance of Transparent Plastics to Surface Abrasion (Taber Abrader Test).
   5. ASTM D 2582 – Standard Test Method for Puncture-Propagation Tear Resistance of Plastic Film and Thin Sheeting.
   6. ASTM D 4830 – Standard Test Method for Characterizing Thermoplastic Fabrics used in Roofing and Waterproofing.
   7. ASTM G 90 – Standard Practice for Performing Accelerated Outdoor Weatherizing for Non-metallic Materials Using Concentrated Natural Sunlight.
   8. ASTM G 26 – Standard Practice for Performing Accelerated Outdoor Weatherizing for Non-metallic Materials Using Concentrated Natural Sunlight.
   9. ASTM E 84 – Standard Method of Test for Surface Burning Characteristics of Building Materials.
   10. ASTM D 1004 – Standard Method of Test for Resistance of Transparent Plastics to Tearing (Graves Tear Test).
   11. ASTM E 1886 – Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials.
   12. ASTM E 1996 – Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors and Impact Protective Systems Impacted by Windborne Debris in Hurricanes.
   13. ASTM F 1642 – Standard Method of Test for Glazing and Glazing Systems Subject to Airblast Loadings, as adapted by the U.S. Government GSA Test Standard Protocols.
   14. ASTM F 2912 – Standard Specification for Glazing and Glazing Systems Subjected to Airblast Loadings.

C. The Consumer Product Safety Commission (CPSC):
   1. 16 CFR, Part 1201, Safety Standard for Architectural Glazing Material

D. GSA-TS01-2003
   1. General Services Administration Standard Test for Glazing and Glazing Systems Subject to

Airblast Loadings.

E. Window
1. A Computer Tool for Analyzing Window Thermal Performance, Lawrence Berkeley Laboratory.

1.4 PERFORMANCE REQUIREMENTS

A. Safety Film – Ultra S800:
1. Tensile Strength (ASTM D882):
a. Base Film: 32,000 psi (MD) / 32,000 psi (TD)
b. Coated Film: 32,000 psi (MD) / 32,000 psi (TD)
2. Break Strength (ASTM D882):
a. Base Film: 250 lb/in (MD) / 250 lb/in (TD)
b. Coated Film: 245 lb/in (MD) / 265 lb/in (TD)
3. Percent Elongation at Break (ASTM D882):
a. Base Film: 115% (MD) / 115% (TD)
b. Coated Film: 132% (MD) / 130% (TD)
4. Yield Strength at 3% Elongation:
a. Base Film: 12,000 psi (MD)
b. Coated Film: 15,000 psi (MD)
5. Percent Elongation at Yield (ASTM D882):
a. Base Film: 7% (MD)
b. Coated Film: 9% (MD)
6. Modulus (ASTM D882):
a. Base Film: 550 kpsi (MD) / 600 kpsi (TD)
b. Coated Film: 460 kpsi (MD) / 486 kpsi (TD)
7. Graves Tear Resistance (ASTM D1004):
a. Maximum Force (lbs):
1) Base Film: 40 (MD) / 40 (TD)
2) Coated Film: 40 (MD) / 40 (TD)
b. Maximum Extension (in):
1) Base Film: 0.45 (MD) / 0.65 (TD)
2) Coated Film: 0.50 (MD) / 0.57 (TD)
c. Graves Area Tear Resistance (lbs%):
1) Base Film: 1,100 (MD) / 1,300 (TD)
2) Coated Film: 1,100 (MD) / 1,300 (TD)
d. Puncture Propagation Tear Resistance (ASTM D2582):
1) Coated Film: 9 lbf (MD) / 10 lbf (TD)
8. Solar Performance Properties: Film applied to 1/4" thick clear glass
a. Visible Light Transmission: 88%
b. Visible Reflection: not more than 9%
c. Ultraviolet Transmission: less than 1% (300 – 380 nm)
d. Solar Heat Gain Coefficient: 0.79

B. Safety Film – Ultra NV S25:
1. Tensile Strength (ASTM D882):
a. Base Film: 28,000 psi (MD) / 27,000 psi (TD)
2. Break Strength (ASTM D882):
a. Base Film: 235 lb/in (MD) / 230 lb/in (TD)
3. Percent Elongation at Break (ASTM D882):
a. Base Film: 120% (MD) / 85% (TD)
4. Percent Elongation Yield (ASTM D882): 8%
5. Yield Strength (ASTM D882): 17,000 psi (MD)
6. Graves Tear Resistance (ASTM D1004): 1,100 lbs% (MD) / 900 lbs% (TD)
7. Puncture Propagation Tear Resistance (ASTM D2582): 10 lbf

8. Modulus (ASTM D882): 600 kps
9. Solar Performance Properties: Film applied to 1/4" thick clear glass
    a. Visible Light Transmission: 27%
    b. Visible Reflection: 7% (interior) / 17% (exterior)
    c. Ultraviolet Transmission: less than 0.5% (300 – 380 nm)
    d. Solar Heat Gain Coefficient: 0.42
    e. Total Solar Energy Rejected: 58%

1.5 SUBMITTALS

A. Submit under provisions of Section 013300 – Submittal Requirements

B. Product Data:
1. Manufacturer's data sheets on each product to be used.
2. Preparation instructions and recommendations.
3. Storage and handling requirements and recommendations.
4. Typical installation methods.

C. Verification Samples: 4 inches by 6 inches minimum sample of glazing film.

D. Shop Drawings: Include details of materials, construction and finish. Include relationship with adjacent construction.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with a minimum ten years successful documented experience.

B. Installer Qualifications:
1. Installer: Glazing film shall be applied by installers with a minimum of five years successful experience installing products of the same type and scope as specified.
2. Provide documentation that the installer is certified by glazing film manufacturer to perform the work specified.
3. Provide references of three projects where the installer has applied safety and security film or similar nature and size. The list should include:
    a. Name of building.
    b. The name and telephone number of project manager.
    c. Type of glass.
    d. Type of film and attachment system.
    e. Amount of film and attachment system installed.
    f. Date of completion.

C. Source Limitations: Provide each type of product from a single manufacturing source to ensure uniformity.

D. Mock-Up: Construct a mock-up with actual materials in sufficient time for Architect's review and to not delay construction progress. Locate mock-up as acceptable to Architect and provide temporary foundations and support.
1. Intent of mock-up is to demonstrate quality of workmanship and visual appearance.
2. If mock-up is not acceptable, rebuild mock-up until satisfactory results are achieved.
3. Retain mock-up during construction as a standard for comparison with completed work.
4. Do not alter or remove mock-up until work is completed or removal is authorized.

1.7 PRE-INSTALLATION CONFERENCE

A. Convene a conference approximately two weeks before scheduled commencement of the Work. Attendees shall include Architect, Contractor and trades involved. Agenda shall include schedule,

responsibilities, critical path items and approvals.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store and handle in strict compliance with manufacturer's written instructions and recommendations.

B. Protect from damage due to weather, excessive temperature, and construction operations.

1.9 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 recommended limits.

B. Surface temperature: Do not apply glazing film when surface temperature is less than 40 degrees Fahrenheit.

C. Prior to installation, the glass and frames shall be inspected for surface contamination, damage, or other defects that may adversely affect the performance of the glazing film.

1.10 SEQUENCING

A. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

1.11 WARRANTY

A. Manufacturer's Warranty: Provide manufacturer's standard limited warranty.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide products by the following:
   1. 3M Commercial Solutions Division
      a. Clear Safety Film: Ultra S800
      b. Tinted Safety Film: Ultra NV S25
   2. Or approved equal.

2.2 SAFETY AND SECURITY WINDOW FILMS

A. Ultra S800:
   1. Flammability or approved equal:
      a. Manufacturer shall provide independent test data showing that the window film shall meet the requirements of a Class A interior Finish for Building Materials for both Flame Spread Index and Smoked Development Values per ASTM E84:
         1) Flame Spread Index (FDI): 5
         2) Smoke Developed Index (SDI): 25
   2. Abrasion Resistance:
      a. Manufacturer shall provide independent test data showing that the film shall have a surface coating that is resistant to abrasion such that, less than 5% increase of transmitted light haze will result in accordance with ASTM D1044 using 100 cycles, 500 grams weight, and the CS10F Calibrase Wheel.
   3. Adhesion to Glass:
      a. Manufacturer shall provide independent test data showing that the film shall have a 180 degree peel strength (adhesion to glass) according to ASTM D1044 of at least 6 lbs/in.
   4. Adhesive System:

a. The fill shall be supplied with a high mass pressure sensitive weatherable acrylate adhesive applied uniformly over the surface opposite the abrasion resistant coated surface. The adhesive shall be pressure sensitive (not water activated) and physically bond (not chemically bond) to the glass. The adhesive shall be essentially optically flat and shall meet the following criteria:
   1) Viewing the film from a distance of ten feet at angles up to 45 degrees from either side of the glass, the film itself shall not appear distorted.
   2) It shall not be necessary to seal around the edges of the applied film system with a lacquer or other substances in order to prevent moisture or free water from penetrating under the film system.

5. Impact Resistance for Safety Glazing:
   a. Manufacturer shall provide independent test data showing that the film, when applied to either side of the window glass, shall meet the 400 ft-lb impact requirements of 16 CFR 1201 (Category 2) and ANSI Z97.1 (Class A, Unlimited). Testing shall be done with film applied both on 1/8 inch and 1/4 inch annealed glass.
6. Impact Protection: per ASTM E1886 / E1996

B. Ultra NV S25 or approved equal:
1. Flammability:
   a. Manufacturer shall provide independent test data showing that the window film shall meet the requirements of a Class A interior Finish for Building Materials for both Flame Spread Index and Smoked Development Values per ASTM E84.
2. Abrasion Resistance:
   a. Manufacturer shall provide independent test data showing that the film shall have a surface coating that is resistant to abrasion such that, less than 5% increase of transmitted light haze will result in accordance with ASTM D1044 using 50 cycles, 500 grams weight, and the CS10F Calibrase Wheel.
3. Adhesion to Glass:
   a. Manufacturer shall provide independent test data showing that the film shall have a 180 degree peel strength (adhesion to glass) according to ASTM D1044 of at least 6 lbs/in.
4. Adhesive System:
   a. The fill shall be supplied with a high mass pressure sensitive weatherable acrylate adhesive applied uniformly over the surface opposite the abrasion resistant coated surface. The adhesive shall be pressure sensitive (not water activated) and physically bond (not chemically bond) to the glass. The adhesive shall be essentially optically flat and shall meet the following criteria:
      1) Viewing the film from a distance of ten feet at angles up to 45 degrees from either side of the glass, the film itself shall not appear distorted.
      2) It shall not be necessary to seal around the edges of the applied film system with a lacquer or other substances in order to prevent moisture or free water from penetrating under the film system.
5. Impact Resistance for Safety Glazing:
   a. Manufacturer shall provide independent test data showing that the film, when applied to either side of the window glass, shall meet the 400 ft-lb impact requirements of 16 CFR 1201 (Category 2) and ANSI Z97.1 (Class A, Unlimited).
6. Impact Protection: per ASTM E1886 / E1996

2.3 IMPACT PROTECTION FILM ATTACHMENT SYSTEMS

A. Impact Protection Adhesive: Weatherable, UV-Resistant, Moisture Curable Structural Sealant Wet Glazed.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product by the following:
   a. 3M Commercial Solutions Division
      1) 3M Impact Protection Adhesive (IPA)

2) Or approved equal.

2. Color:
   a. Black

3. Material Properties (supplied):
   a. Typical Cure Time: 3-7 days (25 degrees C, 50% RH)
   b. Full Adhesion: 7-14 days
   c. Tack-Free Time (ASTM D5895): 21 minutes (25 degrees C, 50% RH)
   d. Flow, Sag or Slump (ASTM D2202): 0 inches
   e. Specific Gravity: 1.4
   f. Working Time: 10-20 minutes (25 degrees C, 50% RH)
   g. VOC Content: 16 g/L

4. Material Properties (as cured – 21 days at 25 degrees C, 50% RH)
   a. Ultimate Tensile Strength (ASTM D412): 380 psi (2.62 MPa)
   b. Ultimate Elongation (ASTM D412): 640 psi
   c. Durometer Hardness, Shore A (ASTM D 2240): 38-39 points
   d. Tear Strength, Die B (ASTM D624): 72 ppi

5. Uniformity: Product shall have uniform consistency and appearance, with no clumping.

6. Impact Resistance and Pressure Cycling:
   a. As part of a filmed glass system, film attachment shall demonstrate ability to withstand Medium Large Missile C and Small Missile A impact, with subsequent pressure cycling (per ASTM E1996 and E 1886) at +/- 75 psf design pressure.
   b. As part of a filmed glass system, attachment shall demonstrate ability withstand structural load requirements of ASTM E330 when tested at +/- 100 psf design pressure.

7. Blast Hazard Mitigation:
   a. GSA level “2” rating (minimal hazard) of “2” with minimum blast load of 11 psi overpressure and 55 psi msec blast impulse.
   b. GSA level “3B” rating (low hazard) with minimum blast load of 10 psi overpressure and 89 psi msec blast impulse.
   c. ASTM F1642 rating of “Low Hazard” with minimum blast load of 8 psi overpressure and 42 psi msec blast impulse.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine glass surfaces to receive new film and verify that they are not free from defects and imperfections, which will affect the final appearance. Correct all such deficiencies before starting film application.

3.2 PREPARATION

A. The window and window framing shall be cleaned thoroughly with a neutral cleaning solution. The inside surface the window glass shall be scraped with stainless steel razor blades with clean, sharp edges to ensure the removal of any foreign contaminants without damages to the glass surface.

B. Drop cloths or other absorbent material shall be placed on the window sill or sash to absorb moisture accumulation generated by the film application.

3.3 INSTALLATION

A. The film shall be applied as to the specifications of the manufacturer by an Authorized

Dealer/Applicator.

1. Materials shall be delivered to the job site with the manufacturer's labels intact and legible.
2. In order to minimize waste, the film shall be cut to the specification utilizing a vertical dispenser designated for that purpose. The film edges shall be cut neatly and square at a uniform distance of 1/8 inch to 1/16 inch of the window sealing device.
3. The film shall be wet-applied using clean water and slip solutions to facilitate positioning of the film onto glass.
4. To ensure efficient removal of excess water from the underside of the film and to maximize bonding of the pressure sensitive adhesive, polyplastic bladed squeegees shall be used.
5. Upon completion, the film may have a dimpled appearance from residual moisture. Said moisture shall, under reasonable weather conditions, dry flat with no moisture dimples within a period of 30 calendar days when viewed under normal viewing conditions.
6. After installation, any leftover material shall be removed and the work area shall be returned to original condition. Use all necessary means to protect the film before, during and after the installation.

B. Impact Protection Adhesive Installation:

1. The film attachment system shall be applied according to the specifications of the Manufacturer by an Authorized Dealer/Applicator. Refer to the manufacturer's publications, Impact Protection Adhesive Attachment System Installation Instructions.
   a. For impact resistance and building envelope protection: minimum 3/8 inch bead overlap on both frame and film (excluding glazing stops or compression gaskets).
2. To ensure a straight and consistent bead width is achieved, masking tape shall be applied to film and frame surfaces prior to application.
3. With prior approval of the building owner or property manager, existing compression gaskets may be partially removed or trimmed to allow for a thinner bead and stronger anchorage. If removing the gaskets, sections shall be trimmed approximately 3-inches in length along all sides of the window to help secure the glazing during application and curing of the Impact Protection Adhesive.
4. The Impact Protection Adhesive shall be dispensed with a caulk gun with nozzle opening diameter sized to match the approximate size of the desired bead width.
5. A plastic putty knife or other tool with a clean straight edge shall be used to trowel and smooth out the adhesive. The completed adhesive bead shall be relatively triangular in shape.
6. Any masking tape used shall be carefully removed within 10 minutes after applying the wet glaze.

3.4 CLEANING

A. The film may be washed using common window cleaning solutions, including ammonia solutions, 30 days after application. Abrasive type cleaning agents and bristle brushes, which could scratch the film, must not be used. Synthetic sponges or soft cloths are recommended.

END OF SECTION 088723

SECTION 088733 – DECORATIVE FILM

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. Architectural Window Film of the Following Types:
   1. Tinted Sun Control Film

1.2 RELATED SECTIONS

A. Section 085000 – Windows

1.3 REFERENCES

A. ASHRAE - American Society for Heating, Refrigeration, and Air Conditioning Engineers; Handbook of Fundamentals.

B. ASTM International (ASTM):
   1. ASTM E 84 - Standard Method of Test for Surface Burning Characteristics of Building Materials.
   2. ASTM E 308 - Standard Recommended Practice for Spectrophotometry and Description of Color in CIE 1931 System.
   3. ASTM E 903 - Standard Methods of Test for Solar Absorbance, Reflectance and Transmittance of Materials Using Integrating Spheres.

1.4 PERFORMANCE REQUIREMENTS

A. Flammability: Surface burning characteristics when tested in accordance ASTM E 84, demonstrating film applied to glass rated Class A for Interior Use:
   1. Flame Spread Index: no greater than 25.
   2. Smoke Developed Index: no greater than 450.

1.5 SUBMITTALS

A. Submit under provisions of Section 013000 - Administrative Requirements.

B. Product Data: Manufacturer's current technical literature on each product to be used, including:
   1. Manufacturer's Data Sheets.
   2. Preparation instructions and recommendations.
   3. Storage and handling requirements and recommendations.
   4. Installation methods.

C. Verification Samples: For each film specified, two samples representing actual film color and pattern.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: All primary products specified in this section will be supplied by a single manufacturer with a minimum of ten years experience.

B. Installer Qualifications: All products listed in this section are to be installed by a single installer with a minimum of five years demonstrated experience in installing products of the same type and scope as specified.
   1. Provide documentation that the installer is authorized by the Manufacturer to perform Work specified in this section.

2. Provide a commercial building reference list of 5 properties where the installer has applied window film. This list will include the following information:
    a. Name of building.
    b. The name and telephone number of a management contact.
    c. Type of glass.
    d. Type of film and/or film attachment system.
    e. Amount of film and/or film attachment system installed.
    f. Date of completion.

C. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
    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.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Follow Manufacturer's instructions for storage and handling.

B. Store products in manufacturer's unopened packaging until ready for installation.

C. Store and dispose of hazardous materials, and materials contaminated by hazardous materials, in accordance with requirements of local authorities having jurisdiction.

1.8 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 recommended limits.

1.9 WARRANTY

A. At project closeout, provide to Owner or Owner's Representative an executed current copy of the manufacturer's standard limited warranty against manufacturing defect, outlining its terms, conditions, and exclusions from coverage.

B. In order to validate warranty, installation must be performed by an Authorized 3M dealer and according to Manufacturer's installation instructions. Verification of Authorized 3M dealer can be confirmed by submission of active 3M dealer code number.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product by the following:

1. 3M Commercial Solutions Division
    a. Tinted Film: Night Vision 25 (**To be applied to second floor windows at Silver Bay if alternate No. 7 is not accepted**).
2. Or approved equal

2.2 DECORATIVE FILMS

A. Material Properties
    1. General: Glass finish field applied application to glass material as visual opaque or decorative graphic.
    2. Film: Tinted.

3. Visible Light:
   a. Reflected (Interior): 6%
   b. Reflected (Exterior): 8%
   c. Transmitted: 26%
4. Total Solar Energy Rejected: 58%
5. Solar Heat Gain Coefficient: 0.42 (G Value)
6. U-Value
   a. 1.03 btu/hft^2 F
   b. 5.8 w/m^2k
7. Solar Heat Reduction: 33%
8. UV Light Rejected: 99%
9. Glare Reduction: 58%
10. Visible Light to Solar Heat Gain Ratio: 0.5

PART 3 EXECUTION

3.1 EXAMINATION

A. Film Examination:
   1. If preparation of glass surfaces is the responsibility of another installer, notify Architect in writing of deviations from manufacturer's recommended installation tolerances and conditions.
      a. Glass surfaces receiving new film should first be examined to verify that they are free from defects and imperfections, which will affect the final appearance.
   2. Do not proceed with installation until glass surfaces have been properly prepared and deviations from manufacturer's recommended tolerances are corrected. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result under the project conditions.
   3. Commencement of installation constitutes acceptance of conditions.

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. Film Installation, General:
   1. Install in accordance with manufacturer's instructions.
   2. Cut film edges neatly and square at a uniform distance of 1/8 inch to 1/16 inch of window sealant. Use new blade tips after 3 to 4 cuts.
   3. Spray the slip solution, composed of one capful of baby shampoo or dishwashing liquid to 1 gallon of water, on window glass and adhesive to facilitate proper positioning of film.
   4. Apply film to glass and lightly spray film with slip solution.
   5. Squeegee from top to bottom of window. Spray slip solution to film and squeegee a second time.
   6. Bump film edge with lint-free towel wrapped around edge of a 5-way tool.
   7. Upon completion of film application, allow 30 days for moisture from film installation to dry thoroughly, and to allow film to dry flat with no moisture dimples when viewed under normal viewing conditions.
   8. If completing an exterior application, check with the manufacturer as to whether edge sealing is required.

3.4 CLEANING AND PROTECTION

A. Remove left over material and debris from Work area. Use necessary means to protect film before,

during, and after installation.

B. Touch-up, repair or replace damaged products before Substantial Completion.

C. After application of film, wash film using common window cleaning solutions, including ammonia solutions, 30 days after application. Do not use abrasive type cleaning agents and bristle brushes to avoid scratching film. Use synthetic sponges or soft cloths.

END OF SECTION 088733

SECTION 090190 - MAINTENANCE OF PAINTING AND COATING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes treatment of painting as follows:

1. Neutral-pH stripping compound for removal of oil-based “akyd” paints, acrylics, lacquers and clear sealers, as well as spray paint and “magic” marker.

1.2 UNIT PRICES

A. Work of this Section is affected by unit prices specified in Division 01 Section "Unit Prices."

1.3 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified treatment specialist to perform preconstruction testing for the existing painted metal surface(s).

1. Select sizes and configurations of existing work to adequately demonstrate capability of products to comply with requirements.
2. Test an area of 4-feet x 4-feet on each metal type. Use manufacturer’s application instructions. Allow for 3 to 7 days for area to dry and perform inspection.
3. Notify Architect seven days in advance of the dates and times when testing will be performed.

1.4 SUBMITTALS

A. Product Data: For type of product indicated.

B. Qualification Data: For treatment specialist.

1.5 QUALITY ASSURANCE

A. Treatment Specialist Qualifications: A qualified painting specialist.

B. Pre-installation Conference: Conduct conference at Project site.

1.6 WARRANTY

A. Where permitted by law, the manufacturer makes no other warranties with respect to this product, express or implied, including without limitation the implied warranties of merchantability or fitness for particular purpose.

B. The applicator shall be responsible to make his own test to determine the suitability of this for product for his particular purpose. The manufacturer’s liability shall be limited in all events to supplying sufficient product to re-treat the specific areas to which defective product has been applied.

C. Refer to manufacturer’s Product Data Sheet for additional information pertaining to warranty.

PART 2 - PRODUCTS

2.1 PAINT REMOVERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide products by the following:

1. PROSOCO, Inc.
   a. Enviro Klean SafStrip 8.
2. Or approved equal.

B. Neutral-PH stripping compound for on most surfaces. This is a Low order, Low toxicity.

C. Technical Data:

1.	Form:	Colorless Gel
2.	Gravity:	1.05
3.	Wt/Gal:	8.80 lbs
4.	Active Content:	N/A
5.	Total Solids:	N/A
6.	VOC Content:	30% maximum
7.	Flash Point:	>200d F per ASTM D 3278
8.	Freeze Point:	N/A

D. Limitations:
1. Not for removal of cementitious coatings.

PART 3 - EXECUTION

3.1 TREATMENT PROCEDURES, GENERAL

A. General: Have treatment of painting directed and performed by a qualified treatment specialist. Ensure that treatment specialist's field supervisors are present when process begins and during its progress. In treating the applicable surfaces, disturb them as minimally as possible and as follows:

1. Apply product according to manufacturer's written instructions unless otherwise indicated.
2. Stop the progress of deterioration and corrosion by removing failed coatings and corrosion and repainting.
3. Verify that substrate surface conditions are suitable for painting.
4. Allow other trades to repair items in place and retain as much original material as possible before repainting.
5. Make treatment of materials reversible whenever possible unless otherwise indicated.
6. Install temporary protective measures to protect adjacent surfaces that are not part of the striping process.

B. Mechanical Abrasion: Where mechanical abrasion is needed for the work, use only the gentlest mechanical methods, such as scraping and lightly hand sanding, that will not abrade softer substrates, reducing clarity of detail. Do not use abrasive methods such as rotary sanding, rotary wire brushing, or power tools except as approved by Architect.

C. Heat Processes: Do not use torches, heat guns, or heat plates.

3.2 EXAMINATION

A. Examine substrates and conditions, with historic treatment specialist present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the painting work. Comply with paint manufacturer's written instructions for inspection.

B. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

1. If existing surfaces cannot be prepared to an acceptable condition for proper finishing by using specified surface-preparation methods, notify Architect in writing.

C. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.

1. Beginning coating application constitutes Contractor's acceptance of substrates and conditions.

3.3 CLEANING

A. General: Use only the gentlest, appropriate method necessary to clean surfaces in preparation for painting. Clean all surfaces, corners, contours, and interstices.

B. Detergent Cleaning: Wash surfaces by hand using clean rags, sponges, and bristle brushes. Scrub surface with detergent solution and bristle brush until soil is thoroughly dislodged and can be removed by rinsing. Use small brushes to remove soil from joints and crevices. Dip brush in solution often to ensure that adequate fresh detergent is used and that surface remains wet. Rinse with water applied by clean rags or sponges.

C. Solvent Cleaning: Use solvent cleaning to remove oil, grease, smoke, tar, and asphalt from painted or unpainted surfaces before other preparation work. Wipe surfaces with solvent using clean rags and sponges. If necessary, spot-solvent cleaning may be employed just prior to commencement of paint application, provided enough time is allowed for complete evaporation. Use clean solvent and clean rags for the final wash to ensure that all foreign materials have been removed. Do not use solvents, including primer thinner and turpentine that leave residue.

D. Mildew: Clean off existing mildew, algae, moss, plant material, loose paint, grease, dirt, and other debris by scrubbing with bristle brush or sponge and detergent solution. Scrub mildewed areas with mildewcide. Rinse with water applied by clean rags or sponges.

E. Chemical Rust Removal:

1. Remove loose rust scale with approved abrasives for ferrous metal cleaning.
2. Apply rust remover with brushes or as recommended by manufacturer.
3. Allow rust remover to remain on surface for period recommended by manufacturer or as determined by preconstruction testing. Do not allow extended dwell time.
4. Wipe off residue with mineral spirits and either steel wool or soft rags, or clean with method recommended by manufacturer to remove residue.
5. Dry immediately with clean, soft cloths. Follow direction of grain in metal.
6. Prime immediately to prevent rust. Do not touch cleaned metal surface until primed.

3.4 PAINT REMOVAL

A. General: Remove paint where indicated. Where cleaning methods have been attempted and further removal of the paint is required because of incompatible or unsatisfactory surfaces for repainting, remove paint to extent required by conditions.

1. Brushes: Use brushes that are resistant to chemicals being used.
2. Spray Equipment: Use spray equipment that provides controlled application at volume and pressure indicated, measured at spray tip. Adjust pressure and volume to ensure that spray methods do not damage surfaces.

    a. Equip units with pressure gages.
    b. Unless otherwise indicated, hold spray tip at least 6 inches from surface and apply material in horizontal, back-and-forth sweeping motion, overlapping previous strokes to produce uniform coverage.
    c. For chemical spray application, use low-pressure tank or chemical pump suitable for chemical indicated, equipped with cone-shaped spray tip.
    d. For heated water-spray application, use equipment capable of maintaining temperature between 140 and 160 deg F at flow rates indicated.

3.5 SUBSTRATE REPAIR

A. General: Repair substrate surface defects that are inconsistent with the surface appearance of adjacent materials and finishes.

B. Metal Substrate:

1. General: Repair defects including dents and gouges more than 1/2 inch across and all holes and cracks by filling with metal patching compound and sanding smooth. Remove burrs and protruding fasteners.
2. Prepare repair locations by wire-brushing and solvent cleaning. Use chemical rust removal method to clean off rust.
3. Prime iron and steel surfaces immediately after repair to prevent flash rusting. Stripe paint corners, crevices, bolts, welds, and sharp edges. Apply two coats to surfaces that will be inaccessible after completion of the Work.

3.6 APPLICATION, GENERAL

A. Comply with manufacturers' written instructions for application methods and with other Division 09 painting Sections.

B. ALWAYS TEST a small area of each surface to confirm suitability, coverage rate and desired results before beginning overall application. Test with the same equipment, recommended surface preparation and application procedures planned for general application.

C. Prepare surfaces to be painted according to the manufacturer's written instructions for each substrate condition.

3.7 DILUTION

A. Do not dilute or alter. Apply as packaged.

3.8 EXTERIOR APPLICATIONS

A. Apply product 1/8 to 1/4 inch thick to dry surface.

B. Let the application dwell 15-60 minutes or until coating “lifts” or shows signs of dissolving. Periodic agitation with a stiff bristle brush improves penetration. Some coatings will need multiple applications/increased dwell time.

C. Remove stripper and residue with pressure-water rinse. The best combination of rinsing pressure and water volume is provided by masonry washing equipment generating 400-1000 psi with a water flow rate of 6-8 gallons per minute delivered through a 15-45 degree fan spray tip. Equipment should be adjustable to reduce water flow rate and rinsing pressure as required for controlled cleaning of more sensitive surfaces. Refer to manufacturer’s Product Data Sheet for additional information regarding equipment. Heated water may improve stripping efficiency.

D. Clean the stripped surface with the appropriate product.

3.9 CLEANUP AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. Clean tools and equipment with high-flash aromatic naphtha or similar solvent. Cleaning with water may be sufficient if material has not dried.

END OF SECTION 090190

SECTION 090561
COMMON WORK RESULTS FOR FLOORING PREPARATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This section applies to floors identified in Contract Documents that are receiving the following types of floor coverings:
   1. Resilient tile and sheet.
   2. Carpet tile.

B. Removal of existing floor coverings.

C. Preparation of new and existing concrete floor slabs for installation of floor coverings.

D. Testing of concrete floor slabs for moisture and alkalinity (pH).

E. Remediation of concrete floor slabs due to unsatisfactory moisture or alkalinity (pH) conditions.
   1. Contractor shall perform all specified remediation of concrete floor slabs. If such remediation is indicated by testing agency's report and is due to a condition not under Contractor's control or could not have been predicted by examination prior to entering into the contract, a contract modification will be issued.

F. Patching compound.

G. Remedial floor coatings.

H. Preparation of new and existing wood-based floors and subfloors for installation of new floor coverings.

1.02 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete: Moisture emission reducing curing and sealing compound for slabs to receive adhered flooring, to prevent moisture content-related flooring failures; to remain in place, not to be removed.

1.03 REFERENCE STANDARDS

A. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or (50-mm) Cube Specimens).

B. ASTM C472 - Standard Test Methods for Physical Testing of Gypsum, Gypsum Plasters and Gypsum Concrete.

C. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.

D. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.

E. RFCI (RWP) - Recommended Work Practices for Removal of Resilient Floor Coverings.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate scheduling of cleaning and testing, so that preliminary cleaning has been completed for at least 24 hours prior to testing.

1.05 SUBMITTALS

A. Visual Observation Report: For existing floor coverings to be removed.

B. Floor Covering and Adhesive Manufacturers' Product Literature: For each specific combination of substrate, floor covering, and adhesive to be used; showing:
   1. Moisture and alkalinity (pH) limits and test methods.
   2. Manufacturer's required bond/compatibility test procedure.

C. Remedial Materials Product Data: Manufacturer's published data on each product to be used for remediation.
   1. Manufacturer's qualification statement.
   2. Manufacturer's statement of compatibility with types of flooring applied over remedial product.
   3. Test reports indicating compliance with specified performance requirements, performed by nationally recognized independent testing agency.
   4. Manufacturer's installation instructions.
   5. Specimen Warranty: Copy of warranty to be issued by coating manufacturer and certificate of underwriter's coverage of warranty.

D. Testing Agency's Report:
   1. Description of areas tested; include floor plans and photographs if helpful.
   2. Summary of conditions encountered.
   3. Moisture and alkalinity (pH) test reports.
   4. Copies of specified test methods.
   5. Recommendations for remediation of unsatisfactory surfaces.
   6. Product data for recommended remedial coating.
   7. Include certification of accuracy by authorized official of testing agency.
   8. Submit report directly to Owner.
   9. Submit report not more than two business days after conclusion of testing.

E. Adhesive Bond and Compatibility Test Report.

F. Floor Moisture Testing Technician Certificate: International Concrete Repair Institute (ICRI) Concrete Slab Moisture Testing Technician- Grade I certificate.

G. Copy of RFCI (RWP).

1.06 QUALITY ASSURANCE

A. Moisture and alkalinity (pH) testing shall be performed by an independent testing agency employed and paid by Contractor.

B. Testing Agency Qualifications: Independent testing agency experienced in the types of testing specified.
   1. Submit evidence of experience consisting of at least 3 test reports of the type required, with project Owner's project contact information.

C. Contractor's Responsibility Relating to Independent Agency Testing:
   1. Provide access for and cooperate with testing agency.
   2. Confirm date of start of testing at least 10 days prior to actual start.
   3. Allow at least 4 business days on site for testing agency activities.
   4. Achieve and maintain specified ambient conditions.
   5. Notify Architect when specified ambient conditions have been achieved and when testing will start.

D. Floor Moisture Testing Technician Qualifications: International Concrete Repair Institute (ICRI) Concrete Slab Moisture Testing Technician Certification- Grade I.

E. Remedial Coating Installer Qualifications: Company specializing in performing work of the type specified in this section, trained by or employed by coating manufacturer, and able to provide at least 3 project references showing at least 3 years' experience installing moisture emission coatings.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, handle, and protect products in accordance with manufacturer's instructions and recommendations.

B. Deliver materials in manufacturer's packaging; include installation instructions.

C. Keep materials from freezing.

1.08 FIELD CONDITIONS

A. Maintain ambient temperature in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 65 degrees F or more than 85 degrees F.

B. Maintain relative humidity in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 40 percent and not more than 60 percent.

PART 2 PRODUCTS

2.01 MATERIALS

A. Patching Compound: Floor covering manufacturer's recommended product, suitable for conditions, and compatible with adhesive and floor covering. In the absence of any recommendation from flooring manufacturer, provide a product with the following characteristics:
   1. Cementitious moisture-, mildew-, and alkali-resistant compound, compatible with floor, floor covering, and floor covering adhesive, and capable of being feathered to nothing at edges.
   2. Latex or polyvinyl acetate additions are permitted; gypsum content is prohibited.
   3. Compressive Strength: 3000 psi, minimum, after 28 days, when tested in accordance with ASTM C109/C109M or ASTM C472, whichever is appropriate.
   4. Products:
      a. TEC, an H.B. Fuller Construction Products Brand; TEC Feather Edge Skim Coat.
      b. Ardex America.
      c. Or equal.

B. Alternate Flooring Adhesive: Floor covering manufacturer's recommended product, suitable for the moisture and pH conditions present; low-VOC. In the absence of any recommendation from flooring manufacturer, provide a product recommended by adhesive manufacturer as suitable for substrate and floor covering and for conditions present.

C. Remedial Floor Coating: Single- or multi-layer coating or coating/overlay combination intended by its manufacturer to resist water vapor transmission to degree sufficient to meet flooring manufacturer's emission limits, resistant to the level of alkalinity (pH) found, and suitable for adhesion of flooring without further treatment.
   1. Thickness: As required for application and in accordance with manufacturer's installation instructions.
   2. Use product recommended by testing agency.

PART 3 EXECUTION

3.01 CONCRETE SLAB PREPARATION

A. Perform following operations in the order indicated:
   1. Existing concrete slabs with coatings or penetrating sealers/hardeners/dustproofers:
      a. Do not attempt to remove coating or penetrating material.
      b. Do not abrade surface.
   2. Preliminary cleaning.

3. Moisture vapor emission tests; 3 tests in the first 1000 square feet and one test in each additional 1000 square feet, unless otherwise indicated or required by flooring manufacturer.
4. Internal relative humidity tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
5. Alkalinity (pH) tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
6. Specified remediation, if required.
7. Patching, smoothing, and leveling, as required.
8. Other preparation specified.
9. Adhesive bond and compatibility test.
10. Protection.

B. Remediations:
1. Active Water Leaks or Continuing Moisture Migration to Surface of Slab: Correct this condition before doing any other remediation; re-test after correction.
2. Excessive Moisture Emission or Relative Humidity: If an adhesive that is resistant to the level of moisture present is available and acceptable to flooring manufacturer, use that adhesive for installation of the flooring; if not, apply remedial floor coating or remedial sheet membrane over entire suspect floor area.
3. Excessive Alkalinity (pH): If remedial floor coating is necessary to address excessive moisture, no additional remediation is required; if not, if an adhesive that is resistant to the level present is available and acceptable to the flooring manufacturer, use that adhesive for installation of the flooring; otherwise, apply a skim coat of specified patching compound over entire suspect floor area.

3.02 REMOVAL OF EXISTING FLOOR COVERINGS

A. Comply with local, State, and federal regulations and recommendations of RFCI Recommended Work Practices for Removal of Resilient Floor Coverings, as applicable to floor covering being removed.

B. Dispose of removed materials in accordance with local, State, and federal regulations and as specified.

3.03 PRELIMINARY CLEANING

A. Clean floors of dust, solvents, paint, wax, oil, grease, asphalt, residual adhesive, adhesive removers, film-forming curing compounds, sealing compounds, alkaline salts, excessive laitance, mold, mildew, and other materials that might prevent adhesive bond.

B. Do not use solvents or other chemicals for cleaning.

3.04 MOISTURE VAPOR EMISSION TESTING

A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.

B. Where this specification conflicts with the referenced test method, comply with the requirements of this section.

C. Test in accordance with ASTM F1869 and as follows.

D. Plastic sheet test and mat bond test may not be substituted for the specified ASTM test method, as those methods do not quantify the moisture content sufficiently.

E. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if test values exceed 3 pounds per 1000 square feet per 24 hours.

F. Report: Report the information required by the test method.

3.05 ALKALINITY TESTING

A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.

B. The following procedure is the equivalent of that described in ASTM F710, repeated here for the Contractor's convenience.
   1. Use a wide range alkalinity (pH) test paper, its associated chart, and distilled or deionized water.
   2. Place several drops of water on a clean surface of concrete, forming a puddle approximately 1 inch in diameter. Allow the puddle to set for approximately 60 seconds, then dip the alkalinity (pH) test paper into the water, remove it, and compare immediately to chart to determine alkalinity (pH) reading.
   3. Use of a digital pH meter with probe is acceptable; follow meter manufacturer's instructions.

C. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if alkalinity (pH) test value is over 10.

3.06 PREPARATION

A. See individual floor covering section(s) for additional requirements.

B. Comply with requirements and recommendations of floor covering manufacturer.

C. Fill and smooth surface cracks, grooves, depressions, control joints and other non-moving joints, and other irregularities with patching compound.

D. Do not fill expansion joints, isolation joints, or other moving joints.

3.07 ADHESIVE BOND AND COMPATIBILITY TESTING

A. Comply with requirements and recommendations of floor covering manufacturer.

3.08 APPLICATION OF REMEDIAL FLOOR COATING

A. Comply with requirements and recommendations of coating manufacturer.

3.09 PROTECTION

A. Cover prepared floors with building paper or other durable covering.

END OF SECTION

SECTION 092116
GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal stud wall framing.

B. Acoustic insulation.

C. Gypsum wallboard.

D. Joint treatment and accessories.

E. Bullet resistant fiberglass panels.

F. Gypsum board ceiling suspension system.

1.02 RELATED REQUIREMENTS

A. Section 079200 - Joint Sealants: Sealing acoustical gaps in construction other than gypsum board or plaster work.

1.03 REFERENCE STANDARDS

A. AISI S100-12 - North American Specification for the Design of Cold-Formed Steel Structural Members.

B. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.

C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

D. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.

E. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members.

F. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.

G. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.

H. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board.

I. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness.

J. ASTM C1047 - Standard Specification for Accessories For Gypsum Wallboard and Gypsum Veneer Base.

K. ASTM C1629/C1629M - Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels.

L. ASTM C1658/C1658M - Standard Specification for Glass Mat Gypsum Panels.

M. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.

N. ASTM E488/E488M - Standard Test Methods for Strength of Anchors in Concrete Elements.

O. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.

P. GA-216 - Application and Finishing of Gypsum Panel Products.

Q. UL (FRD) - Fire Resistance Directory.

1.04 SUBMITTALS

A. See Section 013300-Submittal Procedures.

B. Product Data: Provide data on metal framing, gypsum board, accessories, and joint finishing system.

C. Product Data: Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.

D. Test Reports: Bullet resistant sheathing and wallboard.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing gypsum board installation and finishing, with minimum three years of experience.

PART 2 PRODUCTS

2.01 GYPSUM BOARD ASSEMBLIES

A. Provide completed assemblies complying with ASTM C840 and GA-216.
   1. See PART 3 for finishing requirements.

B. Fire-Resistance-Rated Assemblies: Provide completed assemblies complying with applicable code.
   1. UL Assembly Numbers: Provide construction equivalent to that listed for the particular assembly in the current UL (FRD).

2.02 METAL FRAMING MATERIALS

A. Manufacturers - Metal Framing, Connectors, and Accessories:
   1. ClarkDietrich; .
   2. Jaimes Industries.
   3. Marino.
   4. Phillips Manufacturing Co; [____].
   5. Or equal.

B. Loadbearing Studs for Application of Gypsum Board: As specified in Section 054000.

C. Non-structural Framing System Components: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/120 at 5 psf.
   1. Studs: "C" shaped with knurled or emobossed faces.
   2. Runners: U shaped, sized to match studs.

D. Partition Head to Structure Connections: Provide mechanical anchorage devices that accommodate deflection using slotted holes, screws, and anti-friction bushings, preventing rotation of studs while maintaining structural performance of partition.
   1. Structural Performance: Maintain lateral load resistance and vertical movement capacity required by applicable code, when evaluated in accordance with AISI S100-12.
   2. Material: ASTM A653/A653M steel sheet, SS Grade 50/340, with G60/Z180 hot-dipped galvanized coating.
   3. Provide top track preassembled with connection devices spaced to fit stud spacing indicated on drawings; minimum track length of 12 feet.

2.03 SUSPENSION SYSTEM MATERIALS

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

1. Armstrong World Industries, Inc.; HD8906, Drywall Grid Systems.
2. Chicago Metallic Corporation; 650-C, Drywall Grid System.
3. USG Corporation; DGLW, Drywall Suspension System.
4. Or equal.

B. Grid Suspension System for Ceilings: ASTM C645, direct-hung system composed of main beams and cross-furring members that interlock.

C. Wire Hangers: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.16 inch in diameter.

D. Tie Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.062-inch- diameter wire, or double strand of 0.048-inch- diameter wire if required by loading.

E. Anchorage to Substrate: Tie wire, screws, nails and other metal supports, of type and size to suit application; to rigidly secure materials in place. In concrete, comply with following load carrying capacity by an independent testing agency:
1. Non-Powder-Actuated Fasteners: Sustain load equal to 5 times that imposed during construction according to ASTM E488/E488M.
2. Powder-Actuated Fasteners: Sustain load equal to 10 times that imposed during construction according to ASTM E1190.

204 BOARD MATERIALS

A. Abuse Resistant Wallboard:
1. Application: High-traffic areas indicated.
2. Surface Abrasion: Level 2, minimum, when tested in accordance with ASTM C1629/C1629M.
3. Indentation: Level 1, minimum, when tested in accordance with ASTM C1629/C1629M.
4. Soft Body Impact: Level 1, minimum, when tested in accordance with ASTM C1629/C1629M.
5. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
6. Glass Mat-Faced Type: Gypsum wallboard, as defined in ASTM C1658/C1658M.
7. Type: Fire-resistance-rated Type X, UL or WH listed.
8. Thickness: 5/8 inch.
9. Edges: Tapered.
10. Glass Mat Faced Products:
    a. Georgia-Pacific Gypsum; DensArmor Plus Abuse-Resistant.
    b. National Gypsum Company; Gold Bond eXP Interior Extreme AR Gypsum Panel.
    c. USG Corporation; Sheetrock Brand Glass-Mat Panels Mold Tough Firecode X.
    d. Or equal.

B. Bullet Resistant Fiberglass Panels: Woven roving, multi-ply, ballistic grade fiberglass cloth with thermoset polyester resin; comply with UL 752 Level 1 .
1. Basis of Design: Chicago Bullet Proof Systems; Fibre-Tex: www.chicagobulletproof.com.
2. Acceptable Manufacturer: Armocore: www.armocore.com.
3. Thickness: As indicated on the drawings.

205 GYPSUM WALLBOARD ACCESSORIES

A. Acoustic Insulation: ASTM C665; preformed glass fiber, friction fit type, unfaced. Thickness: 3 inch.

B. Finishing Accessories: ASTM C1047, galvanized steel or rolled zinc, unless noted otherwise.
1. Types: As detailed or required for finished appearance.
2. Special Shapes: In addition to conventional corner bead and control joints, provide U-bead at exposed panel edges.

3. Products:
    a. Same manufacturer as framing materials.
    b. Phillips Manufacturing Co.
    c. Telling Industries.
    d. Or equal.

C. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
    1. Fiberglass Tape: 2 inch wide, coated glass fiber tape for joints and corners.
    2. Joint Compound: Setting type, field-mixed.

D. Screws for Fastening of Gypsum Panel Products to Steel Members from 0.033 to 0.112 inch in Thickness: ASTM C954; steel drill screws, corrosion-resistant.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that project conditions are appropriate for work of this section to commence.

3.02 FRAMING INSTALLATION

A. Metal Framing: Install in accordance with ASTM C754 and manufacturer's instructions.

B. Suspended Ceilings and Soffits: Space framing and furring members as indicated.
    1. Level ceiling and soffit system to a tolerance of 1/1200.
    2. Install bracing as required at exterior locations to resist wind uplift.

C. Studs: Space studs at 16 inches on center.
    1. Extend partition framing to structure where indicated and to ceiling in other locations.
    2. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.
    3. Partitions Terminating at Structure: Attach top runner to structure, maintain clearance between top of studs and structure, and connect studs to track using specified mechanical devices in accordance with manufacturer's instructions; verify free movement of top of stud connections; do not leave studs unattached to track.

D. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs.

3.03 ACOUSTIC ACCESSORIES INSTALLATION

A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.

B. Acoustic Sealant: Install in accordance with manufacturer's instructions.

3.04 BOARD INSTALLATION

A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.

B. Single-Layer Non-Rated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.
    1. Exception: Tapered edges to receive joint treatment at right angles to framing.

C. Bullet Resistant Fiberglass Panels:
    1. Cover all joints between boards with a 4 inch strip of the same thickness material as the boards, centered on the joint.

3.05 INSTALLATION OF TRIM AND ACCESSORIES

A. Control Joints: Place control joints consistent with lines of building spaces and as follows:

1. Not more than 30 feet apart on walls and ceilings over 50 feet long.

B. Corner Beads: Install at external corners, using longest practical lengths.

C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

3.06 JOINT TREATMENT

A. Glass Mat Faced Gypsum Board and Exterior Glass Mat Faced Sheathing: Use fiberglass joint tape, embed and finish with setting type joint compound.

B. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
   1. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
   2. Level 1: Wall areas above finished ceilings, whether or not accessible in the completed construction.

C. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
   1. Feather coats of joint compound so that camber is maximum 1/32 inch.

3.07 TOLERANCES

A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

END OF SECTION

SECTION 092400 - PORTLAND CEMENT PLASTERING (STUCCO)

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Exterior portland cement plasterwork (stucco) on metal lath.

1.2 REFERENCED DOUCMENTS

A. ASTM A641: Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire
B. ASTM C144: Specification for Aggregate for Masonry Mortar
C. ASTM C897: Standard Specification for Aggregate for Job-Mixed Portland Cement-Based Plaster.
D. ASTM C926: Standard Specification for Application of Portland Cement-Based Plaster
E. ASTM C1177: Specification for Glass Mat Gypsum for use as sheathing.
F. ASTM C1513: Standard Specification for Steel Tapping Screws for Cold-Formed Steel Framing Connections.
G. ASTM E84: Test Method for Surface Burning Characteristics of Buildings Materials.
H. ASTM E96: Standard Test Methods for Water Vapor Transmission of Materials.
I. ASTM E2178: Standard Test Method for Air Permeance of Building Materials.
J. NFPA 285: Standard Method of Test for the Evaluation of Flammability Characteristics of Exterior Non-Load-Bearing Wall Assemblies containing Combustible Components Using the Intermediate-Scale, Multistory Test Apparatus.

1.3 DESIGN REQUIREMENTS

A. Moisture Control:

1. Prevent the accumulation of water into or behind the stucco, either by condensation or leakage into the wall construction, in the design and detailing of the wall assembly:
   a. Provide corrosion resistant flashing to protect exposed elements and to direct water to the exterior, including, abutments of lower walls with higher walls, at adjacent intersections of dissimilar materials.
   b. Air leakage Prevention: prevent excess air leakage in the design and detailing of the wall assembly. Provide continuity between air barrier components in the wall assembly.
   c. Provide stucco’s manufacturer standard air/moisture barrier over sheathing.

B. Joints and Accessories:

1. Provide two piece expansion joints in the stucco assembly where building movement is anticipated: at joints in the substrate or supporting construction, where the system is to be installed over dissimilar construction or substrates.
2. Provide minimum 3/8 inch wide joints where the system abuts windows, doors and other through wall penetrations.
3. Provide appropriate accessories at stucco terminations and joints.
4. Avoid the use of channel reveal accessories which can interfere with proper drainage and proper stress relief.
5. Provide appropriate sealant at stucco terminations and at stucco accessory butt joints.

C. Stucco Thickness (does not include primer or textured finish coat)

1. Application to Metal Plaster Bases: stucco thickness shall be uniform 3/4 inch. Stucco thickness shall not exceed 7/8 inch.
2. Stucco shall be applied in 2 coats, scratch and brown coat, to achieve the prescribed thickness.
3. Thickness shall be uniform throughout the wall area.

1.4 PERFORMANCE REQUIREMENTS

A. Refer to stucco manufacturer's published documentation for additional information.

1.5 SUBMITTALS

A. Manufacturer's specifications, details, installation instructions and product data.

B. Manufacturer's code compliance report for air barrier and water resistive barrier.

C. Manufacturer's NFPA 285assebmly report or ICC ESR indicating compliance of air/moisture barrier with requirements of NFPA 285 for use on Types I, II, III, and IV construction.

D. Manufacturer's standard warranty

E. Samples for approval as directed by architect or owner.

F. Fastener manufacturer's pull-out or withdrawal capacity testing for frame and solid substrates.

G. Prepare and submit project-specific details (when required by contract documents).

1.6 QUALITY ASSURANCE

A. Manufacturer requirements:

1. Stucco and air barrier products manufacturer for a minimum of twenty (20) years.
2. Stucco finish products and air barrier products manufactured under ISO 9001:2008 Quality System and 14001:2004 Environmental Management System.

B. Contractor requirements:

1. Licensed, insured and engaged in application of Portland Cement Stucco for a minimum of three (3) years.
2. Knowledgeable in the proper use and handling of stucco manufacturer's materials.
3. Employ skilled mechanics who are experienced and knowledgeable in Portland Cement Stucco application, and familiar with the requirements of the specified work.
4. Successful completion of minimum of three (3) projects of similar size and complexity to the specified project.
5. Provide the proper equipment, manpower and supervision on the job site to install the system in compliance with stucco manufacturer's published specifications and details and the project plans and specifications.

C. Inspections:

1. Provide independent third party inspection where required by code or contract documents.

2. Conduct inspections in accordance with code requirements and contract documents.

1.7 DELIVERY, STORAGE AND HANDLING

A. Deliver all materials in their original sealed containers bearing manufacturer's name and identification of products.

B. Protect coatings (pail products) from freezing and temperatures in excess of 90d F. Store away from direct sunlight.

C. Protect Portland Cement based materials (bag products) from moisture and humidity. Store under cover off the ground in a dry location.

D. Handle all products as directed on labeling.

1.8 PROJECT CONDITIONS

A. Comply with ASTM C 926 requirements.

B. Maintain ambient and surface temperatures above 40d F during application and for 24 hours after set of stucco, and after application of air/moisture barrier and finish materials.

C. Provide supplementary heat for installation in temperatures less than 40d F such that materials temperatures are maintained as in 1.09A. Prevent concentration of heat on uncured stucco and vent fumes and other products of combustion to the outside to prevent contact with stucco.

D. Prevent uneven or excessive evaporation of moisture from stucco during hot, dry or windy weather. For installation under any of these conditions provide special measures to properly moist cure the stucco. Do not install stucco if ambient temperatures are expected to rise above 100d F within a 24 hour period.

1.9 WARRANTY

A. Provide manufacturer's standard warranty.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Basis-of-design products: subject to compliance with requirements, provide product by the following:

1. Sto Corp; StoPowerwall Stucco system (Detail No. 4.01)
2. Or approved equal.

B. Air/Moisture Barrier:

1. Refer to Specification section 072700.

C. Metal Lath:

1. Basis-of-Design product: subject to compliance with requirements, provide product by the following:
    a. Phillips Manufacturing Co.
        1) 3.4 Paper Backed Flat Diamond Mesh Lath (Part No. PB1-2)
    b. Or approved equal

2. Performance requirements:
    a. ASTM A653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanized) by the Hot-Dip Process.
    b. ASTM C847 Standard Specification for Metal Lath.
    c. Federal Specification UU-B-790A; Style 1, Grade D, Style 2.
    d. Post-consumer recycled content: 25%
    e. Pre-consumer recycled content: 5%

D. Mechanical Fasteners:

1. Non-corroding fasteners in compliance with AISI S200 – 200 and ASTM C1513:
    a. Steel Framing: minimum #8 Type S or S-12 wafer head fully threaded corrosion resistant screws with minimum 3/8 inch and three thread penetration into studs.

2. Tie Wire: 18 gauge galvanized and annealed low carbon steel in compliance with ASTM A641 with Class I coating.

E. Accessories:

1. Weep screed, casing bead, corner bead, corner lath, expansion and control joint accessories. Meeting ASTM C841 and C1063.

2. Basis-of-Design product: subject to compliance with requirements, provide product by the following:
    a. AMICO
        1) Accessories as called out on drawings
    b. Or approved equal.

3. All accessories shall have perforated or expanded flanges and shall be designed with grounds for the specified thickness of stucco.

2.2 JOB MIXED INCREDIENTS

A. Water: clean and potable

B. Sand: in compliance with ASTM C897 or ASTM C144, for use with one coat and ASTM C926 stucco concentrates.

2.3 STUCCO

A. 108 StoPowerwall Scratch and Brown or approved equal: Portland cement-based stucco concentrate in compliance with ASTM C926

2.4 PRIMER

A. StoPrime Hot or approved equal: acrylic based primer/sealer for freshly placed (minimum 4 day old) and high pH stucco surfaces.

2.5 FINISH COAT

A. StoPowerwall Finish or approved equal: integrally colored, factory blended, flexible acrylic textured wall finish with graded marble aggregate.

2.6 MIXING

A. StoGuard or approved equal:
   1. Sto EmeralCoat or approved equal: mix with a clean, rust-free electric drill and paddle to a uniform consistency. Do not thin, or dilute with water.

B. StoPowerwall Stucco or approved equal:
   1. Refer to mix instructions on packaging. USE ONLY THE AMOUNT OF WATER NECESSARY FOR A WORKABLE MIX. Use of excess water is detrimental to performance.

C. Primer:
   1. Mix with a clean, rust-free high speed mixer to a uniform consistency

D. Finish:
   1. Mix with a clean, rust-free high speed mixer to a uniform consistency. A small amount of water (up to 12 ounces) may be added to adjust workability. Limit addition of water to amount needed to achieve the finish texture.

E. Mix only as much material as can readily be used. Do not add lime, anti-freeze compounds, or other additives to any of the materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Inspect for:
   1. Contamination – algae, chalkiness, dirt, dust, efflorescence, form oil, fungus, grease, laitance, mildew or other foreign substance.
   2. Damage and deterioration

B. Inspect sheathing application for compliance with applicable requirements:
   1. Glass Mat Faced Gypsum Sheathing in compliance with ASTM C1177 – refer to manufacturer's instructions and/or ICC evaluation report.

C. Report deviations from the requirements of project specifications or other conditions that might adversely affect the air/moisture barrier or stucco installation to the Contractor. Do not proceed with air/moisture barrier or stucco installation until deviations are corrected.

3.2 SURFACE PREPARATION

A. Sheathing

1. Remove surface contaminants and replace damaged sheathing.
2. All sheathing must be handled and installed in compliance with applicable building code and/or manufacturer requirements. Installed sheathing must be clean, dry and free from damage, frost, and all bond-inviting materials. Abut gypsum sheathing joints. Should gaps exceed 1/8 inch up to 1/2 inch wide, use StoRapid Guard or StoGuard Rapid Fill or approved equal to fill joints, or apply low expanding urethane foam into joints and rasp or shave flush with sheathing surface in preparation for installation joint treatment.
3. Spot surface defects in sheathing with joint treatment.

3.3 AIR/MOISTURE BARRIER INSTALLATION

A. Transition Detailing

1. Detail transition areas with StoRapidGuard or approved equal or StoGuard Transition Membrane or approved equal to achieve air barrier continuity. For illustration, refer for to Stucco manufacturer installation guide.

B. Sheathing Joint Treatment

1. Sto Rapid Guard or approved equal: apply to properly installed sheathing. Joints butted for gypsum sheathing. Apply a thick bead of joint treatment material with a caulking gun along sheathing joints, or apply in a zig-zag pattern across and down the joints. Spread to a uniform thickness of 20-30 mils before the material skins. Spread 1 inch beyond the sheathing joint on each side. Follow the same procedure for inside and outside corners.

C. Air/Moisture Barrier Coating Installation

1. For gypsum sheathing, apply waterproof coating by spray or roller over sheathing surface, including the dry joint treatment, and transition areas, to a uniform wet mil thickness of 10 wet mils. Use 3/4 inch nap roller for glass mat faced gypsum sheathing. Protect from weather until dry.

3.4 STUCCO INSTALLATION

A. Refer to stucco manufacturer detail No. 4.01 for additional information

B. Installation over 30 # Felt WRB
1. Weep Screed Installation:
   a. Install weep screed at transition point between existing masonry sill and new stucco area, securely to solid substrate or framing with the appropriate fasteners. Locate weep screed so that it overlaps the joint between framing and sill flashing by a minimum of 1 inch. Lap waterproof air barrier, sheet water-resistive barrier, and drainage mat over the weep screed attachment flange.

C. Lath Installation

1. Diamond Mesh Metal Lath – conform to ASTM C1063
   a. General: install metal lath with the long dimension at right angles to structural framing (horizontally no solid substrates). Terminate lath at expansion joints. Do not install continuously at joints.

b. Seams/Overlaps: overlap side seams minimum 1/2 inch and end seams minimum 1 inch. Stagger end seams. Overlap casing beads and expansion joints minimum 1 inch over narrow wing accessories, minimum 2 inches over expanded flange accessories. Do not install lath continuously beneath expansion joints.

c. Attachment: fasten securely into solid substrates or through sheathing into structural framing at 7 inches on center maximum vertically and 16 inches on center horizontally. Wire tie at no more than 9 inches on center at side: side laps, accessory, accessory overlaps, and where end laps occurs between supports.

D. Inside and Outside Corners

1. Install corner lath at inside corners and corner bead at outside corners over lath. Attach through lath into solid substrate or framing at no more than 7 inches on center with appropriate fasteners.

E. Stucco Installation

1. Scratch Coat: apply stucco with sufficient pressure to key into and embed the metal lath. Apply sufficient material, 3/8 or 1/2 inch, to cover the metal lath and to permit scoring the surface. Score the stucco upon completing of each panel in preparation for a second coat. Score horizontally.
2. Brown Coat: as soon as the first coat is firm enough to receive the second coat without damage, apply the second coat. Alternatively, moist cure the first coat up to 48 hours and dampen the scratched surface with water immediately before applying the second coat. Apply the second coat with sufficient pressure to ensure intimate contact with the first coat and as needed to bring the stucco to a uniform thickness that matches the grounds of the accessories. Use a rod or straight edge to bring the surface to a true, even plane. Fill depressions in plane with stucco. Final thickness of stucco shall be uniform throughout the wall area and shall be either 3/4 inch or 7/8 inch, and shall not exceed 7/8 inch.
3. After the stucco has become slightly firm float the surface lightly with a darby or wood float to densify the surface and to provide a smooth, even surface. The proper time to float is when the wood float no longer sticks to the surface of the stucco.
4. Moist cure after the stucco has set by lightly fogging for at least 48 hours. Fog as frequently as required during the 48 hour period to prevent loss of moisture from the stucco. Avoid eroding the stucco surface with excess moisture. If relative humidity exceeds 75% the frequency of moist curing can be diminished.

F. Primer Installation

1. StoPrime Hot or approved equal: moist cure stucco for a minimum of 48 hours. Allow stucco to dry an additional 48 hours, then apply primer evenly with brush, roller or proper spray equipment over the clean, dry stucco, and allow to dry. Final age of primed stucco application must be minimum 7 days before application of finish.

G. Finish Installation

1. Apply finish to minimum 28 day old stucco or primed stucco, or apply when pH of stucco surface is less than 10. When the basis of design primer is used as the primer the primed stucco surfaces need only be minimum 7 days old. Apply finish by spraying or troweling with a stainless steel trowel, depending on the finish specified. Follow these general rules for application of finish:
   a. Avoid application in direct sunlight.
   b. Apply finish in a continuous application, and work a wet edge towards the unfinished wall area. Work to an architectural break in the wall before stopping to avoid cold joints.
   c. Weather conditions affect application and drying time. Hot or dry conditions limit working time and accelerate drying. Adjustments in the scheduling of work may be required to achieve desired results; cool or damp conditions extend working time and retard drying and may require added measures of protection against wind, dust, dirt, rain and freezing. Adjust work schedule and provide protection.

d. Float (rilled or swirl texture) finishes with a plastic float to achieve their rilled texture.
e. Do not install separate batches of finish side-by-side.
f. Do not apply finish into or over sealant joints. Apply finish to outside face of wall only.
g. Do not apply finish over irregular or unprepared surfaces, or surfaces not in compliance with the requirements of the project specifications.
h. Do not install finish over high pH (≥10) stucco surfaces or surfaces that have not been fully cured.

3.5 PROTECTION

A. Provide protection of installed materials from water infiltration into or behind them.

B. Provide protection of installed stucco from dust, dirt, precipitation, and freezing.

C. Provide protection of installed primer and finish from dust, dirt, precipitation, freezing and continuous high humidity until fully dry.

D. Provide sealant and backer material at stucco terminations and at fixture penetrations through the stucco to protect against air, water and insect infiltration. Provide weeps at areas which require the conduction of water to the exterior.

3.6 CLEANING, REPAIR AND MAINTENANCE

A. Clean and maintain the stucco finish for a fresh appearance and to prevent water entry into and behind the stucco. Repair cracks, impact damage, spalls or delamination promptly.

B. Maintain adjacent components of construction such as sealants, windows, doors, and flashing, to prevent water entry into the wall assembly.

C. Refer to stucco manufacturer's repair and maintenance guide for detailed information on stucco restoration – cleaning, repairs, recoating, resurfacing and refinishing, or re-cladding.

END OF SECTION 092400

SECTION 093000
TILING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Tile for floor applications.

B. Tile for wall applications.

C. Stone thresholds.

D. Ceramic trim.

1.02 RELATED REQUIREMENTS

A. Section 079200 - Joint Sealants: Sealing joints between tile work and adjacent construction and fixtures.

B. Section 090561 - Common Work Results for Flooring Preparation: Concrete slab moisture and alkalinity testing and remediation procedures.

1.03 REFERENCE STANDARDS

A. ANSI A108/A118/A136 - American National Standard Specifications for the Installation of Ceramic Tile (Compendium).

B. ANSI A108.1a - American National Standard Specifications for Installation of Ceramic Tile in the Wet-Set Method, with Portland Cement Mortar.

C. ANSI A108.1b - American National Standard Specifications for Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex-Portland Cement Mortar.

D. ANSI A108.1c - Specifications for Contractors Option: Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar or Installation of Ceramic Tile on a Cured Portland Cement Mortar Bed with Dry-Set or Latex-Portland Cement.

E. ANSI A108.4 - American National Standard Specifications for Installation of Ceramic Tile with Organic Adhesives or Water Cleanable Tile-Setting Epoxy Adhesive.

F. ANSI A108.5 - American National Standard Specifications for Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar.

G. ANSI A108.6 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy.

H. ANSI A108.8 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant Furan Resin Mortar and Grout.

I. ANSI A108.9 - American National Standard Specifications for Installation of Ceramic Tile with Modified Epoxy Emulsion Mortar/Grout.

J. ANSI A108.10 - American National Standard Specifications for Installation of Grout in Tilework.

K. ANSI A108.12 - American National Standard for Installation of Ceramic Tile with EGP (Exterior Glue Plywood) Latex-Portland Cement Mortar.

L. ANSI A108.13 - American National Standard for Installation of Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone.

M. ANSI A108.19 - American National Standard Specifications for Interior Installation of Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs by the Thin-Bed Method Bonded with Modified Dry-Set Cement Mortar or Improved Modified Dry-Set Cement Mortar.

N. ANSI A118.3 - American National Standard Specifications for Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy and Water Cleanable Tile-Setting Epoxy Adhesive.

O. ANSI A118.4 - American National Standard Specifications for Modified Dry-Set Cement Mortar.

P. ANSI A118.7 - American National Standard Specifications for High Performance Cement Grouts for Tile Installation.

Q. ANSI A118.12 - American National Standard Specifications for Crack Isolation Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation.

R. ANSI A118.15 - American National Standard Specifications for Improved Modified Dry-Set Cement Mortar.

S. ANSI A137.1 - American National Standard Specifications for Ceramic Tile.

T. ASTM C373 - Standard Test Methods for Determination of Water Absorption and Associated Properties by Vacuum Method for Pressed Ceramic Tiles and Glass Tiles and Boil Method for Extruded Ceramic Tiles and Non-tile Fired Ceramic Whiteware Products .

U. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation.

1.04 SUBMITTALS

A. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.

B. Shop Drawings: Indicate tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, control and expansion joints, thresholds, and setting details.

C. Samples: Mount tile and apply grout on two plywood panels, minimum 18 by 18 inches in size illustrating pattern, color variations, and grout joint size variations.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Installer's Qualification Statement:
   1. Submit documentation of National Tile Contractors Association (NTCA) or Tile Contractors' Association of America (TCAA) accreditation.

F. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods.

1.05 QUALITY ASSURANCE

A. Maintain one copy of and ANSI A108/A118/A136 and TCNA (HB) on site.

B. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, with minimum five years of documented experience.

C. Installer Qualifications:
   1. Company specializing in performing tile installation, with minimum of five years of documented experience.
   2. Installer Certification:
      a. Ceramic Tile Education Foundation (CTEF): Certified Tile Installer (CTI).

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

1.07 FIELD CONDITIONS

A. Maintain ambient and substrate temperature above 50 degrees F and below 100 degrees F during installation and curing of setting materials.

PART 2 PRODUCTS

201 TILE

A. Manufacturers: All products by the same manufacturer.
   1. American Olean Corporation:.
   2. Dal-Tile Corporation.
   3. Crossville, Inc.
   4. Or equal.

B. Ceramic Mosaic Tile: ANSI A137.1 standard grade.
   1. Moisture Absorption: 0 to 0.5 percent as tested in accordance with ASTM C373.
   2. Size: 1 by 1 inch, nominal.
   3. Shape: Square.
   4. Edges: Cushioned.
   5. Surface Finish: Unglazed.
   6. Color(s): To be selected by Architect from manufacturer's full range.
      a. Design intent is to match existing.
   7. Pattern: Match existing.

C. Glazed Wall Tile: ANSI A137.1 standard grade.
   1. Moisture Absorption: 7.0 to 20.0 percent as tested in accordance with ASTM C373.
   2. Size: Match existing.
   3. Edges: Match existing.
   4. Surface Finish: High gloss.
   5. Color(s): To be selected by Architect from manufacturer's standard range.
      a. Design intent is to match existing.

D. Quarry Tile: ANSI A137.1 standard grade.
   1. Moisture Absorption: Over 3.0 but not more than 5.0 percent as tested in accordance with ASTM C373.
   2. Size: 6 by 6 inch, nominal.
   3. Thickness: 1/2 inch, nominal.
   4. Edges: Cushioned.
   5. Surface Finish: Unglazed.
   6. Color(s): To be selected by Architect from manufacturer's full range.
   7. Trim Units: Matching bullnose, cove, cove base, and window sill or step nosing shapes in sizes coordinated with field tile.

E. Porcelain Tile: ANSI A137.1 standard grade.
   1. Tile for Add Alternate.
   2. Moisture Absorption: 0 to 0.5 percent as tested in accordance with ASTM C373.
   3. Size: 12 by 24 inch, nominal.
   4. Thickness: 3/8 inch.
   5. Edges: Square.
   6. Surface Finish: Unglazed.
   7. Color(s): To be selected by Architect from manufacturer's full range.
   8. Trim Units: Matching bullnose, cove base, and cove shapes in sizes coordinated with field tile.
   9. Products:
      a. "Color Blox" by Crossville (Basis of Design).
      b. Or equal.

202 TRIM AND ACCESSORIES

A. Ceramic Trim: Matching bullnose, double bullnose, cove base, and cove ceramic shapes in sizes coordinated with field tile.
   1. Applications:
      a. Open Edges: Bullnose.
      b. Inside Corners: Jointed.
      c. Floor to Wall Joints: Cove base.
   2. Manufacturers: Same as for tile.

B. Thresholds: 2 inches wide by full width of wall or frame opening; beveled edge on both long edges; without holes, cracks, or open seams.
   1. Thickness: 1/2 inch.
   2. Material: Marble, honed finish.
   3. Applications:
      a. At doorways where tile terminates.

203 SETTING MATERIALS

A. Latex-Portland Cement Mortar Bond Coat: ANSI A118.4.
   1. Applications: Use this type of bond coat where indicatedfor installation of ceramic mosaic tile under base bid.
   2. Products:
      a. ARDEX Engineered Cements; ARDEX X 5.
      b. Custom Building Products, with Multi-Surface Bonding Primer.
      c. LATICRETE International, Inc; 254 Platinum.
      d. Or equal.

B. Improved Latex-Portland Cement Mortar Bond Coat: ANSI A118.15.
   1. Applications: Use this type of bond coat where indicatedfor installation of large format porcelain tile under add alternate.
   2. Products:
      a. ARDEX Engineered Cements; S 28.
      b. Custom Building Products; Complete Contact-LFT Premium Rapid Setting Large Format Tile Mortar, with Multi-Surface Bonding Primer.
      c. LATICRETE International, Inc; LHT.
      d. Or equal.

204 GROUTS

A. High Performance Polymer Modified Grout: ANSI A118.7 polymer modified cement grout.
   1. Applications: Use this type of grout where indicated and where no other type of grout is indicated.
   2. Use sanded grout for joints 1/8 inch wide and larger; use unsanded grout for joints less than 1/8 inch wide.
   3. Color(s): As selected by Architect from manufacturer's full line.
   4. Products:
      a. ARDEX Engineered Cements; ARDEX FL.
      b. Custom Building Products; Fusion Pro Single Component Grout.
      c. LATICRETE International, Inc; LATICRETE PERMACOLOR Grout.
      d. Or equal.

B. Epoxy Grout: ANSI A118.3 chemical resistant and water-cleanable epoxy grout.
   1. Applications: Quarry tile.

2. Color(s): As selected by Architect from manufacturer's full line.
3. Products:
    a. ARDEX Engineered Cements; ARDEX WA: www.ardexamericas.com/#sle.
    b. Custom Building Products; CEG-IG 100% Solids Industrial Grade Epoxy Grout: www.custombuildingproducts.com/#sle.
    c. LATICRETE International, Inc; LATICRETE SPECTRALOCK PRO Premium Grout: www.laticrete.com/#sle.
    d. Or equal.

2.05 MAINTENANCE MATERIALS

A. Tile Sealant: Gunnable, silicone, siliconized acrylic, or urethane sealant; moisture and mildew resistant type.
    1. Applications: Between tile and plumbing fixtures.
    2. Color(s): As selected by Architect from manufacturer's full line.
    3. Products:
        a. ARDEX Engineered Cements; ARDEX SX.
        b. Custom Building Products; Commercial 100% Silicone Caulk.
        c. LATICRETE International, Inc; LATICRETE LATASIL.
        d. Or equal.

B. Grout Sealer: Liquid-applied, moisture and stain protection for existing or new Portland cement grout.
    1. Composition: Water-based colorless silicone.
    2. Products:
        a. Merkrete, by Parex USA, Inc; Merkrete Grout Sealer.
        b. Or equal.

2.06 ACCESSORY MATERIALS

A. Concrete Floor Slab Crack Isolation Membrane: Material complying with ANSI A118.12; not intended as waterproofing.
    1. Crack Resistance: No failure at 1/8 inch gap, minimum.
    2. Fluid or Trowel Applied Type:
        a. Material: Synthetic rubber or Acrylic.
        b. Thickness: 20 mils, maximum.
        c. Products:
            1) H.B. Fuller Construction Products, Inc; TEC HydraFlex Waterproofing Crack Isolation Membrane: www.tecspecialty.com/#sle.
            2) LATICRETE International, Inc; LATICRETE Blue 92 Anti-Fracture Membrane: www.laticrete.com/#sle.
            3) Merkrete, by Parex USA, Inc; Merkrete Fracture Guard: www.merkrete.com/#sle.
            4) Or equal.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that subfloor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive tile.

B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive tile.

C. Verify that subfloor surfaces are dust free and free of substances that could impair bonding of setting materials to subfloor surfaces.

D. Cementitious Subfloor Surfaces: Verify that substrates are ready for tiling installation by testing for moisture and alkalinity (pH).
   1. Test in accordance with Section 090561.
   2. Obtain instructions if test results are not within limits recommended by tiling material manufacturer and setting material manufacturer.

E. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Protect surrounding work from damage.

B. Vacuum clean surfaces and damp clean.

C. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.

3.03 INSTALLATION - GENERAL

A. Install tile and grout in accordance with applicable requirements of ANSI A108.1a through ANSI A108.19 , manufacturer's instructions, and TCNA (HB) recommendations.

B. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.

C. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor joints.

D. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make grout joints without voids, cracks, excess mortar or excess grout, or too little grout.

E. Form internal angles square and external angles bullnosed.

F. Install thresholds where indicated.

G. Sound tile after setting. Replace hollow sounding units.

H. Keep control and expansion joints free of mortar, grout, and adhesive.

I. Prior to grouting, allow installation to completely cure; minimum of 48 hours.

J. Grout tile joints unless otherwise indicated. Use standard grout unless otherwise indicated.

K. At changes in plane and tile-to-tile control joints, use tile sealant instead of grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding.

3.04 INSTALLATION - FLOORS - THIN-SET METHODS

A. Over interior concrete substrates, install in accordance with TCNA (HB) Method F113, dry-set or latex-Portland cement bond coat, with standard grout, unless otherwise indicated.
   1. Where epoxy or furan grout is indicated, but not epoxy or furan bond coat, install in accordance with TCNA (HB) Method F115.

B. Install tile-to-tile floor movement joints in accordance with TCNA (HB) Method EJ171F.

3.05 INSTALLATION - WALL TILE

A. Over interior concrete and masonry install in accordance with TCNA (HB) Method W202, thin-set with dry-set or latex-Portland cement bond coat.

3.06 CLEANING

A. Clean tile and grout surfaces.

3.07 PROTECTION

A. Do not permit traffic over finished floor surface for 4 days after installation.

END OF SECTION

SECTION 095100
ACOUSTICAL CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Suspended metal grid ceiling system.

B. Acoustical units.

C. Perimeter trim and accessories.

D. Supplementary acoustical insulation above ceiling.

1.02 RELATED REQUIREMENTS

A. Section 211300 - Fire-Suppression Sprinkler Systems: Sprinkler heads in ceiling system.

B. Section 233700 - Air Outlets and Inlets: Air diffusion devices in ceiling.

C. Section 265100 - Interior Lighting: Light fixtures in ceiling system.

D. Section 275116 - Public Address Systems: Speakers in ceiling system.

E. Section 284600 - Fire Detection and Alarm: Fire alarm components in ceiling system.

1.03 REFERENCE STANDARDS

A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

B. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

C. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric).

D. ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.

E. ASTM C635/C635M - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.

F. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels.

G. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.

H. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions.

I. ASTM E1264 - Standard Classification for Acoustical Ceiling Products.

J. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth.

K. UL (FRD) - Fire Resistance Directory.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.

B. Do not install acoustical units until after interior wet work is dry.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on suspension system components and acoustical units.

C. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016000 - Product Requirements, for additional provisions.
   2. Extra Acoustical Units: Quantity equal to 5 percent of total installed.
   3. Hold down & Impact clips: Quantity equal to 2 percent of total installed.

1.06 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of acoustical ceiling panel and supporting suspension system through one source from a single manufacturer.

B. Fire-Resistive Assemblies: Complete assembly listed and classified by UL for the fire resistance indicated.

C. Suspension System Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Acoustical Unit Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. 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.

1.08 FIELD CONDITIONS

A. 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.

B. Maintain uniform temperature of minimum 60 degrees F, and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

PART 2 PRODUCTS

2.01 ACOUSTICAL UNITS

A. Manufacturers:
   1. Armstrong World Industries, Inc
   2. CertainTeed Corporation
   3. USG Corporation
   4. Or equal.

B. Acoustical Units - General: ASTM E1264, Class A.
   1. Units for Installation in Fire-Rated Suspension System: Listed and classified for the fire-resistive assembly as part of suspension system.

C. Acoustical Panels, Type APC-1: Mineral fiber with membrane-faced overlay, with the following characteristics:
   1. Application(s): Existing Lobby ceilings.
   2. Form and Pattern: Match existing.
   3. Size: 24 by 48 inches.
   4. Thickness: Minimum 3/4 inches.
   5. Edge: Match exsitng.
   6. Suspension System: Existing.

D. Acoustical Panels, Type APC-2: Mineral fiber with scrubbable finish, with the following characteristics:
   1. Application(s): Kitchen Ceiling.
   2. Classification: ASTM E1264 Type IX.
      a. Form: 2, water felted.
      b. Pattern: "G" - smooth.
   3. Size: 24 by 48 inch.
   4. Thickness: 5/8 inches.
   5. Light Reflectance: 89 percent, determined in accordance with ASTM E1264.
   6. Ceiling Attenuation Class (CAC): 33, determined in accordance with ASTM E1264.
   7. Panel Edge: Square.
   8. Color: White.
   9. Suspension System Type 1: Exposed grid.
   10. Products:
      a. Armstrong; Kitchen Zone, 672 (Basis of Design).
      b. Or equal.

E. Acoustical PanelsType APC-3: Painted mineral fiber, ASTM E1264 Type III, with the following characteristics:
   1. VOC Content: As specified in Section 01 6116.
   2. VOC Content: Certified as Low Emission by one of the following :
      a. GreenGuard Children and Schools; www.greenguard.org.
      b. Product listing in the CHPS Low-Emitting Materials Product List at; www.chps.net/manual/lem_table.htm.
   3. Size: 24 x 48 inches.
   4. Thickness: 5/8 inches.
   5. Composition: Wet felted.
   6. Light Reflectance: 0.85 percent, determined as specified in ASTM E1264.
   7. NRC : 0.55, determined as specified in ASTM E1264.
   8. Ceiling Attenuation Class (CAC): 35, determined as specified in ASTM E1264.
   9. Fire Rating: Class A
   10. Recycled Content: up to 55 %
   11. Edge: Square.
   12. Surface Color: White.
   13. Surface Pattern: Non-directional fissured.
   14. Product: Fine Fissured - #1729 (Basis of Design) by Armstrong.
   15. Suspension System: Exposed gridType 2.

202 SUSPENSION SYSTEM(S)

A. Manufacturers:
   1. Armstrong World Industries, Inc

2. Chicago Metallic Corporation
3. USG

B. Suspension Systems - General: ASTM C635; die cut and interlocking components, with stabilizer bars, clips, splices, perimeter moldings, and hold down clips as required. Provide Wall Moldings to match specified grid system(s). Utilize Angle molding at all walls unless Shadow or Channel moldings are indicated on drawings by detail or schedule.
   1. Materials:
      a. Steel Grid: ASTM A653/A653M, G30 coating, unless otherwise indicated.
      b. Aluminum Grid: Aluminum sheet, ASTM B209 (ASTM B209M).

C. Exposed Suspension System, Type 1: Aluminum grid and cap; factory-applied closed-cell foam gaskets.
   1. Application(s): Kitchen ceilings.
   2. Structural Classification: Light-duty, when tested in accordance with ASTM C635/C635M.
   3. Profile: Tee; 15/16 inch face width.
   4. Finish: Baked enamel.
   5. Products:
      a. Armstrong; Prelude Plus XL Aluminum (Basis of Design).
      b. Or equal.

D. Exposed Steel Suspension SystemType 2: Formed galvanized steel, commercial quality cold rolled; heavy-duty with Aluminum caps.
   1. Profile: Tee; 15/16 inch wide face.
   2. Construction: Double web.
   3. Finish: White painted.
   4. Product: Prelude XL by Armstrong (Basis of Design).
      a. Or equal.
   5. Recycled Content: 30%

2.03 ACCESSORIES

A. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.

B. Hanger Wire: 12 gauge, 0.08 inch galvanized steel wire.

C. Perimeter Moldings: Same metal and finish as grid.
   1. At Exposed Grid: Provide L-shaped molding for mounting at same elevation as face of grid.
   2. If indicated on drawings - provide Shadow and/or Channel moldings at locations identifed on drawings or in schedules.

D. Touch-up Paint: Type and color to match acoustical and grid units.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that layout of hangers will not interfere with other work.

C. 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.

D. Ensure layout of hangers and carrying channels are located to accommodate fixtures and equipment that will be placed after installation of ceiling grid systems.

E. Where ducts or other equipment prevent regular spacing of hangers, reinforce nearest adjacent hangers and related carrying channels as required to span required distance.

3.02 PREPARATION

A. Install after major above-ceiling work is complete.

B. Coordinate the location of hangers with other work.

3.03 INSTALLATION - GENERAL

A. Verify existing conditions before starting work.

B. Verify that layout of hangers will not interfere with other work.

C. Mechanical and Electrical Components: Where mechanical and electrical components are an integral part of ceiling system, support such components by supplementary hangers attached to the grid system and located within 6 inches of each corner of such component. Extremely heavy components shall be supported independently of grid system.

D. Do not eccentrically load system or produce rotation of suspension members.

E. In absence of Reflected Ceiling Plans, lay out ceiling system on room axis to a balanced grid design leaving equal border pieces.

F. Do not support any item via ceiling panels or lay other materials on ceiling panel areas; ceiling panels shall only carry their own weight. Use metal framing or other means of supporting items penetrating ceiling panels.

3.04 INSTALLATION - SUSPENSION SYSTEM

A. Install suspension system in accordance with ASTM C636/C636M, ASTM E580/E580M, and manufacturer's instructions and as supplemented in this section.

B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.

C. Locate system on room axis according to reflected plan.

D. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
   1. Use longest practical lengths.

E. Install after major above-ceiling work is complete. Coordinate the location of hangers with other work.

F. Provide hanger clips during steel deck erection. Provide additional hangers and inserts as required.

G. Suspension System, Non-Seismic: Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.

H. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.

I. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.

J. Support fixture loads using supplementary hangers located within 6 inches of each corner, or support components independently.

K. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.

L. Do not eccentrically load system or induce rotation of runners.

M. Do not attach hangers to steel deck tabs or to steel roof deck. Attach hangers to structural members.

N. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
   1. Use longest practical lengths.
   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.
   3. Miter corners.

O. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

3.05 INSTALLATION - ACOUSTICAL UNITS

A. Install acoustical units in accordance with manufacturer's instructions.

B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.

C. Lay directional patterned units as indicated on the reflected ceiling plans. In the abscence of plans - lay directional patterned units.

D. Fit border trim neatly against abutting surfaces.

E. Install units after above-ceiling work is complete.

F. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.

G. Cutting Acoustical Units:
   1. Cut to fit irregular grid and perimeter edge trim.
   2. Make field cut edges of same profile as factory edges.
   3. Double cut and field paint exposed reveal edges.

H. Where round obstructions occur, provide preformed closures to match perimeter molding.

I. Lay acoustical insulation for a distance of 48 inches either side of acoustical partitions as indicated.

J. Install hold-down / impact clips on each panel to retain panels tight to grid system; comply with fire rating requirements. Install clips to retain identified panels tight to grid, spaced as recommended by panel manufacturer's written instructions, unless otherwise indicated. Install in areas indicated, in areas required by authorities having jurisdiction, [for fire-resistance ratings,] and at following locations:
   1. Within entrance vestibules.
   2. 15 feet of inner vestibule doors where air up-lift might occur.
   3. Toilet rooms.
   4. Stair towers.

K. Install hold-down clips on panels within 20 ft of an exterior door in open rooms/areas and corridors not seperated from the exterior by a vestibule.

3.06 TOLERANCES

A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.

B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

3.07 FIELD QUALITY CONTROL

A. [Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
   1. Compliance of seismic design.

B. Make complete inspection after installation by representative of ceiling manufacturer to verify that suspension system is properly installed according to manufacturer's published specifications and details.

C. During progress of Work required by this Section, make visual inspections to verify that:
   1. Materials used comply with specified requirements.
   2. Materials are properly stored and handled.
   3. Wire hangers are properly installed with specified overlaps.

D. Make necessary repairs or corrections as a result of representative's inspections at no additional cost to Owner.

3.08 ADJUSTING

A. Adjust ceiling components to provide a consistent finish and appearance in conformity with pre-established tolerances and requirements. Replace panels showing signs of damage, either in finish or in form, with new materials at no additional cost to Owner.

3.09 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.

B. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

3.10 SCHEDULE

A. Unless otherwise indicated on Drawings, conform to acoustical panel types, grid types, and accessories as identified in this schedule per the requiremnts identified in the sections above.

END OF SECTION

SECTION 096500
RESILIENT FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Resilient tile flooring.

B. Resilient base.

C. Installation accessories.

1.02 RELATED REQUIREMENTS

A. Section 090561 - Common Work Results for Flooring Preparation: Removal of existing floor coverings, cleaning, and preparation.

B. Section 090561 - Common Work Results for Flooring Preparation: Concrete slab moisture and alkalinity testing and remediation procedures.

1.03 REFERENCE STANDARDS

A. ASTM F1066 - Standard Specification for Vinyl Composition Floor Tile.

B. ASTM F1861 - Standard Specification for Resilient Wall Base.

1.04 SUBMITTALS

A. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.

B. Selection Samples: Submit manufacturer's complete set of color samples for Architect's initial selection.

C. Verification Samples: Submit two samples, 4 by 4 inch in size illustrating color and pattern for each resilient flooring product specified.

D. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016000 - Product Requirements, for additional provisions.
   2. Extra Wall Base: 20 linear feet of each type and color.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in installing specified flooring with minimum three years documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Upon receipt, immediately remove any shrink-wrap and check materials for damage and the correct style, color, quantity and run numbers.

B. Store all materials off of the floor in an acclimatized, weather-tight space.

C. Maintain temperature in storage area between 55 degrees F and 90 degrees F.

D. Protect roll materials from damage by storing on end.

1.07 FIELD CONDITIONS

A. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F.

PART 2 PRODUCTS

2.01 TILE FLOORING

A. Vinyl Composition Tile - Type [____]: Homogeneous, with color extending throughout thickness.
   1. Manufacturers:
      a. Armstrong Flooring; ; Excelon (Basis of Design): www.armstrongflooring.com.
      b. Johnsonite, a Tarkett Company.
      c. [____].
   2. Minimum Requirements: Comply with ASTM F1066, of Class corresponding to type specified.
   3. Size: 12 by 12 inch.
   4. Thickness: 0.125 inch.
   5. Color: Color type and distribution as indicated on the drawings. Final selection by the Architect.

2.02 RESILIENT BASE

A. Resilient Base: ASTM F1861, Type TS rubber, vulcanized thermoset; top set Style B, Cove.
   1. Manufacturers:
      a. Burke Flooring; Commercial Wall Base - TS: www.burkeflooring.com/#sle.
      b. Johnsonite, a Tarkett Company: www.johnsonite.com/#sle.
      c. Roppe Corp: www.roppe.com/#sle.
      d. Or equal.
   2. Height: 4 inch.
   3. Thickness: 0.125 inch.
   4. Finish: Satin.
   5. Length: Roll.
   6. Color: To be selected by Architect from manufacturer's full range.
   7. Accessories: Premolded internal corners and end stops.

2.03 ACCESSORIES

A. Subfloor Filler: White premix latex; type recommended by adhesive material manufacturer.

B. Primers and Adhesives: Waterproof; types recommended by flooring manufacturer.

C. Filler for Coved Base: Plastic.

D. Sealer and Wax: Types recommended by flooring manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.

B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive resilient base.

C. Cementitious Subfloor Surfaces: Verify that substrates are ready for resilient flooring installation by testing for moisture and alkalinity (pH).
   1. Test in accordance with Section 090561.
   2. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.

3.02 PREPARATION

A. Prepare floor substrates for installation of flooring in accordance with Section 090561.

3.03 INSTALLATION - GENERAL

A. Starting installation constitutes acceptance of subfloor conditions.

B. Install in accordance with manufacturer's written instructions.

C. Adhesive-Applied Installation:
   1. Spread only enough adhesive to permit installation of materials before initial set.
   2. Fit joints and butt seams tightly.
   3. Set flooring in place, press with heavy roller to attain full adhesion.

D. Where type of floor finish, pattern, or color are different on opposite sides of door, terminate flooring under centerline of door.

E. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated.
   1. Resilient Strips: Attach to substrate using adhesive.

F. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.

3.04 INSTALLATION - TILE FLOORING

A. Mix tile from container to ensure shade variations are consistent when tile is placed, unless otherwise indicated in manufacturer's installation instructions.

B. Lay flooring with joints and seams parallel to building lines to produce symmetrical pattern.

C. Install square tile to random pattern. Allow minimum 1/2 full size tile width at room or area perimeter.

3.05 INSTALLATION - RESILIENT BASE

A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches between joints.

B. Install base on solid backing. Bond tightly to wall and floor surfaces.

C. Scribe and fit to door frames and other interruptions.

3.06 CLEANING

A. Remove excess adhesive from floor, base, and wall surfaces without damage.

B. Clean and wax in accordance with manufacturer's written instructions.

3.07 PROTECTION

A. Prohibit traffic on resilient flooring for 48 hours after installation.

END OF SECTION

SECTION 096618
RESILIENT QUARTZ TILE FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Resilient quartz tile.

B. Accessories:
   1. Adhesives.
   2. Trowels.
   3. Cleaning products.

C. Applied four-coat protective finish

1.02 REFERENCE STANDARDS

A. ASTM F 710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring

B. ASTM E 648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source.

C. ASTM E 662 - Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials.

D. ASTM F 970 - Standard Test Method for Static Load Limit.

E. ASTM F 1700 - Standard Specification for Solid Vinyl Floor Tile. Resilient Floor Covering Institute (RFCI) - Recommended Work Practices for Removal of Resilient Floor Coverings

1.03 SUBMITTALS

A. Product Data: Provide product data including manufacturer's installation instructions.

B. Shop Drawings: Indicate keyed location plans, tile type, layout pattern direction, edge transitions and attachment requirements. Show cutouts for columns, doorways, enclosing partitions, built-in furniture, cabinets, expansion joints, and control joints..

C. Samples: Submit two representative samples, 24 by 24 inch in size, illustrating color and texture.

D. Certificate: Certify that products of this section meet or exceed specified requirements.

E. Manufacturer's Instructions: Indicate all methods of installation, cleaning and sealing.

F. Installer's Qualification Statement.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project:
   1. Extra Stock Materials: 100 square feet of each type and color of tile.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing work of the type specified and with at least five years ofdocumented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Storage, Delivery & handling per manufacturer’s guidelines, and industry guidelines.

1.06 FIELD CONDITIONS

A. Provide permanent HVAC operation (1-week minimum) and permanent lighting prior to installation.

B. Ambient Conditions: Maintain room temperatures at 65 to 80 degrees F during and after installation of resilient quartz tile.

C. Do not install flooring until all other significant construction work is complete. Moisture producing activities, such as drywall, concrete, masonry, painting and grouting must be complete and cured.

1.07 WARRANTY

A. Provide twenty year manufacturer warranty for wear through due to normal use in light industrial and commercial applications.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Rickett America; Rickett Quartz Tile (Basis of Design).

2.02 MATERIALS

A. Quartz Tile: Construction.
   1. Composition: Minimum 70 percent mined quartz suspended in a vinyl matrix.
   2. Surface: Type A, smooth.
   3. Thickness: 0.100 inch.
   4. Edge: Square.
   5. Color: To be selected by Architect from full range. Multiple colors may be selected for pattern.

2.03 ACCESSORIES

A. Concrete slab leveling and patching compound: Latex modified Portland cement-based patching compound; Ardex CP, or Architect chosen acceptable equivalent.

B. Adhesive: Pressure sensitive, solvent free, low odor, acrylic based water-resistant type as recommended by the tile manufacturer.

C. Moldings, Transition and Edge Strips: as required at condition.

D. Finishers and Cleaners:
   1. Provide Phazer Low Maintenance Floor Finish system by Ecolab (Basis of Design).
   2. Zinc-free, 20% solids, low odor.
      a. Physical State: Liquid [Emulsion].
      b. Color: Opaque
      c. Odor: Ammoniacal
      d. pH: 7.5 to 8.5
      e. Relative Density: 1.02 to 1.03.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verification of Conditions: Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, clean, dry and free of chemicals that might interfere with bonding of flooring to substrate..

3.02 PREPARATION

A. Prepare per manufacturer's written instructions
   1. Verify that subfloor is clean, flat, smooth, free of dirt, rust, paint, oil, wax or any contaminant that will interfere with adhesive bonding.
   2. Expansion joints, isolation joints, or other moving joints must be honored and must not be filled with underlayment products or other materials, and floor coverings must not be laid over them.
   3. Existing and Other Substrates:

a. Refer to manufacturer's professional installation guide and/or contact manufacturer, as special conditions may exist.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. On installed Quartz Tile flooring, install four (4) coats of Floor Finish system in accordance with manufacturer's instructions.
   1. Apply each coat at 1750 ft2/U.S. gallon.
   2. Allow a minimum of 40 minutes dry time between coats.

3.04 CLEANING

A. Clean and protect completed construction until Date of Substantial Completion..

END OF SECTION

SECTION 096813
TILE CARPETING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Carpet tile, fully adhered.

1.02 RELATED REQUIREMENTS

A. Section 096500 - Resilient Flooring : Resilient base.

1.03 REFERENCE STANDARDS

A. ASTM D2859 - Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials.

B. CRI 104 - Standard for Installation of Commercial Carpet.

C. CRI (GLP) - Green Label Plus Testing Program - Certified Products.

1.04 SUBMITTALS

A. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.

B. Shop Drawings: Indicate layout of joints.

C. Samples: Submit two carpet tiles illustrating color and pattern design for each carpet color selected.

D. Submit two, 6 inch long samples of edge strip.

E. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

F. Concrete Subfloor Test Report: Submit a copy of the moisture and alkalinity (pH) test reports.

G. Installer's Qualification Statement.

H. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.

I. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

J. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. Extra Carpet Tiles: Quantity equal to 5 percent of total installed of each color and pattern installed.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in installing carpet tile with minimum three years documented experience and approved by carpet tile manufacturer.

1.06 FIELD CONDITIONS

A. Store materials in area of installation for minimum period of 24 hours prior to installation.

1.07 WARRANTY

A. Provide the Owner with manufacturer's limited lifetime commercial warranty.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Tile Carpeting:

1. Forbo Flooring Systems; Coral Brush (Basis of Design).
   a. Or equal.
2. Interface; Step Repeat Collection: www.interface.com.
3. Shaw Contract; Steppin Out, welcome II tile 5T031: www.shawcontract.com.

202 MATERIALS

A. Tile Carpetingfor Walk-off Mat: Tufted cut pile, manufactured in one color dye lot.
   1. Product: Coral Brush manufactured by Forbo Flooring Systems.
   2. Tile Size: 50 by 50 cm.
   3. Thickness: Total 9 mm.
   4. Color: Selected from by the Architect from the manufacturer's full range of colors.
   5. Pattern: Broadloom or tessellated.
   6. Surface Flammability Ignition: Pass ASTM D2859 (the "pill test").
   7. Maximum Electrostatic Charge: Less than 2 Kv. at 20 percent relative humidity.
   8. Pile Material: 100 percent regenerated nylon.
   9. Pile Installation Weight: 750 grams/square meter.
   10. Pile Density: 0.111 gram/cubic meter.
   11. Primary Backing Material: Phthalate free vinyl.
   12. Total Weight: 3,950 grams/square meter.

B. Tile Carpeting: Multi-level pattern loop, manufactured in one color dye lot.
   1. Product: Altered Collection, Style No. as noted on drawings manufactured by Shaw Contract.
   2. Tile Size: 9 by 36 or 18 by 36 inch, nominal.
   3. Thickness: Total 0.22 inch.
   4. Color: As selected by the Architect from the manufacturer's full range of colors.
   5. Pattern: As indicated on the drawings.
   6. Surface Flammability Ignition: Pass ASTM D2859 (the "pill test").
   7. VOC Content: Provide CRI (GLP) certified product; in lieu of labeling, independent test report showing compliance is acceptable.
   8. Maximum Electrostatic Charge: 3.5 Kv. at 20 percent relative humidity.
   9. Gage: 1/12 inch.
   10. Stitches: 10 per inch.
   11. Density Factor: 10.98 kilotex.
   12. Pile Density: 0.111 gram/cubic meter.
   13. Primary Backing Material: Synthetic.
   14. Secondary Backing Material: exoworx tile.
   15. Total Weight: 18.0 oz/sq yd.

203 ACCESSORIES

A. Sub-Floor Filler: White premix latex; type recommended by flooring material manufacturer.

B. Edge Strips, Floor Transition Strips: Rubber, color as selected by Architect.

C. Adhesives:
   1. Compatible with materials being adhered; maximum VOC content of 50 g/L; CRI (GLP) certified; in lieu of labeled product, independent test report showing compliance is acceptable.

D. Carpet Tile Adhesive: Recommended by carpet tile manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that sub-floor surfaces are smooth and flat within tolerances specified for that type of work and are ready to receive carpet tile.

B. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of adhesive materials to sub-floor surfaces.

C. Cementitious Sub-floor Surfaces: Verify that substrates are dry enough and ready for flooring installation by testing for moisture and pH.
   1. Test in accordance with ASTM F710.
   2. Obtain instructions if test results are not within limits recommended by flooring material manufacturer and adhesive materials manufacturer.

3.02 PREPARATION

A. Prepare floor substrates as recommended by flooring and adhesive manufacturers.

B. Remove sub-floor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with sub-floor filler.

C. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Prohibit traffic until filler is cured.

D. Vacuum clean substrate.

3.03 INSTALLATION

A. Starting installation constitutes acceptance of sub-floor conditions.

B. Install carpet tile in accordance with manufacturer's instructions.

C. Blend carpet from different cartons to ensure minimal variation in color match.

D. Cut carpet tile clean. Fit carpet tight to intersection with vertical surfaces without gaps.

E. Lay carpet tile in square pattern, with pile direction parallel to next unit, set parallel to building lines.

F. Locate change of color or pattern between rooms under door centerline.

G. Fully adhere carpet tile to substrate.

H. Adhere carpet up vertical surfaces to form base at riser locations as indicated on drawings. Terminate top of base with nosing.

I. Trim carpet tile neatly at walls and around interruptions.

J. Complete installation of edge strips, concealing exposed edges.

3.04 CLEANING

A. Remove excess adhesive without damage, from floor, base, and wall surfaces.

B. Clean and vacuum carpet surfaces.

END OF SECTION

SECTION 099113 - EXTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes surface preparation and the application of paint systems on the following exterior substrates:

1. Steel.
2. Aluminum (not anodized or otherwise coated).
3. Stucco (**for East Dover ES**)

1.2 DEFINITIONS

A. Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.

B. Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.

C. Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.

D. Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.

E. Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.

F. Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

B. Samples: For each type of paint system and each color and gloss of topcoat.

C. Product List: For each product indicated. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.

1.4 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. Paint: **5** percent, but not less than 1 gal. of each material and color applied.

1.5 QUALITY ASSURANCE

A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.

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 color selections will be based on mockups.

a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product by the following:

1. Tnemec High Performance Protective Coatings
   a. Refer to sections below for product applications.
2. Or approved equal

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. VOC Content: Provide materials that comply with VOC limits of authorities having jurisdiction.

D. Colors: As selected by Architect from manufacturer's full range.

2.3 PRIMERS

A. Primer, Phenalkamine Epoxy Mastic (**for Steel Lintels**)

1. ProTuff Mastic, Series 132 or approved equal.

B. Primer, Hydrophobic Acrylic Polymer (**for Aluminum Panels**)

1. Spra-Saf EN, Series 30 or approved equal.

C. Primer, Inorganic Hybrid Water-Based Epoxy (**for Stucco**)

1. Typoxy, Series 27WB

2.4 EXTERIOR PAINTS (TOP AND FINISH COATS)

A. Top and Finish, Advanced Thermoset Solution Fluoropolyme (**for Steel**)

1. Fluoronar, Series 1070V or approved equal.

B. Top and Finish, Advanced Thermoset Solution Fluoropolyme (**for Aluminum**)

1. Fluoronar, Series 1070V or approved equal.

C. Top and Finish, Modified Polyamine Epoxy (**for Stucco**)

1. Mult-Purpose Epoxy, Sereis 49 or approved equal.

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. Portland Cement Plaster: 12 percent.

C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

D. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates and paint systems indicated.

B. 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.

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions and recommendations in "MPI Manual."

B. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

3.4 CLEANING AND PROTECTION

A. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

B. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

END OF SECTION 099113

SECTION 099123
INTERIOR PAINTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints.

C. Scope: Finish interior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.

D. Do Not Paint or Finish the Following Items:
   1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
   2. Items indicated to receive other finishes.
   3. Items indicated to remain unfinished.
   4. Fire rating labels, equipment serial number and capacity labels, bar code labels, and operating parts of equipment.
   5. Stainless steel, anodized aluminum, bronze, terne coated stainless steel, and lead items.
   6. Floors, unless specifically indicated.
   7. Glass.
   8. Concealed pipes, ducts, and conduits.

1.02 RELATED REQUIREMENTS

A. Section 055000 - Metal Fabrications: Shop-primed items.

B. Section 220553 - Identification for Plumbing Piping and Equipment: Painted identification.

C. Section 230553 - Identification for HVAC Piping and Equipment: Painted identification.

D. Section 260553 - Identification for Electrical Systems: Painted identification.

1.03 DEFINITIONS

A. Comply with ASTM D16 for interpretation of terms used in this section.

1.04 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency.

B. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications.

C. MPI (APL) - Master Painters Institute Approved Products List; Master Painters and Decorators Association.

D. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual.

E. SCAQMD 1113 - Architectural Coatings.

F. SSPC-SP 1 - Solvent Cleaning.

G. SSPC-SP 6 - Commercial Blast Cleaning.

1.05 SUBMITTALS

A. Product Data: Provide complete list of products to be used, with the following information for each:
   1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
   2. MPI product number (e.g. MPI #47).

3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
4. Manufacturer's installation instructions.

B. Samples: Submit two painted samples, illustrating selected colorsand textures for each color and system selectedwith specified coats cascaded. Submit on tempered hardboard, 8 1/2 by 11 inch in size.

C. Certification: By manufacturer that paints and finishes comply with VOC limits specified.

D. Manufacturer's Instructions: Indicate special surface preparation procedures.

E. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, material safety data sheets (MSDS), care and cleaning instructions, touch-up procedures, repair of painted and finished surfaces, and color samples of each color and finish used.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. Extra Paint and Finish Materials: 1 gallon of each color; from the same product run, store where directed.
2. Label each container with color in addition to the manufacturer's label.

1.06 QUALITY ASSURANCE

A. Applicator Qualifications: Company specializing in performing the type of work specified with minimum three years experience and approved by manufacturer.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.08 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Do not apply materials when relative humidity exceeds 85 percent; at temperatures less than 5 degrees F above the dew point; or to damp or wet surfaces.

D. Minimum Application Temperatures for Paints: 50 degrees F for interiors unless required otherwise by manufacturer's instructions.

E. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide paints and finishes used in any individual system from the same manufacturer; no exceptions.

B. Paints:
1. Base Manufacturer: Sherwin-Williams Company.
2. Behr Process Corporation.

3. PPG Paints.
4. Or equal.

C. Primer Sealers: Same manufacturer as top coats.

2.02 PAINTS AND FINISHES - GENERAL

A. Paints and Finishes: Ready mixed, unless intended to be a field-catalyzed paint.
1. Where MPI paint numbers are specified, provide products listed in Master Painters Institute Approved Product List, current edition available at www.paintinfo.com, for specified MPI categories, except as otherwise indicated.
2. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
3. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
4. Supply each paint material in quantity required to complete entire project's work from a single production run.
5. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.

B. Volatile Organic Compound (VOC) Content:
1. Provide paints and finishes that comply with the most stringent requirements specified in the following:
a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
b. SCAQMD 1113 Rule.
2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.

C. Flammability: Comply with applicable code for surface burning characteristics.

D. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.

E. Colors: To be selected from manufacturer's full range of available colors.
1. Selection to be made by Architect after award of contract.

2.03 PAINT SYSTEMS - INTERIOR

A. Paint I-OP - Interior Surfaces to be Painted, Unless Otherwise Indicated: Including concrete masonry units and uncoated steel.
1. Two top coats and one coat primer.
2. Top Coat(s): Interior Latex.
a. Products:
1) Behr Marquee Interior Semi-Gloss Enamel [No. 3450]. (MPI #54)
2) PPG Paints Ultra-Hide 150 Interior Paint, 1416-XXXXV, Semi-Gloss. (MPI #54)
3) Sherwin-Williams Harmony Interior Acrylic Latex, Semi-Gloss. (MPI #54)
3. Top Coat Sheen:
a. Semi-Gloss: MPI gloss level 5; use this sheen at all locations.
4. Primer: As recommended by top coat manufacturer for specific substrate.

B. Paint I-OP-MD-WC - Medium Duty Overhead: Including gypsum board.
1. Two top coats and one coat primer.
2. Top Coat(s): High Performance Architectural Interior Latex.

a. Products:
1) Behr Premium Plus Interior Eggshell Enamel [No. 2050]. (MPI #139)
2) PPG Paints Pitt-Tech Plus WB DTM Industrial Enamel, 90-1110 Series, Satin.
3) Sherwin-Williams Pro Industrial Acrylic Coating, Eg-Shel.

3. Primer: As recommended by top coat manufacturer for specific substrate.

2.04 PRIMERS

A. Primers: Provide the following unless other primer is required or recommended by manufacturer of top coats.
1. Interior/Exterior Latex Block Filler; MPI #4.
a. Products:
1) Behr Paint; Behr Pro, Block Filler PR50. (MPI #4)
2) PPG Paints Speedhide Masonry Hi Fill Latex Block Filler, 6-15XI. (MPI #4)
3) Sherwin-Williams; Pro Industrial, Heavy Duty Block Filler B42W00150 (MPI #4).

2.05 ACCESSORY MATERIALS

A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin application of paints and finishes until substrates have been properly prepared.

B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.

D. Test shop-applied primer for compatibility with subsequent cover materials.

E. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
1. Gypsum Wallboard: 12 percent.
2. Masonry, Concrete, and Concrete Masonry Units: 12 percent.

3.02 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.

D. Seal surfaces that might cause bleed through or staining of topcoat.

E. Masonry:
1. Remove efflorescence and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces or if alkalinity of mortar joints exceed that permitted in manufacturer's written instructions. Allow to dry.
2. Prepare surface as recommended by top coat manufacturer.

F. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.

G. Ferrous Metal:

1. Solvent clean according to SSPC-SP 1.
2. Remove rust, loose mill scale, and other foreign substances using using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.

3.03 APPLICATION

A. Apply products in accordance with manufacturer's written instructionsand recommendations in "MPI Architectural Painting Specification Manual".

B. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.

C. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

D. Apply each coat to uniform appearance in thicknesses specified by manufacturer.

E. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

F. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.05 PROTECTION

A. Protect finishes until completion of project.

B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION

SECTION 099419
MULTI-COLOR WALL FINISH

<<<< UPDATE NOTES

PART 1 GENERAL

201 SECTION INCLUDES

A. Provide labor, material, equipment, related services, and supervision required, including, but not limited to, manufacturing, fabrication, erection, and application for multi-color wall finishes as required for the complete performance of the work, and as shown on the Drawings and as herein specified.
   1. Provide a water-based single component multi-color finish in a single can that shall be spray-applied.
   2. Product shall contain anti-microbial product that shall fight mold and mildew build-up on the dried paint film.

202 RELATED REQUIREMENTS

A. Section 042000: Unit Masonry.

B. Section 099123 - Interior Painting.

203 REFERENCE STANDARDS

A. ASTM D 56, "Standard Test Method for Flash Point by Tag Closed Tester."

B. ASTM D 522, "Standard Test Methods for Mandrel Bend Test of Attached Organic Coatings."

C. ASTM D 523, "Standard Test Method for Specular Gloss."

D. ASTM D 1308, "Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes."

E. ASTM D 1653, "Standard Test Methods for Water Vapor Transmission of Organic Coating Films."

F. ASTM D 2486, "Standard Test Method for Scrub Resistance of Interior Latex Flat Wall Paints."

G. ASTM D 2574, “Standard Test Method for Resistance of Emulsion Paints in the Container to Attack by Microorganisms.”

H. ASTM D 2794, "Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)."

I. ASTM D 2805, “Standard Test Method for Hiding Power of Paints by Reflectometry.”

J. ASTM D 3273, “Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.”

K. ASTM D 3359, "Standard Test Method for Measuring Adhesion by Tape Test."

L. ASTM D 3363, "Standard Test Method for Film Hardness by Pencil Test."

M. ASTM D 3456, "Standard Practice for Determining by Exterior Exposure Tests the Susceptibility of Paint Films to Microbiological Attack."

N. ASTM D 3960, "Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings."

O. ASTM D 4060, "Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser."

P. ASTM D 4828, “Standard Test Methods for Practical Washability of Organic Coatings.”

Q. ASTM E 84, "Standard Test Method for Surface Burning Characteristics of Building Materials."

R. 18. ASTM G 53, "Standard Practice for Operating Light- and Water-Exposure Apparatus (Fluorescent UV - Condensation Type) for Exposure of Non-Metallic Materials."

S. Fed. Std. 141, “Paint, Varnish, Lacquer and related materials: Methods of Inspection, Sampling and Testing.”

T. SCAQMD Rule #1168, “Adhesive and Sealant Applications,” including most recent amendments.

U. SSPC SP-3, "Surface Preparation Specification No. 3, Power Tool Cleaning."

204 SUBMITTALS

A. Product Data: Submit product data showing material proposed. Submit sufficient information to determine compliance with the Drawings and Specifications. Product data shall include, but shall not be limited to, manufacturer's product data and application instructions.

B. Samples:
   1. Color Samples: Submit two samples of each color (5 inches by 8 inches.)
   2. Control Samples: Submit a spray-out with each batch of finish coat to demonstrate that batches match approved samples.

C. Manufacturer's Qualification Statement.

D. Installer's Qualification Statement: Submit letter from manufacturer stating that applicator has completed manufacturer's training program.

E. Maintenance Data: Instructions for normal maintenance and stain removal.

F. Specimen Warranty.

205 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with at least five years ofdocumented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years ofdocumented experience.

206 MOCK-UP

A. Prior to application of the work, fabricate and erect mock-ups for each type of finish and application required to verify selections made under sample submittals and to demonstrate aesthetic effects as well as qualities of materials and execution. Build mock-ups to comply with the following requirements, using materials indicated for final unit of work.
   1. Minimum 100 square foot (9.3 square meter) mock-up application of specified coating system on each type of surface. Provide separate mock-up for each color blend.
   2. Upon acceptance by the Architect, mock-ups shall serve as standard for the work.

B. Locate where directed.

C. Mock-up may remain as part of the Work.

207 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in their original, unopened containers bearing manufacturer's labels.

B. Provide fire extinguisher in storage area. Do not leave containers open. Remove empty cans and rags with oil or solvent from building every day.

C. Store between 50 degrees F (10 degrees C) and 85 degrees F (29 degrees C). Protect from freezing.

2.08 FIELD CONDITIONS

A. Apply coating under following conditions:
   1. Temperature of air and substrate is between 50 degrees F (10 degrees C) and 85 degrees F (29 degrees C).
   2. Temperature of substrate is above dew point.
   3. Substrate is dry to touch.

B. Protect surfaces not to be coated.

C. Provide adequate illumination.

D. Provide adequate fresh air and ventilation during application.

2.09 WARRANTY

A. Correct defective Work within a five year period after Date of Substantial Completion.

B. Provide five year manufacturer warranty for failure of the coating system to adhere to wall surface when applied according to manufactuerer's printed instructions, and does not include subsequent failure or damage caused by exogenous factors such as substrate failure or defect, sharp objects.

PART 2 PRODUCTS

3.01 COATING SYSTEM

A. Basis of Design Manufacturer: Products specified are those as manufactured by Master Coating Technologies.
   1. Or equal.

B. Performance:
   1. Abrasion Resistance: 50 mg loss/1000 cycles/1000 gram weight, ASTM D 4060.
   2. Accelerated Weathering: 2000 hours, no chalking or change in film integrity, very good color retention, excellent water resistance, ASTM G 53.
   3. Adhesion Over Primed Surfaces: Good adhesion, ASTM D 3359.
   4. Bacterial Resistance: No growth, ASTM D 3456.
   5. Continuous Color: Complete integration of color particles within and throughout the paint finish.
   6. Coverage: Up to 170 square feet per gallon depending upon pattern size, surface porosity, surface texture and method of application.
   7. Fire Rating: Coating shall be Class A fire-rated, ASTM E 84.
   8. Flashpoint: D.O.T., not regulated; OSHA, not regulated; ASTM D 56.
   9. Flexibility Test: No cracking of film when bent around a 1/8 inch (3 mm) mandrel, ASTM D 522.
   10. Hardness, Pencil: 2B, ASTM D 3363.
   11. Hiding Power of Paints by Reflectometry: Not less than 0.96 contrast ratio, passes LEED requirement of minimum 0.95 contrast ratio, ASTM D 2805.
   12. Impact Resistance: Pass, 80 lbs. in, no visible cracking (over bonderite steel panel), ASTM D 2794.
   13. Lifting: Can be re-coated, painted or covered with sheet goods without stripping, Fed. Std. 141, Method 6252.
   14. Mildew and Fungal Resistance: No growth, ASTM D 3273.
   15. Permeability: 5.2 perms (with 100 percent acrylic primer), ASTM D 1653.
   16. Practical Washability of Organic Coatings: Rated 7 or higher for each stain tested, passes LEED requirement of minimum 7 rating, ASTM D 4828.

17. Resistance of Emulsion Paint in the Container to Attack by Micro-Organism: No growth, ASTM D 2574.
18. Resistance to Common Cleaners and Disinfectants: Including, but not limited to, soapy water, liquid cleansers, mild abrasive cleansers, 70 percent isopropyl alcohol solutions, film not affected, ASTM D 1308.
19. Scrubability: 5130 cycles (slight wear), ASTM D 2486. 40,000+ cycles (no wear), Fed. Std. 141 Method 6142.
20. Specular Gloss: Maximum of 10 at 60 degrees, ASTM D 523.
21. Stain Resistance: Resistant to the following: mustard, catsup, butter, orange juice, soda, vegetable oil, acetic acid, gasoline, motor oil, and betadine, ASTM D 1308.
22. VOC: Less than 50 grams/liter, ASTM D 3960.
23. Washability of Paints: No change in specular gloss, Fed. Std. 141, Method 6141.

3.02 MATERIALS

A. Primers, Sealers, and Fillers: Provide primers recommended by manufacturer for substrates. Do not tint primers. Provide white only.
   1. Block Filler:
      a. Basis of Design: Quality Block Filling Primer that accepts water-base top coat.
   2. Water Base Primer:
      a. Basis of Design: “SP97 Multi-Purpose Waterbase Primer,” Master Coating Technologies.

B. Intermediate and Finish Coats: Finish shall be ready mixed; no tinting shall be required.
   1. Basis of Design: “Polomyx,” Master Coating Technologies.
   2. Color: To be selected by Architect from full range.

3.03 EQUIPMENT

A. Apply with equipment recommended by coating manufacturer. Use conventional air spraying equipment with internal mix spray gun air cap; dual-regulated, ASME Code-certified 110 psi (758 kPa) tank, and compressor sized to provide necessary volume of air to spray gun on a continuous basis.

PART 3 EXECUTION

4.01 EXAMINATION

A. Verification of Conditions: Examine areas and conditions under which the work is to be applied, and notify the Contractor in writing, with a copy to the Owner and the Architect, of any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.
   1. Verify that substrates are ready to receive work of this Section and are in accordance with coating manufacturer's requirements. Report any conditions that would adversely affect the appearance or performance of the coating systems.
   2. Beginning of the work shall indicate acceptance of the areas and conditions as satisfactory by the Applicator.

4.02 PREPARATION

A. General:
   1. Protection: Prior to surface preparation and application operations, completely mask, remove, or otherwise protect hardware, accessories, plates, lighting fixtures, floors, and similar items in contact with or in the vicinity of coating surfaces, but not scheduled to receive special coating. Protect and store removed items. Re-install items after completion of coating application.

2. Cleaning: Before applying special coating, thoroughly clean surfaces involved. Surfaces shall be clean, dry, and adequately protected from dampness. Surfaces shall be smooth, even and true to place, and free of any foreign material which will adversely affect adhesion or appearance of applied coating.
3. Moisture Levels: Gypsum board, plaster, concrete, and masonry surfaces shall be tested with moisture testing device before coating is applied. No coating shall be applied when moisture content exceeds 12 percent, except as may be required by the manufacturer of the coating materials used.
4. Mildew: Mildew shall be removed and neutralized.
5. pH: pH of surface to be coated shall be under 10.
6. Priming: Provide recommended primers for surfaces to receive special coating. The Contractor shall sand and re-prime all abrasions and damage spots in the surface of the primer before proceeding with subsequent finish coat.

B. Masonry: Tool joints and clean surfaces as specified in Section 04 20 00 - Unit Masonry. Rinse off cleaning solutions and allow surface to dry. Cure mortar 28 days minimum before application of coating.

C. Previously Painted Surfaces: Thoroughly clean and dry surface to be re-coated. Sand lightly and remove sanding dust. Prime entire wall surface with manufacturer’s recommended stain blocker before general priming.

4.03 APPLICATION

A. Install in accordance with manufacturer's instructions.

B. Equipment shall be kept clean and in proper working condition to provide best quality work as intended by this Section.

C. Materials shall be applied under adequate illumination, evenly spread, and smoothly applied, free of runs, sags, holidays, lap marks, air bubbles, and pinholes to assure a smooth finish.

D. Suction or hot spots shall be spot-primed prior to general priming.

E. Apply as many primer coats as necessary to produce a white uniform substrate appearance. Do not exceed manufacturer's recommended coverage rate. Allow individual coats to dry prior to application of subsequent coats. Over gypsum board, back-roll primer if airless applied.

F. Over wood and gypsum board, sand primer with 100 grit or finer sandpaper. Remove dust.

G. Apply special coating material by using two-step pressure differential spray technique, with variable control to assure uniform distribution and 100 percent full coat (continuous) coverage. Slight variations in pattern and texture are normal for multi-color coatings.

H. Apply multicolor finish to “FastFix” sheets as well as the specified substrate. Insert finished sheets into manufacturer’s maintenance manual or job close out package. Should any coat of coating be deemed unsatisfactory, it shall be sanded and additional coats applied.

4.04 FIELD QUALITY CONTROL

A. Request acceptance of each coat before applying succeeding coats.

B. Touch-up and repair work that is not acceptable to the Architect and request final acceptance.

4.05 CLEANING

A. Remove paint spatters from adjoining surfaces.

B. Repair any damage to coatings or surfaces caused by cleaning operations.

C. Remove debris from job site and leave storage area clean.

4.06 PROTECTION

A. Protect installed coatings from subsequent construction operations.

END OF SECTION

SECTION 099600
HIGH-PERFORMANCE COATINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. High performance coatings.

B. Surface preparation.

1.02 RELATED REQUIREMENTS

A. Section 099123 - Interior Painting: Requirements for mechanical and electrical equipment surfaces.

1.03 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency.

B. ASTM D2486 - Standard Test Methods for Scrub Resistance of Wall Paint.

C. ASTM D3363 - Standard Test Method for Film Hardness by Pencil Test.

D. ASTM D4258 - Standard Practice for Surface Cleaning Concrete for Coating.

E. MPI (APL) - Master Painters Institute Approved Products List; Master Painters and Decorators Association.

F. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual.

1.04 SUBMITTALS

A. Product Data: Provide complete list of all products to be used, with the following information for each:
   1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
   2. MPI product number (e.g. MPI #47).
   3. Cross-reference to specified coating system(s) product is to be used in; include description of each system.
   4. Manufacturer's installation instructions.
   5. If proposal of substitutions is allowed under submittal procedures, explanation of all substitutions proposed.

B. Samples: Submit two samples 8 by 8 inch in size illustrating colors available for selection.

C. Manufacturer's Certificate: Certify that high-performance coatings comply with VOC limits specified.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

F. Maintenance Data: Include cleaning procedures and repair and patching techniques.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. Extra Coating Materials: 1 gallon of each type and color.
   2. Label each container with manufacturer's name, product number, color number, and room names and numbers where used.

1.05 QUALITY ASSURANCE

A. Maintain one copy of each referenced document that applies to application on site.

B. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

C. Applicator Qualifications: Company specializing in performing the work of this section with minimum three years documented experience.

1.06 MOCK-UP

A. Provide mock-up , 10 feet long by 10 feet wide, illustrating coating.

B. Locate where directed.

C. Mock-up may remain as part of the work.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of coating, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Coating Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.08 FIELD CONDITIONS

A. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

B. Do not install materials when temperature is below 55 degrees F or above 90 degrees F.

C. Maintain this temperature range, 24 hours before, during, and 72 hours after installation of coating.

D. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

E. Restrict traffic from area where coating is being applied or is curing.

1.09 WARRANTY

A. Correct defective Work within a five year period after Date of Substantial Completion.

B. Warranty: Include coverage for bond to substrate.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide high performance coating products from the same manufacturer.
   1. In the event that a single manufacturer cannot provide specified products, minor exceptions will be permitted provided approval by Architect is obtained using the specified procedures for substitutions.
   2. Substitution of MPI-approved products by a different manufacturer is preferred over substitution of unapproved products by the same manufacturer.

B. High-Performance Coatings:
   1. PPG Paints: www.ppgpaints.com/#sle.
   2. Sherwin-Williams Company; Basis of Design: www.protective.sherwin-williams.com/industries/#sle.
   3. Tnemec Company, Inc: www.tnemec.com/#sle.
   4. Or equal.

202 HIGH-PERFORMANCE COATINGS

A. MPI Standards: Provide products that comply with MPI standards indicated and are listed in "MPI Approved Products List."

B. Provide coating systems that meet the following minimum performance criteria, unless more stringent criteria are specified:
   1. Scrub Resistance; 500 to 600 cycles with a stiff bristle brush and pumice scrub media when tested in accordance with ASTM D2486.
   2. Pencil Hardness: 2B, when tested in accordance with ASTM D3363.
   3. Adhesion: 100 percent, when tested in accordance with ASTM D3359.
   4. Stain Resistance: Resistant to the following substances, when tested in accordance with ASTM D3023.
      a. Mustard.
      b. Grape juice.
      c. Lipstick, red.
      d. Permanent ink (limited resistance).
      e. Coffee.
      f. 10% sodium hydroxide.
      g. Acetic acid.
   5. Scrubbability: 500 to 600 cycles with stiff bristle brush and pumice scrub media, when tested in accordance with ASTM D2486.
   6. Chemical Resistance: Resistant to the following substances, when tested in accordance with ASTM D1308.
      a. Distilled water.
      b. Ethyl alcohol.
      c. Vinegar (3% acetic acid).
      d. Alkali (10% sodium hydroxide).
      e. Acid (10% sulfuric acid).
      f. 50/50 xylene/mineral spirits.

203 TOP COAT MATERIALS

A. Coatings - General: Provide complete multi-coat systems formulated and recommended by manufacturer for the applications indicated, in the thicknesses indicated; number of coats specified does not include primer or filler coat.
   1. Lead Content: Not greater than 0.06 percent by weight of total nonvolatile content.
   2. Chromium Content, as Hexavalent Chromium, Zinc Chromate, or Strontium Chromate: None.
   3. Volatile Organic Compound (VOC) Content:
      a. Provide coatings that comply with the most stringent requirements specified in the following:
         1) 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
         2) Architectural coatings VOC limits of State in which the project is located.
      b. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.

B. Epoxy Coating:
   1. Number of coats: Two.
   2. Top Coat(s): Light Industrial Coating, Interior, Water Based Epoxy.

a. Sheen: Semi-Gloss.
b. Products:
1) PPG Paints; Pitt-Glaze WB1 Pre-Catalyzed Water-Borne Acrylic Epoxy, 16-510 Series, Semi-Gloss; MPI #153: www.ppgpaints.com/#sle.
2) Sherwin-Williams; Pro Industrial Pre-Catalyzed Waterbased Epoxy; MPI #151, 153: www.protective.sherwin-williams.com/#sle.
(a) Basis of Design.
3) Tnemec: Enviro-Pox Series 287; www.tnemec.com.
4) Substitutions: Section 016000 - Product Requirements.
3. Primer: As recommended by coating manufacturer for specific substrate.

C. Shellac: Pure, white type.

2.04 PRIMERS

A. Primers: Provide the following unless other primer is required or recommended by coating manufacturer.
1. Block Filler, Latex.
a. Products:
1) PPG Paints; 6-15XI Speedhide Masonry Hi Fill Latex Block Filler; MPI #4: www.ppgpaints.com/#sle.
2) Sherwin-Williams; Heavy Duty Block Filler; MPI #4: www.protective.sherwin-williams.com/#sle.
3) Tnemec; Epoxoblock WB Series 1254: ww.tnemec.com.
4) Substitutions: Section 016000 - Product Requirements.

2.05 ACCESSORY MATERIALS

A. Accessory Materials: Provide all primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of coated surfaces.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Do not begin application of coatings until substrates have been properly prepared.

C. Verify that substrate surfaces are ready to receive work as instructed by the coating manufacturer. Obtain and follow manufacturer's instructions for examination and testing of substrates.

D. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

E. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

F. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
1. Cementitious Substrates: Do not begin application until substrate has cured 28 days minimum and measured moisture content is not greater than 12 percent.
2. Masonry, Concrete, and Concrete Unit Masonry: 12 percent.

G. Proceed with coating application only after unacceptable conditions have been corrected.
1. Commencing coating application constitutes Contractor's acceptance of substrates and conditions.

3.02 PREPARATION

A. Clean surfaces of loose foreign matter.

B. Remove substances that would bleed through finished coatings. If unremovable, seal surface with shellac.

C. Remove finish hardware, fixture covers, and accessories and store.

D. Concrete:
   1. Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
   2. Clean concrete according to ASTM D4258. Allow to dry.
   3. Prepare surface as recommended by coating manufacturer and according to SSPC-SP 13.

E. Masonry:
   1. Remove efflorescence and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces or if alkalinity of mortar joints exceed that permitted in manufacturer's written instructions. Allow to dry.
   2. Prepare surface as recommended by coating manufacturer.

F. Protect adjacent surfaces and materials not receiving coating from spatter and overspray; mask if necessary to provide adequate protection. Repair damage.

3.03 PRIMING

A. Apply primer to all surfaces, unless specifically not required by coating manufacturer. Apply in accordance with coating manufacturer's instructions.

B. Concrete: Prior to priming, patch with masonry filler to produce smooth surface.

C. Concrete Masonry: Apply masonry filler to thickness required to fill holes and produce smooth surface; minimum thickness of 30 mils.

3.04 COATING APPLICATION

A. Apply coatings in accordance with manufacturer's written instructions, to thicknesses specified and recommendations in "MPI Architectural Painting and Specification Manual".

B. Apply in uniform thickness coats, without runs, drips, pinholes, brush marks, or variations in color, texture, or finish. Finish edges, crevices, corners, and other changes in dimension with full coating thickness.

3.05 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

B. Clean surfaces immediately of overspray, splatter, and excess material.

C. After coating has cured, clean and replace finish hardware, fixtures, and fittings previously removed.

3.06 PROTECTION

A. Protect finished work from damage.

3.07 SCHEDULE

A. Colors: As selected by the Architect from manufacdturer's standard colors.

END OF SECTION

SECTION 101400
SIGNAGE

PART 1 GENERAL

1.01 SUMMARY

A. Section includes:
   1. Signage with tactile and non-tactile signage with and without Braille.
   2. Painted signage in designated areas.

1.02 DEFINITIONS

A. ADA-ABA Accessibility Guidelines: U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines."

1.03 SUBMITTALS

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

B. Shop Drawings: Show fabrication and installation details for signs:
   1. Show sign mounting heights and floor plans indicating locations of each sign.
   2. Provide message list, typestyles, graphic elements, including tactile characters and Braille, and layout for each sign.

C. Samples for Initial Selection: Submit one sign of each type, style, letter font, and manufacturer's color charts consisting of actual material showing the full range of colors available.

D. Sign Schedule: Use same designations indicated.

E. Qualification Data: For fabricator.

F. Maintenance Data: For signs to include in maintenance manuals.

G. Warranty: Special warranty specified in this Section.

1.04 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. Source Limitations for Signs: Obtain each sign type indicated from one source from a single manufacturer.

C. Regulatory Requirements: Comply with applicable provisions in ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

1.05 PROJECT CONDITIONS

A. Field Measurements: Verify locations by field measurements before fabrication and indicate measurements on Shop Drawings.

1.06 WARRANTY

A. Warranty: Limited lifetime in which manufacturer agrees to repair or replace components of signs that fail in materials or workmanship.

PART 2 PRODUCTS

2.01 MATERIALS

A. Rigid Vinyl Sheet: Of thickness indicated, manufactured from chemical and stain resistant polyvinyl chloride with the addition of impact modifiers and without plasticizers.
   1. Impact Strength: 30.4 ft-lbs/ inch of thickness in accordance with ASTM D256.

2. Stain Resistance: Resistance to stain in accordance with ASTM D543.
3. Fungal and Bacterial Resistance: Does not support fungal or bacterial growth in accordance with ASTM G21 and ASTM G22.
4. Color Consistency: Matched in accordance with SAE J-1545 - (Delta E) with a color difference no greater than 1.0 units using CIE Lab, CIE CMC, CIE LCh, Hunter Lab or similar color space scale systems.

2.02 SIGNAGE

A. Basis-of-Design Product: The design for signage is based on product as manufactured by InPro SignScape. Subject to compliance with requirements, provide the product indicated or a comparable product by one of the following:
   1. Advance Corporation; Braille-Tac Division.
   2. Bunting Graphics, Inc.
   3. Mohawk Sign Systems.
   4. Takeform Architectural Graphics.
   5. Or equal.

B. Tactile and Braille Sign: Provide text and symbols complying with ADA-ABA Accessibility Guidelines and with ICC/ANSI A117.1. Text shall be accompanied by Grade 2 Braille. Produce precisely formed characters with square-cut edges free from burrs and cut marks; Braille dots with domed or rounded shape:
   1. Panel Material: Rigid vinyl sheet.
   2. Raised-Copy Thickness: Not less than 1/32 inch.

C. Partial Inlay: Provide sign panel consisting of 0.080 inch sheet engraved to receive 0.060 inch sheet that is cut and assembled to create signage.

D. Grade 2 Braille: Provide Grade 2 Braille produced with the Raster Method, patented process for placing Braille on signage. Raster Braille is computer engineered using a carbide-engraving bit, press-fit tool with vacuum pump and UV stable acrylic rasters.

E. Changeable Message Inserts: Fabricate signs to allow insertion of changeable messages in the form of transparent covers with paper inserts printed by Owner.

2.03 ACCESSORIES

A. Double-sided Foam Tape and Heavy Duty Adhesive: Provide double sided foam tape and heavy duty adhesive to adhere signs to clean, dry, well sealed substrates.

2.04 FINISHES, GENERAL

A. Protect finishes on exposed surfaces from damage by temporary protective covering before shipping.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

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

3.02 INSTALLATION

A. General: Locate the signage system as indicated on the approved detail drawing for the appropriate substrate and in compliance with installation instructions.
   1. Install signs level, plumb, and at heights indicated, with sign surfaces free of distortion and other defects in appearance.

2. Interior Wall Signs: Install signs on walls adjacent to latch side of door where applicable. Where not indicated or possible, such as double doors, install signs on nearest adjacent walls. Locate to allow approach within 3 inches of sign without encountering protruding objects or standing within swing of door.

B. Wall-Mounted Signs: Comply with sign manufacturer's written instructions except where more stringent requirements apply.
   1. Double-sided Foam Tape and Heavy Duty Adhesive: Mount signs to smooth, non-porous surfaces. Do not use this method for vinyl-covered or rough surfaces.
   2. Signs Mounted on Glass: Provide matching opaque plate on opposite side of glass to conceal mounting materials.

3.03 CLEANING AND PROTECTION

A. After installation, clean soiled sign surfaces according to manufacturer's written instructions. Protect signs from damage until acceptance by Owner.

3.04 SIGN SCHEDULE

A. Coordinate with Owners numbering and naming requirements.

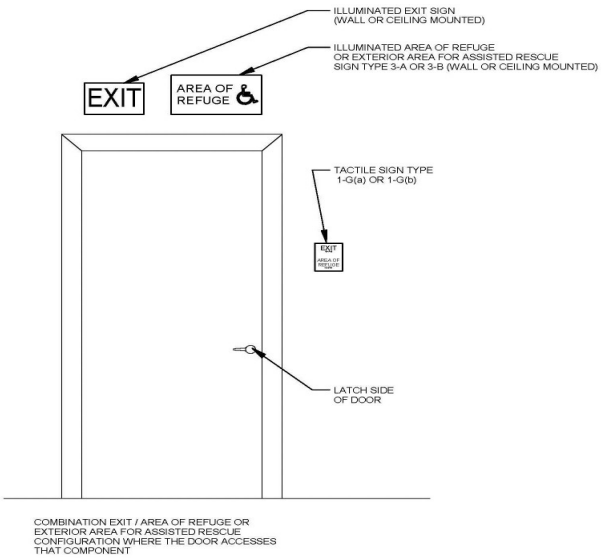
B. Provide signs with room number and function for each room listed on the Room Finish Schedule on the Drawings.
   1. If room or space has more than one door, provide signage at all door locations.

C. At individual office spaces, provide insert window for name in addition to room name and room number.

D. Stair, Elevator and Area of Refuge signage shall be provided as required by Code.

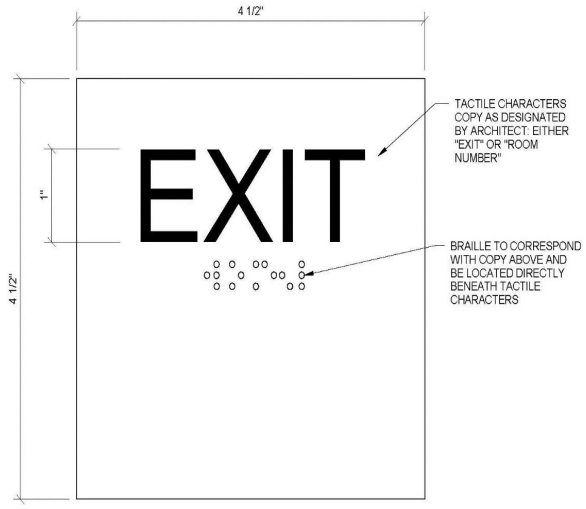
E. Directional Signage Type -1F: Provide 10 signs.

F. Signage in spaces within Housing Pods shall comply with requirements (minus Braille) of this Section but shall be painted signage applied to the walls.



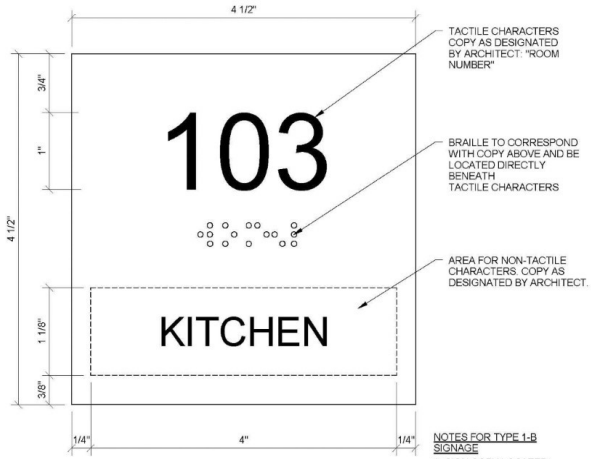
COMBINATION EXIT / AREA OF REFUGE OR EXTERIOR AREA FOR ASSISTED RESCUE CONFIGURATION WHERE THE DOOR ACCESSES THAT COMPONENT

TYPICAL ACCESSIBLE EXIT CONFIGURATION IDENTIFICATION



TYPE 1-A SIGNAGE

TACTILE CHARACTERS AND BRAILLE ONLY



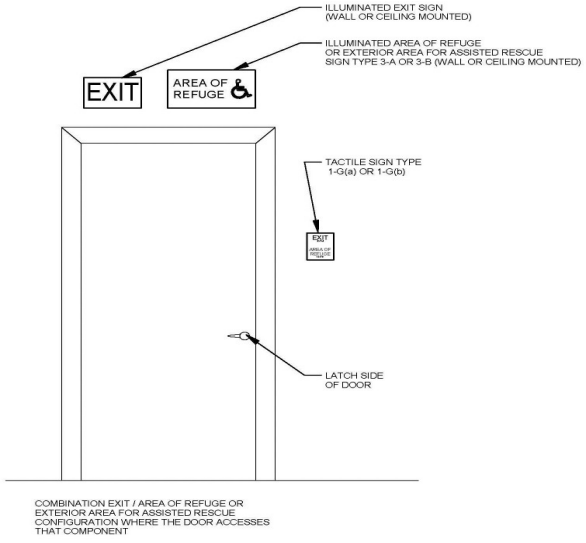
TYPE 1-B SIGNAGE

TACTILE CHARACTERS, BRAILLE AND PERMANENT NON-TACTICAL CHARACTERS

NOTES FOR TYPE 1-B SIGNAGE

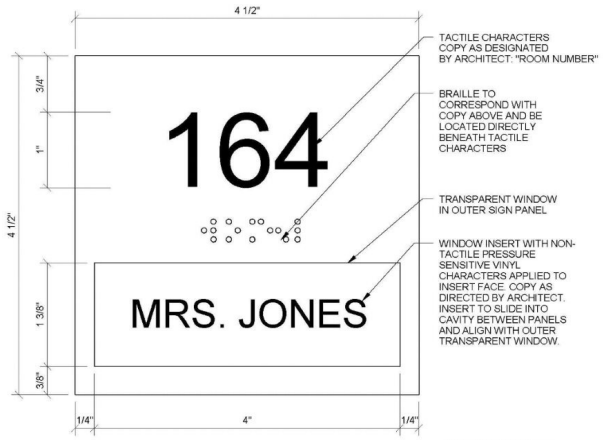
1. SIGN COPY LOCATED IN WINDOW DOES NOT FALL UNDER ADA REQUIREMENTS FOR PERMANENT ROOMS AND SPACES.

2. SIGN COPY LOCATED IN WINDOW TO BE ON ONE LINE IF POSSIBLE OR TWO LINES CENTERED AND SPACED EQUALLY WITHIN THE WINDOW.



COMBINATION EXIT / AREA OF REFUGE OR EXTERIOR AREA FOR ASSISTED RESCUE CONFIGURATION WHERE THE DOOR ACCESSES THAT COMPONENT

TYPICAL ACCESSIBLE EXIT CONFIGURATION IDENTIFICATION



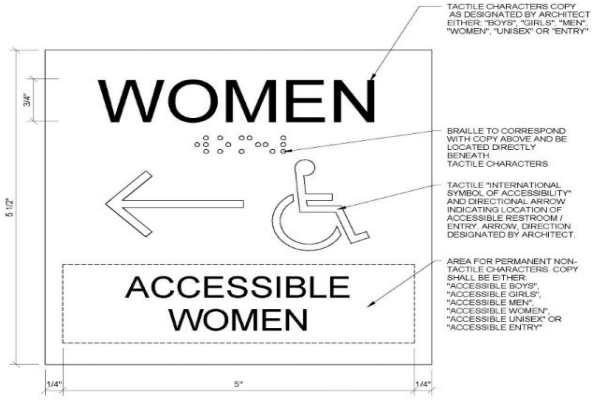
TYPE 1-C SIGNAGE

TACTILE CHARACTERS, BRAILLE AND NON-TACTILE SIGN INSERT

NOTES FOR TYPE 1-C SIGNAGE

1. SIGN COPY LOCATED IN WINDOW DOES NOT FALL UNDER ADA REQUIREMENTS FOR PERMANENT ROOMS AND SPACES.

2. SIGN COPY LOCATED IN WINDOW TO BE ON ONE LINE IF POSSIBLE OR TWO LINES CENTERED AND SPACED EQUALLY WITHIN THE WINDOW.



TYPE 1-D SIGNAGE

(INACCESSIBLE TOILET ROOM)

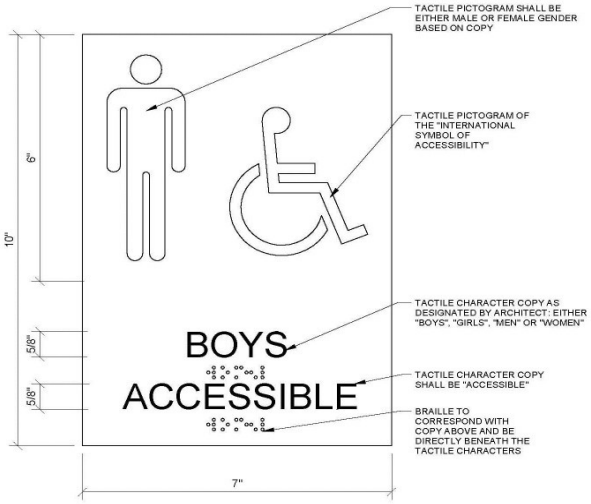
TACTILE CHARACTERS, BRAILLE, TACTILE DIRECTIONAL ARROW, TACTILE INTERNATIONAL SYMBOL OF ACCESSIBILITY, AND NON-TACTILE PERMANENT CHARACTERS

NOTES FOR TYPE 1-D SIGNAGE

1. SIGN COPY LOCATED IN WINDOW DOES NOT FALL UNDER ADA REQUIREMENTS FOR PERMANENT ROOMS AND SPACES.

2. SIGN COPY LOCATED IN WINDOW TO BE ON ONE LINE IF POSSIBLE OR TWO LINES CENTERED AND SPACED EQUALLY WITHIN THE WINDOW.

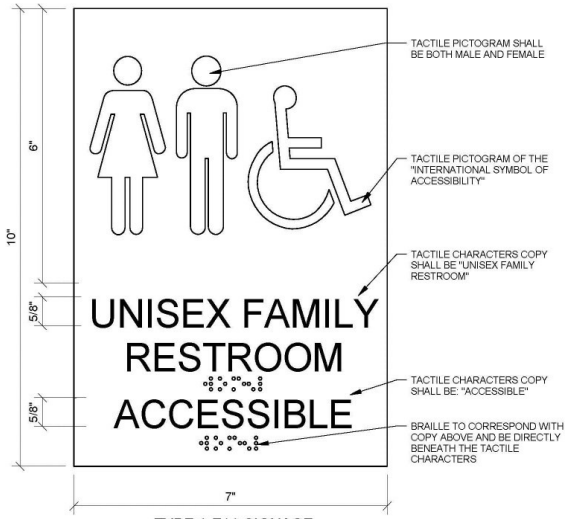
3. DIMENSIONAL PARAMETERS FOR NON-TACTILE TEXT FIELD WINDOW TO BE AS DEFINED UNDER TYPE 1-C SIGNAGE.



TYPE 1-E(a) SIGNAGE

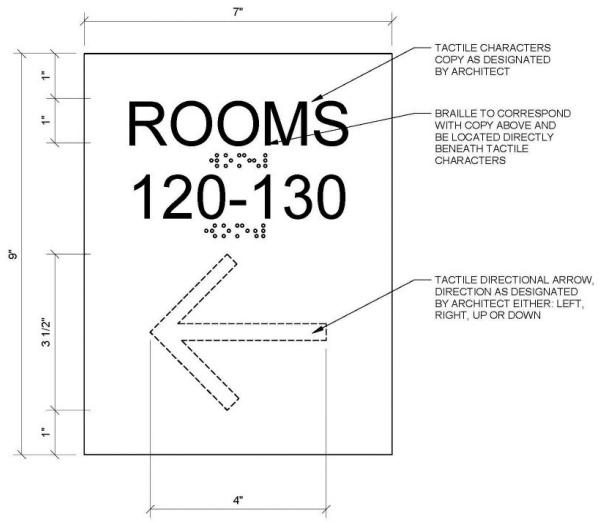
(ACCESSIBLE TOILET ROOM)

TACTILE CHARACTERS, BRAILLE, TACTILE PICTOGRAM AND TACTILE INTERNATIONAL SYMBOL OF ACCESSIBILITY



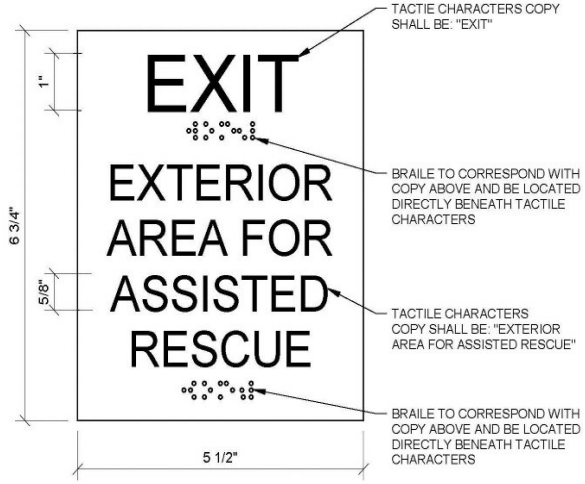
TYPE 1-E(c) SIGNAGE

TACTILE CHARACTERS, BRAILLE, TACTILE PICTOGRAMS AND TACTILE INTERNATIONAL SYMBOL OF ACCESSIBILITY



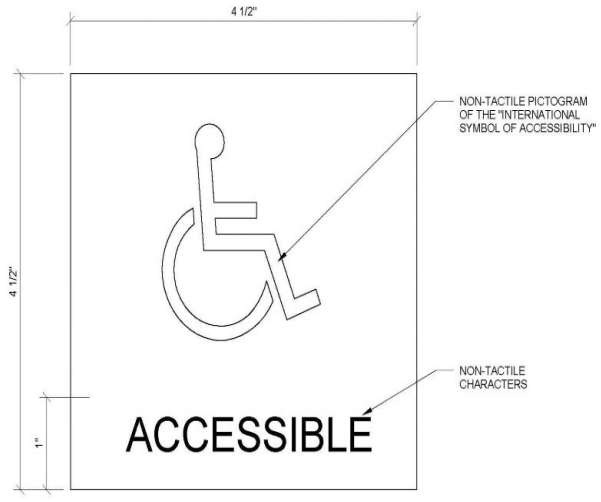
TYPE 1-F SIGNAGE

TACTILE CHARACTERS, BRAILLE AND TACTILE DIRECTIONAL ARROW



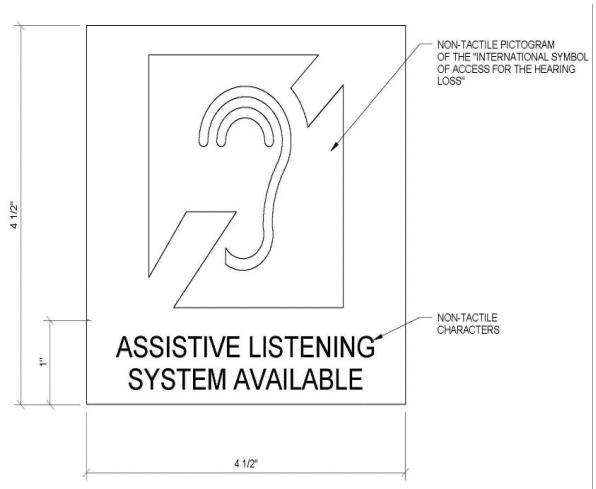
TYPE 1-G(b) SIGNAGE

TACTILE CHARACTERS AND BRAILLE ONLY



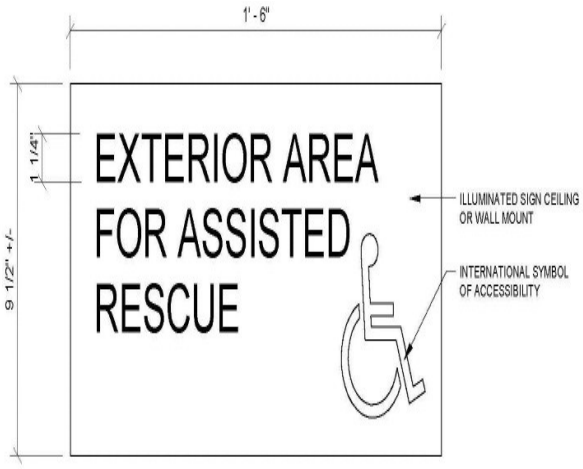
TYPE 2-C SIGNAGE

NON-TACTILE CHARACTERS AND NON-TACTILE PICTOGRAM



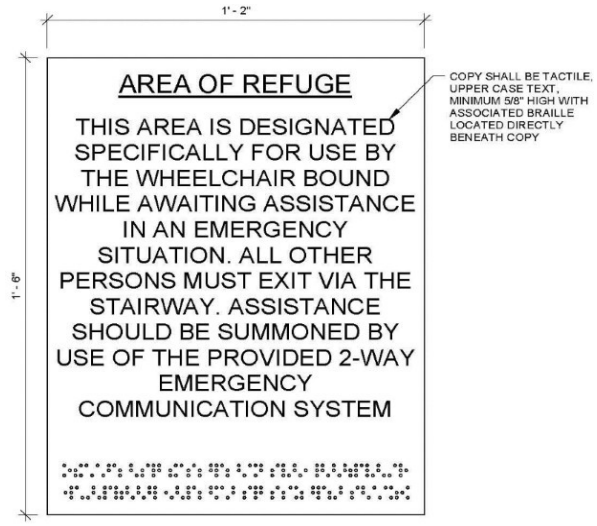
TYPE 2-D SIGNAGE

NON-TACTILE CHARACTERS AND NON-TACTILE PICTOGRAM. PICTOGRAM TO BE THE INTERNATIONAL SYMBOL OF ACCESS FOR THE HEARING LOSS.



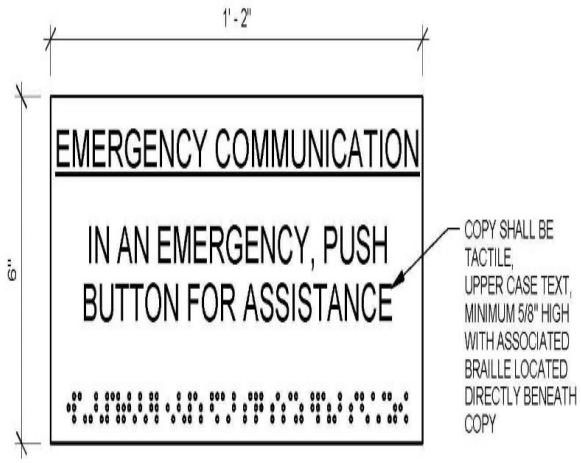
TYPE 3-C SIGNAGE

NON-TACTILE ILLUMINATED AREA OF REFUGE SIGNAGE



TYPE 3-E SIGNAGE

TACTILE CHARACTERS AND BRAILLE



TYPE 3-F SIGNAGE

TACTILE CHARACTERS AND BRAILLE

END OF SECTION

SECTION 102113.17
PHENOLIC TOILET COMPARTMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Phenolic toilet compartments.

B. Urinal screens.

1.02 RELATED REQUIREMENTS

A. Section 102810 - Toilet and Bath Accessories.

1.03 REFERENCE STANDARDS

A. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

1.04 SUBMITTALS

A. Product Data: Provide data on panel construction, hardware, and accessories.

B. Shop Drawings: Indicate partition plan, elevation views, dimensions, details of wall supports, door swings.

C. Samples: Submit two samples of partition panels, 3 by 3 inch in size illustrating panel finish, color, and sheen.

D. Manufacturer's Installation Instructions: Indicate special procedures.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Phenolic Toilet Compartments:
   1. All American Metal Corp - AAMCO.
   2. Partition Systems International of South Carolina; Phenolic Toilet Partitions.
   3. ACCU TEC Manufacturing.
   4. Or equal.

2.02 PHENOLIC TOILET COMPARTMENTS

A. Toilet Compartments: Factory fabricated doors, pilasters, and divider panels made of solid phenolic core panels with integral melamine finish, floor-mounted headrail-braced.
   1. Color: Single color as selected.

B. Doors:
   1. Thickness: 3/4 inch.
   2. Width: 24 inch.
   3. Width for Handicapped Use: 36 inch, out-swinging.
   4. Height: 58 inch.

C. Panels:
   1. Thickness: 1/2 inch.
   2. Height: 58 inch.
   3. Depth: As indicated on drawings.

D. Pilasters:
   1. Thickness: 3/4 inch.
   2. Width: As required to fit space; minimum 3 inch.

2.03 ACCESSORIES

1. Provide adjustment for floor variations with screw jack through steel saddles integral with pilaster.

B. Attachments, Screws, and Bolts: Stainless steel , tamper proof type.
   1. For attaching panels and pilasters to brackets: Through-bolts and nuts ; tamper proof.

C. Hardware: Polished stainless steel:
   1. Pivot hinges, gravity type, adjustable for door close positioning; two per door.
   2. Nylon bearings.
   3. Door Latch: Slide type with exterior emergency access feature.
   4. Door strike and keeper with rubber bumper; mounted on pilaster in alignment with door latch.
   5. Coat hook with rubber bumper; one per compartment, mounted on door.
   6. Provide door pull for outswinging doors.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify correct spacing of and between plumbing fixtures.

3.02 INSTALLATION

A. Install partitions secure, rigid, plumb, and level in accordance with manufacturer's instructions.

B. Maintain 3/8 inch to 1/2 inch space between wall and panels and between wall and end pilasters.

C. Attach panel brackets securely to walls using anchor devices.

D. Attach panels and pilasters to brackets. Locate head rail joints at pilaster center lines.

E. Field touch-up of scratches or damaged finish will not be permitted. Replace damaged or scratched materials with new materials.

3.03 TOLERANCES

A. Maximum Variation From True Position: 1/4 inch.

B. Maximum Variation From Plumb: 1/8 inch.

3.04 ADJUSTING

A. Adjust and align hardware to uniform clearance at vertical edge of doors, not exceeding 3/16 inch.

B. Adjust hinges to position doors in partial opening position when unlatched. Return out-swinging doors to closed position.

C. Adjust adjacent components for consistency of line or plane.

END OF SECTION

SECTION 102600
WALL AND DOOR PROTECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Crash rails.

1.02 REFERENCE STANDARDS

A. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.

B. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.

C. SAE AMS-STD-595 - Colors Used in Government Procurement.

1.03 SUBMITTALS

A. Product Data: Indicate physical dimensions, features, anchorage details, and rough-in measurements.

B. Shop Drawings: Include plans, elevation, sections, and attachment details.

C. Manufacturer's Instructions: Indicate special procedures, perimeter conditions requiring special attention.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver wall and door protection items in original, undamaged protective packaging. Label items to designate installation locations.

B. Protect work from moisture damage.

C. Do not deliver products to project site until areas for storage and installation are fully enclosed, and interior temperature and humidity are in compliance with manufacturer's recommendations for each type of item.

D. Store products in either horizontal or vertical position, in compliance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Metal Crash Rails:
   1. Omega Indusrial Products; Safety Barriers: www.omegaind.com.
   2. Hearland Steel Products; Safey Rail: www.heartlandsteel.com.
   3. Wildeck, Inc; Wilgard MT Series Guard Rail: www.wildeck.com.
   4. Or equal.

2.02 PRODUCT TYPES

A. Metal Crash Rails: Factory- or shop-fabricated, with preformed end wall returns, and internal and external corners:
   1. Performance of Installed Assembly:
      a. Resist lateral force of 10,000 lbs at 5 miles per hour at any point without damage or permanent set.
   2. Material: cold formed 11-gauge steel and shall meet the requirements of ASTM A1011/A1011M, CS Type B.
   3. Mounting: Surface.

4. Mounting Posts: T.S. 4” x 4” x 3/16” upright, with a 10” x 10” x .50” base plate, constructed from cold formed structural steel tubing, that meets the requirements of ASTM A500/A500M - Grade B, with a minimum yield of 46 K.S.I.
    a. Height: Manufacturer's standard height to accomodate two rails.
    b. Number: As indicated on the drawings.
5. Rail Length: As indicted on the drawings.
6. Finishes.
    a. Heat cured, polyester based powder coating with sea spray and ultraviolet enhancements. And shall be O.S.H.A. approved “ Traffic Safety Yellow” (SAE AMS-STD-595, color number 13507).

2.03 FABRICATION

A. Fabricate components with tight joints, corners and seams.

B. Pre-drill holes for attachment.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated on drawings.

B. Start of installation constitutes acceptance of project conditions.

3.02 INSTALLATION

A. Install components in accordance with manufacturer's instructions, level and plumb, secured rigidly in position to supporting construction.

END OF SECTION

SECTION 102810
TOILET AND BATH ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Toilet, bath, shower and washroom accessories.

B. Attachment hardware.

1.02 RELATED SECTIONS

A. Section 079200 - Joint Sealants.

B. Section 102113.17 - Phenolic Toilet Compartments.

1.03 REFERENCE STANDARDS

A. American National Standards Institute (ANSI): ANSI A117.1 - Safety Standards for the Handicapped.

B. Americans With Disabilities Act (ADA): ADA - Accessibility Guidelines.

1.04 SUBMITTALS

A. Product Data: Include construction details, material descriptions and thicknesses, dimensions, profiles, fastening and mounting methods, specified options, and finishes for each type of accessory specified.

B. Samples: When requested by Architect, submit one sample of each type of fixture specified for review of construction, color and finishes. Acceptable samples will be returned and may be used in the work.

C. Maintenance Data: Submit to Architect for processing to Owner, two copies of manufacturer's maintenance data, operating instructions, and keys required for each type of equipment and lock.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery:
   1. Do not deliver accessories to project until rooms in which they are to be installed are ready to receive them.
   2. Pack accessories individually in a manner to protect accessory and its finish.
   3. Deliver items in manufacturer's original unopened protective packaging.

B. Storage: Store materials in manufacturer's protective packaging to prevent soiling, physical damage, or wetting.

C. Handling: Handle items so as to prevent physical damage or scratching to finished surfaces.

1.06 PROTECTION

A. Protect adjacent or adjoining finished surfaces and work from damage during installation of work of this section.

B. Whenever possible maintain protective covers on units until installation is complete. Remove covers at final clean-up of installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide toilet accessories and catalog numbers listed on the Contract Drawings are taken from the catalog of Bobrick Washroom Equipment, Inc., or a comparable product by one of the following:

1. American Specialties, Inc.
2. Bradley Corporation.
3. Or equal.

2.02 MATERIALS

A. Sheet Steel: ASTM A366, cold-rolled stretcher leveled; 1.25 oz./sq. ft. galvanized coating in accordance with ASTM A386.

B. Stainless Steel Sheet: ASTM A167, 302/304 grade, gauge as listed.

C. Stainless Steel Tubing: ASTM A269, commercial grade, seamless welded.

D. Brass: Cast or forged quality alloy, FS WW-P-541.

2.03 FINISHES

A. Stainless Steel: No. 4 satin luster finish.

2.04 FABRICATION

A. Weld and grind smooth joints of fabricated components.

B. Form exposed surfaces from one sheet of stock, free of joints.

C. Provide steel anchor plates and anchor components for installation on building finishes.

D. Form surfaces flat without distortion. Maintain flat surfaces without scratches or dents.

E. Hot dip galvanize ferrous metal anchors and fastening devices.

F. Shop assemble components and package complete with anchors and fittings.

PART 3 EXECUTION

3.01 PREPARATION/INSPECTION

A. Deliver inserts and rough-in frames to jobsite at appropriate time for building-in. Provide templates and rough-in measurements as required.

B. Inspect surfaces to receive surface mounted units for conditions that would affect quality and execution of work, or operation of units.

C. Do not begin installation of washroom accessories until conditions are satisfactory. Beginning installation means “acceptance” of existing surfaces and conditions.

D. Verify exact location of accessories with drawings; if not shown with Architect.

3.02 INSTALLATION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

B. Secure mirrors to walls in concealed, tamper-resistant manner with special hangers, toggle bolts, or screws. Set units level, plumb, and square at locations indicated, according to manufacturer's written instructions for substrate indicated.

3.03 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation and verify that mechanisms function properly. Replace damaged or defective items.

B. Remove temporary labels and protective coatings.

C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

3.04 TOILET AND BATH ACCESSORY SCHEDULE

A. Refer to listing in the SPECIALTY EQUIPMENT / TOILET ACCESSORY LEGEND and mounting heights shown in the FIXTURE AND ACCESSORY MOUNTING HEIGHTS LEGEND on Contract Drawings.

END OF SECTION

SECTION 111700
TELLER AND SERVICE EQUIPMENT

<<<< UPDATE NOTES

PART 1 GENERAL

2.01 SECTION INCLUDES

A. Bullet Resistant Devices.
   1. Bullet resistant package passer.

2.02 REFERENCE STANDARDS

A. UL 752 - Standard for Bullet-Resisting Equipment.

2.03 SUBMITTALS

A. Product Data: Provide manufacturer's data sheets on each product to be used.

B. Shop Drawings: Indicate details of materials, construction and finish. Include relationship with adjacent construction.

C. Manufacturer's Instructions: Indicate procedures for installation.

D. Manufacturer's Qualification Statement.

E. Installer's Qualification Statement.

F. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

2.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with at least three years ofdocumented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years ofdocumented experience.

2.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver product to project site in strict compliance with manufacturer's written instrucitons and recommendations.

B. Protect from damage due to weather, excessive temperature, and construction operations.

2.06 FIELD CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

2.07 WARRANTY

A. Manufacturer's Warranty: Provide manufacturer's standard limited warranty.

PART 2 PRODUCTS

3.01 MANUFACTURERS

A. Chicago Bullet Proof Systems.

B. Or equal..

3.02 BULLET RESISTANT DOOR AND FRAME ASSEMBLIES

A. Basis of Design Manufacturer: Chicago Bullet Proof Systems; Bullet Resistant Package Passer, Model CBP with Package Passer Model PP.

B. Performance:
   1. Bullet Resistance: UL 752, Level 4.

PART 3 EXECUTION

4.01 EXAMINATION

A. Verification of Conditions: Verify that substrates have been properly constructed and prepared.
   1. If substrate preparation is the responsibility of another installer, notify Architect in writing of unsatisfactory preparation before proceeding.

4.02 PREPARATION

A. Surface Preparation:
   1. Clean surfaces thoroughly prio to installation.
   2. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

4.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.
   1. Install in accordance with approved submittals, and UL 752, and in proper relationship with adjacent construction.

B. Install all equipment plumb, level, rigid and in true alignment.

4.04 TOLERANCES

A. Maximum Offset From True Alignment: Do not exceed the following installation tolerances.
   1. Squareness: Plus or minus 1/16 inch (1.6 mm) measured on a line, 90 degrees from one jamb, at the upper corner of the frame at the other jamb.
   2. Alignment: Plus or minus 1/16 inch (1.6 mm) measured on jambs on a horizontal line parallel to the plane of the wall
   3. Twist: Plus or minus 1/16 inch (1.6 mm) measured at face corners of jambs on parallel lines perpendicular to the plane of the wall.
   4. Plumb: Plus or minus 1/16 inch (1.6 mm) measured on the jamb at the floor.

4.05 ADJUSTING

A. Adjust installed doors for correct function and for smooth operation.

4.06 CLEANING

A. Clean in accordance with manufacturer's recommendations.

B. Touch-up, repair or replace damaged products before Substantial Completion.

4.07 PROTECTION

A. Protect installed products from subsequent construction operations.

END OF SECTION

SECTION 114000
FOOD SERVICE EQUIPMENT

PART 1 GENERAL

1.01 SCOPE OF WORK

A. General: Provide and install all food service equipment with related items necessary to complete the work shown on the drawings and required by the provisions of this section.
   1. The term "install" shall mean the delivery of all food service equipment complete with transportation charges prepaid to the building, uncrated, set-in-place and properly anchored, where required.
   2. Deliver all parts that are to be built into cast-in-place concrete or masonry in ample time for inclusion in the concrete or masonry work. Provide all necessary setting plans and instructions, oversee the installation of all parts in the masonry or concrete, and be responsible for the correctness and accuracy of location and installation.
   3. Cut holes and ferrules on equipment for pipes, drains, electric outlets, conduits and similar items, as required, coordinating the installation of the food service equipment with the work of other Contractors.
   4. Keep premises clean and remove from site all crates, cartons, and other debris resulting from work. Leave all areas "broom clean" throughout construction and final clean prior to turning over to Owner. Final sanitizing of equipment by Owner.
   5. Field check building measurements.

1.02 MECHANICAL AND ELECTRICAL WORK INCLUDED IN FOOD SERVICE EQUIPMENT WORK

A. Plumbing:
   1. Interplumb food service equipment between valves, vacuum breakers, and equipment connections, and make ready for final connection by Plumbing Contractor. All exposed plumbing shall be silver-painted copper piping, except where noted.
   2. Provide and install all chrome-plated faucets and fill hoses for sinks and other equipment. Provide all backsplash-mounted faucets with double-male nipples having locknuts for rigidly securing faucets to backsplash.
   3. Provide and install all copper wastes incorporated in the custom-fabricated food service equipment, complete with silver-painted copper tailpiece.
   4. Extend all indirect wastes not connected to the sewage system with copper piping, silver-painted. Drain extensions shall drip over and into floor drain. Where drain runs under an item of equipment, provide proper support from bottom of equipment to eliminate interference with the floor cleaning.
   5. Provide gas-pressure regulators on the individual pieces of gas-fired equipment per manufacturer's recommendation.

B. Electrical:
   1. Interwire food service equipment between heating elements, switches, starters, thermostats, outlets, motors and solenoids complete to junction box, terminal box or disconnect switch.
   2. Provide and install all switches, including disconnect switches within equipment, contactors, combination starters with fused disconnect, controls and similar items necessary for the safe and proper operation of the equipment.
   3. Provide all electrically-operated portable or movable equipment with three-wire or four-wire, heavy-duty rubber cord fitted with grounded plug with one (1) leg of the cord grounded to frame of equipment.
   4. Provide and install grounded receptacles specified under Item Specifications and/or shown as part of the item of equipment, including stainless-steel faceplate.

5. Provide and install electric thermostats, where required; Robertshaw, or approved equal, unless otherwise specified.

C. Refrigeration:
   1. Provide, install, and thoroughly test Refrigeration Systems furnished as part of the food service equipment. (See Paragraph "Warranty and Service" for general specifications covering Refrigeration Systems and Service Contracts for same.)

D. Heating and Ventilation:
   1. Provide and install #18-gauge stainless-steel vent ducts from vent collars in top of dishwasher to six (6") inches above finished ceiling. Provide dampers, where required.
   2. Provide and install Fire Extinguishing Systems as required by National Fire Protection Association, Current Edition, and as specified.

1.03 RELATED WORK SPECIFIED ELSEWHERE: (NOT IN THIS SECTION)

A. Floor depressions indicated on the drawings and where required.

B. Required holes and recesses for piping and ducts provided with information as to location and size is furnished to other trades in adequate time to be incorporated in the work.

C. Roughing-in wiring for the food service equipment and final connection between roughing-in points and points of connection (pigtails or terminals) on the food service equipment; connections to the equipment shall be in accordance with equipment wiring diagrams.

D. Wall receptacles shown and required for the food service equipment.

E. Required disconnect switches between roughing-in points and points of connection to the equipment.

F. Providing and installing traps, strainers, and valves, including items furnished by the Food Service Equipment Contractor, and making final connections to the food service equipment.

G. Final connections between the vent ducts off dishwasher, these ducts being extended six (6") inches above the finished ceiling by the Food Service Equipment Contractor.

H. Roughing-in, providing, and installing all hot and cold water piping between roughing-in points and points of connection on the equipment, providing in each water line a shut-off valve and, where required, a pressure reducer and regulator, and making final connection to the food service equipment.

I. Installation of the final connection to faucets and fill hoses provided by the Food Service Equipment Contractor on sinks, tables, and other equipment.

J. Waste piping (excluding extending of indirect waste piping), traps, vents, and final connections to drain outlets of sinks and other equipment.

1.04 SUBMITTALS

A. Food Service Equipment Contractor shall coordinate submittal due dates with the Construction Schedule for this Project.

B. Equipment List: Submit for approval within ten (10) days after notification of award of contract an itemized list of equipment to be provided under the contract, with manufacturer's name and model number for each item.

C. Samples: Upon the request of the Architect, submit for approval all hardware, drawer slides, drawers, feet, casters, brackets, and similar items, including samples of construction showing typical reinforcement of underside of tops, as well as angle framing of counters.

D. Brochures:
   1. Electronically submit complete brochure booklet containing manufacturer's specification catalog pages with all pertinent engineering and dimensional data identified, together with

typewritten cover pages for each "buy-out" item to the Architect and Food Service Consultant for review, approval and distribution.

2. Brochure booklet to contain manufacturer's illustration sheet for each manufactured or "buy-out" item, with cover sheet for each item indicating the quantity required, list of accessories required, electrical characteristics, and other pertinent data.
3. Arrange items in numerical order following scheduled Item Numbers. Brochure booklet shall be complete, covering all manufactured or "buy-out" items of equipment. No consideration will be given to partial lists made at various times.

E. Roughing-In or Mechanical Connection Drawings:
1. Electronically submit drawings to the Architect and Food Service Consultant for review, approval and distribution.
2. Prepare roughing-in drawings of all equipment shown on Contract drawings (this includes new equipment supplied as a part of the Contract, as well as any existing equipment to be reused). Prepare AutoCAD-generated drawings at one-quarter (1/4") inch scale on sheet of same size as Contract Drawings showing all the mechanical roughing-in (including sleeves and conduit) for electric, water, waste, gas, refrigeration, ventilation, condensate drain lines, air and exhaust connections and characteristics, and roughing-in data for all services in each area. Indicate the approximate location of the food service equipment with allowances for traps, switches and other final connection requirements.
3. Dimension each roughing-in location accurately from column centerlines and/or walls (not partition walls).
4. Assume responsibility for proper location of sleeves and conduits through which the utility lines will be installed and for conforming to roughing-in location with the food service equipment and connections thereto, or compensate the other trades for any necessary relocation of the roughing-in. Make field inspection before the finished floors are laid and relocate sleeves, as necessary.

F. Shop Drawings of Custom-Fabricated Equipment:
1. Electronically submit drawings to the Architect and Food Service Consultant for review, approval and distribution.
2. Prepare computer-generated shop drawings at three-quarter (3/4") inch scale, or larger, on sheets of same size as Contract Drawings indicating all dimensions, details for construction, reinforcement and for installation and relation to adjoining work that requires cutting and close-fitting. Obtain written permission from the Architect, before fabrication, for any departure from construction indicated, or required, which may be necessary due to special conditions found at the building.
3. Do not fabricate custom-manufactured equipment until final approvals are received on shop drawings and until field inspection and measurements are taken.

G. Field Measurements:
1. Make field measurements giving due consideration to any architectural, mechanical or structural discrepancies that may occur during construction of the building. No extra compensation will be allowed for any difference between actual dimensions and designed dimensions.
2. Submit any differences found during field measurements to the Architect for consideration before proceeding with the fabrication.

1.05 STANDARDS

A. Except as modified by governing codes and by the Contract Documents, comply with the applicable provisions and recommendations of the following:
1. National Fire Protection Association (NFPA)
a. NFPA 96 - Installation of Equipment for Removal of Smoke and Grease-laden

b. Vapors from Commercial Cooking Equipment, Current Edition.
1) NFPA 17A -Wet Chemical Extinguishing Systems, Current Edition
2. National Sanitation Foundation (NSF)
3. Underwriters' Laboratories, Inc. (U.L.)
4. National Electric Manufacturers Association (NEMA)
5. National Electric Code (NEC)
6. American Gas Association (AGA)
7. National Fuel Gas Code (NFGC)
8. International Mechanical Code (IMC)
9. International Building Code (IBC)

1.06 GENERAL REQUIREMENTS

A. Electrical: (Check voltage requirements on job before ordering any electrically-operated equipment.)
1. All electric units and equipment shall be of voltages indicated. Differences in current characteristics of equipment listed and that available must be submitted to the Architect for consideration before the equipment is ordered.
2. All internal wiring of the equipment to the outlets on the equipment shall be by the Food Service Equipment Contractor in accordance with National Electric Code and/or jurisdictional governing agencies.
3. All electrically-operated equipment shall conform to the Rules and Regulations and the Laws of the State of the particular installation and shall be approved by the Electrical Inspector or the Underwriters' Laboratories.
4. All electrically-operated assemblies of fabricated equipment shall have Underwriters' Laboratories Approval where such Approval has been established.
5. All electrically-operated manufactured items of equipment shall have Underwriters' Laboratories Approval or U.L. Re-examination listed in every case where such Approval has been established for the particular device in question.

B. Steam-Heated or Steam-Operated Equipment:
1. All steam-heated or steam-operated equipment shall be manufactured in accordance with ASME Code Requirements and shall carry the ASME Stamp.

C. Sanitary Requirements:
1. All food service equipment provided and installed shall conform to the Standards of National Sanitation Foundation, Ann Arbor, Michigan, (where Standards have been established) to the Rules and Regulations of the State Board of Health and the local Board of Health. All equipment covered by NSF Standards shall bear its Seal.

D. Gas-Heated Equipment:
1. All gas-fired equipment shall be manufactured and installed in accordance with American Gas Association Requirements and shall carry the AGA Stamp.

E. Ventilation Equipment:
1. Cooking Equipment Ventilation Systems shall be designed, fabricated, and installed in strict compliance with the National Fire Protection Association, Current Edition, and International Mechanical Code, Section 507, and all associated State and Local Code Standards.

F. Building Code Requirements:
1. Walk-In Refrigerator and Freezer Rooms and other "built-in" pieces of equipment shall be designed, fabricated, and installed in strict compliance with the applicable State Building Codes or the local authority having jurisdiction. This equipment shall also comply with all other applicable Codes.

1.07 CONTRACTOR QUALIFICATIONS

A. Food Service Equipment Contractor shall have been in business at least five (5) years with a suitable organization to procure, deliver, and install the equipment, all in accordance with specified conditions, and shall be able to refer to other successful installations of similar equipment and size to that specified herein and which have proven satisfactory under similar operating conditions. Under no condition shall this Contractor sublet any portion of the project to any subcontractor without Architect's approval.

B. All labor shall be performed by experienced mechanics in this kind of work. All work on the premises shall be done at such time as to promote the proper conduct of the project. Provide a competent superintendent to supervise the installation of equipment and to give to other trades such information necessary for the proper conduct and completion of this installation.

PART 2 PRODUCTS

2.01 STANDARD MANUFACTURED OR "BUY-OUT" EQUIPMENT

A. Standard food service equipment made on a production basis is named by catalog number in the Item Specifications and establishes the "Standard" required. Items identified by a manufacturer's model number shall be supplied with all parts and accessories listed by that manufacturer as "Standard" and included in the base price; optional accessory items will be specifically stated in the Item Specifications.

2.02 NAMEPLATES

A. Each item of manufactured or "buy-out" equipment furnished under this Contract shall be provided with identifying nameplate of corrosion-resistant material giving name and address of manufacturer, catalog and serial numbers, and other identifying information for use in securing replacement parts.

B. Nameplate shall fit snugly against the surface of the item, shall be free of rough edges, and shall be attached in such manner as not to interfere with the cleaning of the equipment.

2.03 MOTORS

A. All electric motors and operating controls shall be splash-proof and conform to the available electrical characteristics on the premises. All fractional horsepower motors under 1/2-horsepower shall be supplied to operate on 120 volt, 60 cycle, single-phase current. All 1/2-horsepower and over shall be supplied to operate on the power circuit, three-phase current or as otherwise specified.

2.04 HEATING EQUIPMENT

A. All electrical heating units shall be provided with an "On/Off" switch, ruby light indicator, U.L. Approved wiring, grounded, and prewired by this Contractor to a connection box ready for final connection by other trades.

2.05 WARRANTY AND SERVICE

A. Provide a listing of factory-authorized service agencies and copies of written service and warranty agreements on all food service equipment items. Provide written Warranty agreeing to replace free of charge any work, equipment, parts, materials and/or workmanship that become defective during the Warranty Period (except that which becomes defective due to abuse of the equipment). Replacement shall be made without cost to the Owner. The Food Service Equipment Contractor shall reimburse the other contractors for extra work involved in the replacement of defective equipment. Warranty Period is for one (1) year from date equipment is put into continuous operation and accepted by the Owner.

B. All Refrigeration Systems shall be provided with a One (1) Year Prepaid Service Contract and a Five (5) Year Warranty on the compressor. Warranty to begin at time when equipment is put

into continuous operation and accepted by the Owner.

C. Service contracts on Refrigeration Systems must be contracted for by the Food Service Equipment Contractor with authorized local service organizations capable of providing prompt and efficient service on the equipment. Submit copies of all service contracts to the Architect upon completion of the installation of the food service equipment.

2.06 SUBSTITUTIONS – STANDARDS

A. The name or make of any article, device, material, or form of construction listed in the Item Specifications shall establish the "Standard" required.

B. Proposals shall be based on the manufacturers and models specified; however, bidders may submit prices of other manufacturers identified on the “Additional Acceptable Manufacturers” listing at the end of this section, with the understanding the specified manufacturer and model number establishes the minimum standards required.

C. Any equipment selected from the “Additional Acceptable Manufacturers” listing must conform to space limitations of the layout and the cost of any deviation will be the responsibility of the Food Service Equipment Contractor at no extra cost to the Owner or other Contractors.

D. Accepted alternates will be noted in the Contract and no other substitutions will be permitted subsequent to the signing of the Contract, except by specific change order.

2.07 CUSTOM-FABRICATED EQUIPMENT

A. Custom-fabricated equipment shall be constructed in strict accordance with the Contract Drawings and be the best grade manufacture of one of the following pre-approved food service equipment custom-fabricators: Bova Corporation, P.O. Box 118, 111 McFann Road, Valencia, PA 16059; Keystone Custom Fabricators, Inc., 108 Atlantic Avenue, Elizabeth, PA 15037; and Commercial Stainless, Inc., 900 Patterson Drive, Bloomsburg, PA 17815. This discipline shall have been in continuous business for a minimum of five (5) years and successfully completed projects of similar size and scope.

B. Products must conform to the requirements of the plans and specifications established as the "Standard" required.

2.08 MATERIALS – METAL

A. All materials shall be new, of prime quality, full-gauge thickness of composition indicated by name or abbreviations used in Item Specifications.

B. All gauges herein specified shall be standard U.S. gauges. Unless specified, no material shall be provided lighter than #18-gauge.

C. Where stainless steel is specified, sheets, castings or tubing shall be Type 304 of the 18-8 Series, with a content of from 17% to 19% chrome, 7% to 10% nickel and a maximum carbon content of .09. All exposed stainless-steel surfaces shall be a No. 4 mill finish. An exposed surface shall be interpreted to include inside surfaces exposed to view when any door is opened.

D. All unexposed portions shall be ground smooth with either a #80-grit finish or a first cut commercial finish.

E. Tubing shall be #16-gauge stainless steel, (.065) thick, seamless drawn or shall have seam welded continuously, ground smooth and polished.

F. Color of equipment of any nature: As selected by the Architect from laminate manufacturer's full range of colors/finishes.

2.09 GENERAL DETAILS FOR THE CONSTRUCTION OF CUSTOM-FABRICATED EQUIPMENT

A. Joints and Welds:

1. All equipment herein specified, when constructed of more than one (1) piece and/or sheet of metal shall be continuously butt-welded, ground and polished smooth. Field joints shall be as few as possible. All welded parts shall be homogeneous, non-porous, free-from-pits, cracks, imperfections or discolorations. All welding shall be electric process, with all joints ground and polished smooth. The welding rods used shall be of the same composition as sheets of parts welded.

B. Tops:
   1. All table tops, counters and like items, unless otherwise specified, shall be of #14-gauge stainless steel of one (1) sheet without seams with edges as indicated on detail drawings.
   2. Tops shall be stud-bolted to counter frames on 2'-6" centers and to channel bracing of "open" fixtures. Provide chrome-plated acorn cap nuts.
   3. Field joints in tops shall be welded, ground smooth, and polished only where tops exceed length of available sheets and/or where building accesses do not permit the top to be brought into the building in one (1) piece.

C. Channels:
   1. All channels shall be of #14-gauge stainless-steel construction, 1" x 4" x 1", edges ground and polished. Channel shall be attached to table tops, counters and like items in "legs down" position. Full perimeter shall be sealed to table top with clear silicone mastic sealant, Component Hardware M90-1010. Channels shall run front-to-back at each leg location with additional channel bracing running between front-to-back channels, down the center of the fixture. Where channels intersect, they shall be fully welded, ground and polished. Where an item of food service equipment is to be placed on a work table or counter, provide additional channel bracing to accommodate the weight and operation of the equipment items.

D. Sound Deadening:
   1. Apply 3M Company, #Y434 W/L, two (2") inch wide, aluminum foil tape to the underside of all table and counter tops, spaced on eight (8") inch centers.

E. Sinks:
   1. All sinks shall be constructed of #14-gauge stainless steel, with all corners formed with a three-quarter (3/4") inch radius, both horizontal and vertical. All sink sizes established on the Detail Drawings to be inside measurements.
   2. Partitions between sink compartments shall be double-walled with three-quarter (3/4") inch radius corners and three-quarter (3/4") inch radius top edges welded-in-place, ground smooth and polished. Fronts, bottoms and back of multiple-compartment sinks shall be one (1) piece, with no overlapping joints or open crevices. Bottom of each compartment shall be creased to center and fitted with lever-operated waste with strainer plate and a brass tailpiece for slip connection. Lever waste to be set into one-half (1/2") inch deep recess assuring complete draining. Overflow shall be fitted in back of sink so that the constant water level is one (1") inch below sink rim and/or adjoining drainboard level and shall be factory-installed.
   3. Where sinks occur in tables, they shall be entirely welded to the table top with all welds ground smooth and polished with no trace of welding left, all to give the appearance of one (1) continuous piece.
   4. Sinks are to have a stainless-steel backsplash, where required, of the height specified.
   5. Provide two (2) holes for specified faucets. Where adjacent equipment has a similar backsplash, the backsplash shall be matching in height and design and tops joined with a top cap.

F. Drainboards and Dish Tables:

1. All drainboards shall be constructed of #14-gauge stainless steel. Turn front and ends up three (3") inches and finish with one-and-one-half (1-1/2") inch, 180-degree roll. All corners, both horizontal and vertical, shall have standard three-quarter (3/4") inch radius. Exterior corners shall be rounded. Weld drainboards to sink forming an integral unit.

G. Pitch and Drainage:
   1. Wherever a fixture is used with a waste or drain outlet, the surface shall have a distinct pitch toward such an outlet. Dish tables and drainboards shall have a definite pitch to drain. Pitch to be accomplished on table top only.
   2. Where drains are called for to be located in long tables or where drainage is necessary, such table tops shall be provided with drains located at specific points as shown on the drawings.

H. Faucets and Wastes:
   1. All plumbing fixtures shall be ANSI/NSF 61 Section 9 Certified, CSA Certified, and EPA Act 2005 Compliant. Faucets shall be provided with stainless-steel seats and two-part swivel stem assemblies, lever handles, and chrome-plated ADA easy-turn stems.
   2. Provide all faucet's lever-handle, quick-opening wastes with overflow assemblies, basket wastes, straight wastes and valves normally supplied with equipment for proper operation of a particular item. Sink mixing faucets are to be Chicago models, as follows, or T & S B200 Series with Monel seat.
   3. Wall-type swing faucet with integral stops, Chicago 540-LD-L9-R-748-2K, or Fisher 3250 Series, combination sink fitting, less soap dish, complete with R integral stop supply arms and with nine (9") inch swing spout attached to backsplash with one-half (1/2") inch close nipple and one-half (1/2") inch copper to flange sink ell.
   4. Deck-type swing faucet less integral stops, Chicago 540-LD-l9-EA-748-2K, or Fisher 3310 Series, combination sink fitting, less soap dish, with one-half (1/2") inch flanged female inlet shank with integral stop, one-half (1/2") inch I P male brass supply with locknut, galvanized washer, coupling nut on inlet and nine (9") inch swing spout.
   5. Chrome-plated, lever-handle, two (2") inch, I.P.S. quick-opening waste with rear outlet connection for chrome-plated brass overflow fitting with one-and-one-quarter (1-1/4") inch brass tubing to be complete assembly as manufactured by Fisher 24902 Series or Component Hardware Model D50-7215 or D10-4591.

I. Enclosed Cabinets:
   1. Construct all enclosed bases, cabinets and wall cabinets and the like of #18-gauge stainless-steel, single-wall, pan-type, completely one (1) piece welded construction with no visible joints or screw attachments showing. Entire unit to be rigidly braced with #14-gauge stainless-steel angles or channels, where required, and/or angle-iron frames. All vertical corners shall be standard square break radius.

J. Doors:
   1. Doors shall be double pan construction, #18-gauge face, #20-gauge rear stainless steel, unless otherwise specified. Doors to be five-eighth (5/8") inch thick and filled with sound-deadening material. Provide each door with a door handle.

K. Counter Legs:
   1. Component Hardware A52-9907, six (6") inch high, adjustable, stainless-steel legs.

L. Wheels and Casters:
   1. Portable equipment shall be mounted on casters of the size specified or as provided as standard by the manufacturer, but must comply with the Load-Rating Standards of the Casters & Floor Truck Manufacturers' Association, and with the NSF Sanitary Requirements. Casters, forks and guards are to be cadmium-plated. Wheels are to be disc steel-type with neoprene tires. Provide wheel locks where specified.

2. Casters shall be equal in quality to:
   a. Jarvis & Jarvis swivel plate Model 5-25-111, with or without brakes.
      Jarvis & Jarvis rigid plate Model 5-26-111.
      Jarvis & Jarvis stem caster Model 5-27-111, with or without brakes.
      Jarvis & Jarvis sealed caster - NSF Listed.
      Jarvis & Jarvis Model 5-50-113 GBL, wheel and rotation brakes, five (5") inch diameter, ball-bearing, swivel.
   b. Bassick swivel Model 5NS6GW-2BCHR - plate.
      Bassick swivel Model 5NS6GW-2BX67CHR - pipe leg.
      Bassick rigid Model 5NT6GW-2BCHR - plate.

M. Undershelves – Open Construction:
1. Solid, removable undershelves shall be fabricated of #16-gauge stainless steel, with all edges formed to fit cross-rails with rolled drop edges one-and-one-half (1-1/2") inches deep. All corners and intersections ground and polished smooth. Cut out corners of shelves to fit snug around all leg locations. At shelf joint where cross rails do not occur, provide a one-and-one-half (1-1/2") inch, ninety (90□) degree turn-down. Turn rear edges of undershelves up one-and-one-half (1-1/2") inches with coved radius. Maximum length of sections shall be 2'-6".
2. Solid, fixed undershelves shall be fabricated of #16-gauge stainless steel, with all free edges turned down one-and-one-half (1-1/2") inches.
3. Notch and weld at legs. Where edges are specified to be turned up, turn up on a three-quarter (3/4") inch radius to the height specified.
4. Weld a #14-gauge stainless-steel channel centered full-length of underside of fixed undershelves.

N. Undershelves – Cabinet Style:
1. All cabinet shelving shall have pan-type, removable, bottom and intermediate shelves and shall be #18-gauge stainless steel, unless otherwise specifically stated, with all shelf joints welded. Turn shelves up three (3") inches at rear and ends with one (1") inch radius cove corner where shelves turn up at the rear. The turned up edges must be tight-fitting against cabinet framing and enclosure. If cabinet enclosure has sliding doors, the lower shelf shall have stainless-steel guide pins. The intermediate shelving shall be fixed, unless specifically stated otherwise.

O. Overshelves:
1. Overshelves shall be fabricated of #16-gauge stainless steel with edges rolled down or up, as specified, having same construction as "Tops."
2. Mount shelving on #16-gauge stainless-steel tubing of the diameter specified.
3. Overshelves at walls are to be cantilever-mounted, with the upright passing down through the backsplash rim and bolted to extended channels for support.
4. When overshelves are to be mounted to a flat top, secure with concealed fasteners.

P. Wall Shelves:
1. Wall shelves shall be fabricated of #16-gauge stainless steel, No. 4 finish, with edges rolled up or down, as specified, having same construction as "Tops." Provide with two (2") inch turned up rear and end risers. Mount to wall on #14-gauge stainless-steel cantilever brackets. Secure brackets to wall with stainless-steel screws with lead-expansion shields. Brackets shall be spaced a maximum of 4'-0" on center.

Q. Legs:
1. All legs shall be 1-5/8" outer-diameter x #16-gauge stainless-steel tubing. Legs shall be located as shown on the plan and/or sections and shall not exceed 6'-0" on center. All joints between legs and undershelves or cross rails shall be welded, ground smooth and

polished. Each leg shall be fitted with Component Hardware Model A10-0852, round bottom collar and foot insert, Type #18-8 stainless steel, sized for one-and-five-eighth (1-5/8") inch, #16-gauge tubing.

R. Leg Sockets (Gussets):
   1. Leg sockets shall be cylindrical, one (1) piece, stainless-steel construction. Leg sockets shall be welded to supporting members and spot welded with sealant around remaining perimeter. At legs or uprights, leg sockets shall fit snug and legs or uprights shall be secured by an Allen setscrew. Leg sockets shall be Component Hardware A20-0206, Type #18-8 stainless steel.

S. Cross Rails:
   1. Cross rails shall be 1-1/4" outer-diameter x #16-gauge stainless-steel tubing mounted ten (10") inches above the floor, ground and polished. Cross rails shall be attached to every leg and shall be run front-to-back and full-length between legs at rear and front. When fixed undershelves are specified, cross-rails may be omitted.

T. Drawers: (See Details on Drawing)
   1. The drawer pan shall be #20-gauge stainless steel. All vertical and horizontal corners shall have three-quarter (3/4") inch minimum coved radius. Top of pan to flange out and be removable without the use of tools.
   2. The drawer slides shall be the full-suspension, self-closing type fitted with four (4), case-hardened, ball-bearing rollers. Track attached to drawer upper edge shaped to fit contour of roller rim to provide a position drawer guide and prevent jarring, outer track fastened to the drawer housing and provided with limit stops. Assembly shall be Component Hardware Model S52-002.
   3. The drawer housing shall be #18-gauge stainless steel to enclosed front, sides and back of drawer assembly to extend from underside of table or counter top, down to bottom of drawer front. Front of housing fitted with opening (with edges turned in one-half (1/2") inch) and corners welded to accommodate drawer body and slides. Top turn-in provided with holes for receiving threaded studs welded to underside of table or counter top for bolting housing thereto.
   4. All drawers shall be 20" x 20" x 5" deep, unless otherwise specified. All drawers shall be fitted with Kason Model 0382 drawer pulls.

PART 3 EXECUTION

3.01 OPENINGS – ACCESS

A. General: Coordinate with other contractors for provision and scheduling of temporary openings in walls or floors that may be required for passing large sections of equipment into the building that cannot be accommodated through permanent openings.

3.02 INSTALLATION

A. General: Make arrangements for receiving food service equipment and make delivery into the building as requisitioned by installation superintendent. Do not consign any equipment to the Owner or to any other contractor without receiving written acceptance from them and making arrangements for the payment of freight and handling charges.

B. Deliver all equipment into the building, uncrate, assemble, level, and repair any damaged or abraded surfaces. Set equipment temporarily in its final location to permit mechanical trades to take necessary measurements for the connection of the service lines. Move the equipment sufficiently to permit the installation of such service lines and then realign equipment level and plumb. Install all equipment so as to eliminate objectionable vibration.

C. All cabinets and other items of equipment that butt against walls shall be sealed thereto with Dow Corning #732 RTV, or equal, General Electric clear silicone sealant, all excess sealant

being cleaned out of the joints to a radius fillet.

D. Where necessary, in order to seal a cabinet to the wall, provide scribing or filler strips matching the metal used in the cabinet construction and seal the strips to the wall construction with silicone sealant.

3.03 TESTING, DEMONSTRATING, AND INSTRUCTING OWNER'S DESIGNATED PERSONNEL

A. After complete installation, all items of equipment provided under this Contract shall be operated and thoroughly tested by a factory-authorized service agency to insure proper and safe operation.

B. Food Service Equipment Contractor shall arrange to have all mechanically-operated equipment provided under this Contract demonstrated by authorized Representatives of the equipment manufacturers. These Representatives shall instruct the Owner's designated personnel in the use, care, and maintenance of all items of equipment after equipment has been thoroughly tested by a factory-authorized service agency and is in working order. “Live” demonstrations are required. Food Service Equipment Contractor shall be present during all demonstrations.

3.04 OPERATING AND MAINTENANCE MANUALS

A. After completion of the installation, the Food Service Equipment Contractor shall present to the Owner two (2) sets of all Operating and Maintenance Manuals and one (1) Flash Drive covering all mechanically-operated equipment provided under this contract; each set being neatly bound in a loose-leaf binder having a durable cover.

B. Include in each binder the manufacturer, model number, and serial number of all equipment, and a list of names, addresses, and telephone numbers of local service agencies authorized to make necessary repairs and/or adjustments of the equipment provided under this Contract.

3.05 LUBRICATION – OIL AND GREASE

A. Each moving part in the entire food facilities installation shall be provided with suitable bearings with provision for greasing or with grease gun connections suited to a high-pressure gun for distributing heavy oil or light grease. Points of lubrication shall be readily accessible. All grease guns connections shall be of the same type to fit the same gun.

B. All bearings and packing glands shall be properly protected during installation. Before the equipment is placed in operation, they shall be filled with the type of lubricant recommended by the manufacturer of the apparatus. Prior to final acceptance, all equipment glands shall be repacked and all valve packing glands tightened.

3.06 CORRELATION WITH DRAWINGS

A. This written specification must be closely correlated with the Drawings and Schedules. Each complements the other and cross-reference will be necessary to fulfill the requirements of the specifications. All information shown on drawings and listed in schedules shall be incorporated as part of the written specifications.

3.07 SPECIAL PROVISIONS

A. Similar or “like” equipment must be provided by the same manufacturer, as multiple manufacturers will not be accepted.

PART 4 SCHEDULE OF EQUIPMENT

4.01 EXISTING EQUIPMENT

A. Non-Reused Equipment: Many existing pieces of equipment are not to be reused in the renovated kitchen. These items are to be disconnected by the various trades, where required, and removed from the existing kitchen by the Food Service Equipment Contractor. It shall be the responsibility of the Food Service Equipment Contractor to either move these items into a

designated storage area, and/or to discard them after receipt of written authorization from the Owner's representative.

B. Existing Equipment - Reused in Existing Location: Equipment items with the Item Number Prefix "X" shall be reused in the renovated kitchen in existing positions. These items are to be disconnected by the various trades, where required, and removed from the existing kitchen by the Food Service Equipment Contractor to enable architectural work to be performed. It shall be the responsibility of the Food Service Equipment Contractor to move these items into a designated storage area, fully protect, move them back to their former locations, and make ready for final connections.

C. Existing Equipment - Relocated: Equipment items with the Item Number Prefix "XR" shall be reused in the renovated kitchen in new positions. Food Service Equipment Contractor shall move these items from their existing locations after they have been disconnected by the various trades, where required, move them into a designated storage area, fully protect, and move them to new locations indicated on floor plan drawing. These items of equipment shall be reassembled, where required, and made ready for final connections only by other trades involved. Care shall be exercised in moving, however, no additional work shall be required under this specification.

D. Existing Equipment - Relocated and Reworked: Equipment items with the Item Number Prefix "XRW" shall be reused in the renovated kitchen. After disconnection by the various trades, where required, Food Service Equipment Contractor shall move these items from their existing locations, rework as specified in the Specifications, move them to new locations shown, install, and make ready for final connections by other trades involved, where required.

E. Existing Equipment - Reworked: Equipment items with the Item Number Prefix "XW" shall be reused in the renovated kitchen facility. These items are to be disconnected by the various trades, where required, removed from the existing kitchen by the Food Service Equipment Contractor, reworked as specified, and make ready for final connections by other trades involved, where required.

4.02 ITEM NO. 1 – WALK-IN REFRIGERATOR ONE
(INCLUDING 1A1, 1A2, 1B1 & 1B2 REFRIGERATION EQUIPMENT) COMBINATION
ITEM NO. 2 – WALK-IN FREEZER UNIT
(INCLUDING 2A1, 2A2, 2B1 & 2B2 REFRIGERATION EQUIPMENT) REQUIRED

A. Walk-In Refrigerator and Freezer Rooms, as manufactured by Tafco, Hyde, Pennsylvania. Overall size of combination unit shall measure 66'-8-1/4" long x 13'-6” wide x 10'-6" high. Note, special 6” corner panels, complete with corresponding floor and ceiling panels shall be utilized to attain the overall length dimension. Building walls shall form exterior limitations at rear, both sides and partial front (Dry Storage Room location), with remainder of front of combination unit exposed. Size and shape as shown on Contract Drawings.

B. Construction: Prefabricated sectional construction with metal interior and exterior pans “sandwiching” foamed-in-place insulation. Provide reinforced, self-supporting ceiling panels. Each room shall be provided with stainless-steel pressure relief vent. Note, provide foamed-in-place, minimum one-half (1/2") inch thick plywood reinforcement above each door section to enable installation and accommodate weight of Air Doors, Items No. 3 — coordinate accordingly.

C. Approvals: Entire construction and installation of walk-in rooms shall comply with NSF Standards and the local building codes. Insulation shall be U.L. Rated, flame-retardant, self-extinguishing type. All electrical accessories shall be U.L. Approved.

D. Interior and Exterior Surfaces: Exposed exterior sections of combination unit shall be #20-gauge, Type 304 embossed stainless steel. All unexposed exterior surfaces shall be #26-gauge embossed galvalume. All interior walls and ceilings shall be .040" white smooth aluminum. Door finishes shall be #20-gauge, Type 304 stucco stainless steel on exterior and .040" white smooth aluminum on interior. Provide and install #18-gauge stainless-steel trim strips at points where walk-in walls abut building walls. Provide and install #18-gauge stainless-steel closure panels from top of combination unit, along exposed front to finished ceiling above. Closure panels shall be pan-type, removable, and installed within upper/lower stainless-steel channels. Provide and install 36" high, 5-bar tread kick plate on exposed exterior front of combination unit, splitting kick plate as required to accommodate wall guides. Provide and install #16-gauge stainless-steel triangular-shaped bumper rails on exposed front of combination unit (excluding doors and sections with wall guide) at ten (10") inches and thirty-four (34") inches above finished floor at locations indicated on Contract Drawings. Securely attach and seal to Walk-In wall panels.

E. Doors: Door jambs shall be U.L. Approved, fully insulated, and measure 5'-0" wide x 8'-0" high. Replaceable NSF gaskets. Provide and install electrically-operated Frank Sliding Door at each door opening, Model EFD. 120 Volt, single-phase operation. Units shall be single panel, horizontal electrical slide, four (4") inches thick, constructed of #20-gauge, Type 304 stainless steel exterior, .040" white aluminum interior, #24-gauge Type 304 stainless-steel back-up header and casings; stainless-steel chain lock with inside release; #24-gauge stainless-steel clad header, with matching clad Droptrac; matching stainless-steel clad extruded aluminum casings; panel-mounted gaskets; casing-mounted, leading edge closure hook; floor-mounted trailing edge poly-guides; exterior pull handle; Model HDPE, Interior Pull Handle; Model DCS18; Digital Control and Drive System (UL listed); chain disconnect; reversing edge; jamb-mounted photo eye; radio control receiver, with two (2) double channel transmitters; pad lockable lockout switch; NEMA 4X Box; stainless-steel hardware package; 120 Volt heater in door and frame; slide "right" operation; complete Installation Kit; and ten (10") inch stainless-steel carriage bolts, nuts, and washers. Each door shall include Santoprene Dual Blade Adjustable Bottom Sweep; double swing strip door; and 14" x 14", triple pane heated view window with metal frame, heat-reflective tempered safety glass, and integral heating system. Note doors shall be provided with #14-gauge stainless-steel kickplates on interior and exterior from bottom to underside of door handle, secured with stainless-steel fasteners and sealed around full perimeter. Note Food Service Equipment Contractor shall remove door assemblies during installation, then install prior to operation of Walk-In Refrigerator and Freezer, or shall be held responsible for damage to metal finish of Walk-In units.

F. Lighting: Walk-In Rooms shall be equipped with U.L. Approved, universal LED light fixtures with exterior switch and pilot light fully prewired to junction boxes over door panels. Provide Refrigerator with three (3) additional, and Freezer with five (5) additional ceiling-mounted light fixtures, Component Hardware Model LED48X754-ML-N, measuring 50" long x 6.3" wide, prewired to junction box on the exterior of the rooms with perforations through the ceiling panels and insulated, as required, to prevent condensation formation on the interior electrical components. Refer to the Contract Drawings for locations of ceiling-mounted fixtures. Provide timer device to automatically shut off lights within each walk-in unit when they are unoccupied for periods exceeding fifteen (15) minutes in duration.

G. Thermometers / Alarm Systems: Each room shall be equipped with recess-mounted Audio / Visual-Type Temperature / Alarm System, Weiss Instruments Model XWA11V-KIT, pre-wired to junction box over door panel. Provide additional dry contacts for interconnection with Building Alarm System and/or automatic dialer (by others) — fully coordinate with Owner to obtain specific requirements. Food Service Equipment Contractor shall verify particular type of contactors, as required, to insure compatibility with Owner's equipment.

H. Floors: Floors shall be prefabricated construction similar to that in wall and ceiling panels, but measuring five (5”) thick with integral PVC pipe reinforcement and “foamed-in-place” minimum of one (1”) thick plywood underlayment, with a minimum rating of 5,000 pounds per square foot, uniformly distributed with no given point load on a seam. Design shall accommodate installation within existing 5” – 5-1/2” recessed floor area. Interior floor shall be provided with high strength, 10-gauge, 5-Bar High Performance Flooring of aluminum alloy construction, directly atop plywood underlayment. Provide minimum three-quarter (3/4") inch radius coved base at all floor and wall junctures within Walk-In assembly to comply with NSF Code Standards.

I. Hanger Rod Brackets: Provide and install hanger rod brackets, as required, to provide support for evaporator coils.

J. Insulation: Insulation shall be urethane foamed-in-place under pressure. 97% Closed cell construction. Wall panels shall be a minimum four (4") inches thick, minimum R-25 value for Refrigerator, minimum R-32 value for Freezer. Floor panels shall be a minimum five (5”) inches thick, with a minimum R-36 value in refrigerator and R-40 in freezer.

K. Special Provisions: All sealant used within Walk-In Units shall be silicone based and shall be rated at -40°Fahrenheit.

L. Refrigeration Equipment: Walk-In Refrigerator Room shall be set to maintain a temperature of 35ºFahrenheit. Walk-In Freezer Room shall be set to maintain a temperature of -10ºFahrenheit. The following Refrigeration Equipment shall be supplied and completely interconnected, ready for final electrical connections only, all as part of this specification.

M. Provide two (2) Russell Model RFO180E4S-EANT/RL6A117ADARE Systems for Refrigerator Section. Each system shall include one (1), 1.8-horsepower Condensing Unit rated at approximately 16,840 BTU’s-per-hour capacity, and one (1) Blower Coil, rated at approximately 13,600 BTU’s-per-hour capacity. Provide two (2) Russell Model RFO600L4S-EBNT/(2)RL6E090DDARE Systems for Freezer Section. Each system shall include one (1), 6-horsepower Condensing Unit rated at approximately 12,990 BTU’s-per-hour capacity and two (2) Blower Coils, each rated at approximately 10,600 BTU’s-per-hour capacity. Note freezer system shall provide a minimum of 60% redundancy. All Blower Coils shall be provided with high-efficiency, dual EC motors. Each system shall include integral EcoNet Control Package, including Sporlan EEV, suction pressure transducer; suction, entering air, Coil Temp Thermistors; local on-board two (2) row LCD Display and Push-Button adjustments. Each Freezer System shall also include two (2) Model HX-75, Heat Exchangers (one per system), fully installed by Food Service Equipment Contractor.

N. Each Refrigeration System shall consist of a galvalume metal weather shield on a galvanized structural steel base, compressor, liquid receiver, air-cooled condenser, fused disconnect, complete with refrigeration and electrical accessories and matched evaporators. Both Refrigerator and Freezer Condensing Unit sections shall be charged with Refrigerant R448A. The liquid-line sight glass/moisture indicator and filter-drier (isolated by two (2) service valves) and suction line kit and accumulator shall be factory-installed and leak-tested with the condensing units.

O. Systems shall be designed to operate properly at low ambient conditions. This shall be accomplished with the use of condenser fan cycling, crankcase heater, suction accumulator, and the use of rapid-response, balanced, port expansion valves. Condensing units shall be installed on building roof directly above walk-in units, at location indicated on Architectural/Mechanical Contract Drawings. Food Service Equipment Contractor shall provide mounting curbs and pipe portal, manufactured by thyCURB, 12" high x 9-1/2" wide, including mounting flange, and shall be constructed of #18-gauge galvanized steel shell, 2" x 6" wood nailer, internal bulkheads, and one (1) curb longer than the other to include integral three-and-one-half (3-1/2") inch diameter sleeves for EPDM boots and clamps to accommodate utility

lines, and delivered to General Contractor for installation. Food Service Equipment Contractor shall fully coordinate routing of refrigeration lines between Walk-In location and condensing unit location. Systems shall be completely factory-piped and wired requiring only connection pipe and wiring between evaporators and condensing units.

P. The compressors for the Walk-In Freezer shall be Next Gen Minicon Scroll type, with 3,500 rpm motor and wired for 208 Volt, 60-cycle, three-phase. Each compressor shall include internal overload protection, positive lubrication system, suction and discharge line vibration isolators, rubber mounts, and crankcase heaters.

Q. The compressors for the Walk-In Refrigerator shall be Next Gen Minicon Scroll type, with 3,500 rpm motor and wired for 208 Volt, 60-cycle, three-phase. Each compressor shall include internal overload protection, positive lubrication system, suction and discharge line vibration isolators, rubber mounts, and crankcase heater.

R. Air-cooled condensers shall be constructed of aluminum die-formed fins mechanically-bonded to copper tubes with an integral sub-cooling coil. Condensing fan motors shall be life-lubricated with internal thermal overload protection.

S. Controls to be located in weather-protected, factory-installed-and-wired control panel. Wiring to be in accordance with NEC. Controls shall consist of compressor motor contactor, high/low pressure switch, and oil pressure switch (as required).

T. Evaporators shall be of sufficient capacity to balance with their respective condensing units to provide the proper storage conditions.

U. The Freezer evaporator motors shall be wired for 208 Volt, 60-cycle, single-phase. Motors shall be life-lubricated with thermal overload protection. Assembly shall include properly-sized, balanced port expansion valves, heat exchanger, and integral EcoNet Control Package.

V. The Refrigerator evaporator motors shall be wired for 115 Volt, 60-cycle, single-phase. Motors shall be life-lubricated with thermal overload protection. Assembly shall include properly sized, balanced, port expansion valves and integral EcoNet Control Package.

W. All drain lines from evaporators shall extend to safe waste drain and shall be directed downward into drain on the exterior of Refrigerator and be fabricated of copper tubing. Freezer drain lines shall be wrapped with heater tape (15-watts per foot of drain line) and provided with 120 Volt, single-phase cord and plug connection. Assembly shall plug into compatible receptacle mounted within Walk-In Freezer. Food Service Equipment Contractor shall fully coordinate with General Contractor. Provide “P-trap” in drain line between Refrigerator and Freezer boxes and immediately preceding floor receptor. Food Service Equipment Contractor shall provide corrosion-resistant hanger rods, through-the-wall insulated sleeves, etc., as required, for proper installation of the evaporators.

4.03 ITEM NO. 3 – AIR DOOR TWO REQUIRED

A. Berner Model CHD10-1060AA-SS. 120 Volt, single-phase operation. Unit shall provide full coverage for a sixty (60") inch door opening, include one (1) motor, and stainless steel cabinet finish. Provide three-speed motor, with factory-installed fan speed switch; adjustable nozzle vanes; perforated aluminum intake screens; 0”-12” stand-off, complete with mounting hardware; and 24 Volt Control Package to accommodate interconnection to each sliding door, specified as part of Items No. 1 and 2. Food Service Equipment Contractor shall securely attach to front of Walk-in Refrigerator and Freezer units, directly above door sections, at locations indicated on Contract Drawings. Units shall be interconnected to Walk-in Refrigerator and Freezer sliding doors to enable automatic activation and shut-down upon opening and closing of doors. All interconnections between sliding doors and air doors shall be by Food Service Equipment Contractor.

4.04 ITEM NO. 4 – PALLET **ONE LOT REQUIRED**

1. Not in Food Service Contract — By Owner

4.05 ITEM NO. 5 – SHELVING **TWENTY REQUIRED**

A. InterMetro Industries Corporation MetroMax “Q” Shelving units shall consist of the following components:
   1. One (1) unit shall consist of:
      a. Four (4) Model MQ74PE, posts.
      b. Five (5) Model MQ2136G2, shelves.
   2. Five (5) units shall consist of:
      a. Four (4) Model MQ74PE, posts.
      b. Five (5) Model MQ2142G2, shelves.
   3. Fourteen (14) units shall consist of:
      a. Four (4) Model MQ74PE, posts.
      b. Five (5) Model MQ2148G2, shelves.

4.06 ITEM NO. XR6 – DUNNAGE RACK **EXISTING SIXTEEN REQUIRED**

A. Existing polymer dunnage racks, fourteen (14) units measuring 21” x 48”, and two (2) units measuring 21” x 60”, as manufactured by Cambro, shall be relocated as indicated on Contract Drawings.

4.07 ITEM NO. 7 – NOT USED

4.08 ITEM NO. 8 – NOT USED

4.09 ITEM NO. 9 – WORK TABLE **TWO REQUIRED**

A. Size and shape as required and as shown on Contract Drawings. All stainless-steel construction. Provide four (4), five (5") inch diameter, heavy-duty swivel-type casters, two (2) with locking brakes.

4.10 ITEM NO. XRW10 – PREPARATION TABLE WITH SINKS **EXISTING ONE REQUIRED**

A. Existing preparation table with sinks, measuring approximately 13'-4" long x 2'-3-1/2" wide x 3’-0” high, with two (2), fifty-two (52") inch drainboards, two (2), twenty-seven (27") inch wide sink bowls, and ten (10”) inch high a two (2”) wide backsplash, shall be relocated as indicated on Contract Drawings (approximately 24” left of current location), and reworked as follows:
   1. Food Service Equipment Contractor shall remove existing faucet and drain/waste assemblies, and provide and install new faucet assembly, complete with overflows and twist-handle waste assemblies, as per General Specifications. Provide and install #18 gauge stainless steel cap between this table and abutting tables, Items No. 12 and No. 13, full-length of backsplash. Provide and install flanged feet on opposite legs of table, and securing attach to building floor, utilizing stainless steel fasteners, to prohibit movement of table. Manifold and extend drain lines to floor sink and direct downward into floor sink.

4.11 ITEM NO. XR11 – MIXER **EXISTING ONE REQUIRED**

A. Existing eighty (80) quart mixer, wired for 208 Volt, three-phase operation, as manufactured by Hobart, Model No. L800, shall be relocated as indicated on Contract Drawings.

4.12 ITEM NO. 12 – PREPARATION TABLE WITH SINKS **ONE REQUIRED**

A. Size and shape as required and as shown on Contract Drawings. All stainless-steel construction. Unit shall abut Preparation Table with Sinks, Item No. XW10. Provide stainless-steel finished backsplash at rear of exposed section of table, full welded around full perimeter, as indicated on Contract Drawings.

B. Install flanged feet on opposite legs and securely attach flanged feet to building floor, utilizing stainless steel fasteners, to prohibit movement of table.

C. Note Can Opener, Item No. 14, shall be securely attached to table, at location indicated on Contract Drawings. Marine edge shall be flattened at this location to enable “flat” installation of unit.

D. Food Service Equipment Contractor shall extend drain lines from sinks to floor sink and direct downward into floor sink.

4.13 ITEM NO. 13 – WORK TABLE ONE REQUIRED

A. Size and shape as required and as shown on Contract Drawings. All stainless-steel construction. Unit shall abut Preparation Table with Sinks, Item No. XW10. Provide stainless-steel finished backsplash at rear of exposed section of table, full welded around full perimeter, as indicated on Contract Drawings. Unit shall be installed four (4”) from adjacent Preparation Table with Sinks, Item No, 12.

4.14 ITEM NO. 14 – CAN OPENER ONE REQUIRED

A. Edlund Model G-2SL. Provide stainless-steel base with long bar. Unit shall be securely attached to Preparation Table with Sinks, Item No. 14, at location indicated on Contract Drawings. Provide and install chrome-plated acorn cap nuts on exposed fasteners beneath table.

4.15 ITEM NO. XR15 – MIXER EXISTING ONE REQUIRED

A. Existing twenty (20) quart mixer, wired for 120 Volt, single-phase, as manufactured by Hobart, Model No. A200, shall be relocated as indicated on Contract Drawings.

B. Unit shall plug into compatible receptacle mounted within Modular Electrical Raceway, Item No. 18 — coordinate accordingly.

4.16 ITEM NO. 16 – EQUIPMENT STAND THREE REQUIRED

A. Size and shape as required and as shown on Contract Drawings. All stainless-steel construction. Provide four (4) plate casters, complete with wheel and rotation brakes.

4.17 ITEM NO. 17 – WORK TABLE ONE REQUIRED

A. Size and shape as required and as shown on Contract Drawings. All stainless-steel construction.

4.18 ITEM NO. 18 – MODULAR ELECTRICAL RACEWAY ONE REQUIRED

A. Avtec Model MOD-Raceway, overhead style modular distribution system. Unit shall measure 8'-0" long x 4-1/2" high x 6" wide and be secured to structural members above finished ceiling and installed 7'-0" above finished floor at location indicated on Contract Drawings. Overhead raceway shall be wired for 50 Amps, 120/208 Volt, three-phase operation and include four (4) Avtec link connection plates, 20-Amp, 120 Volt, single-phase, with ground fault interrupted duplex outlet and matching thirty-six (36") inch long, straight blade extension cords, with plug and connector bodies; one (1) Avtec link connection plate, 20-Amp, 208 Volt, single-phase, with ground matching thirty-six (36") inch long, straight blade extension cord with plug and connector body; and additional blank Avtec link plates, where applicable.

B. Food Service Equipment Contractor shall fully coordinate with Electrical Contractor and provide cord drops at locations along MOD to accommodate equipment positioned beneath.

4.19 ITEM NO. XR19 – SLICER EXISTING ONE REQUIRED

A. Existing slicer, wired for 120 Volt, single-phase, as manufactured by Hobart, Model No. 1712, shall be relocated as indicated on Contract Drawings.

B. Unit shall plug into compatible receptacle mounted within Modular Electrical Raceway, Item No. 18 — coordinate accordingly.

4.20 ITEM NO. XR20 – SLICER EXISTING ONE REQUIRED

A. Existing slicer, wired for 120 Volt, single-phase, as manufactured by Hobart, Model No. 1612, shall be relocated as indicated on Contract Drawings.

B. Unit shall plug into compatible receptacle mounted within Modular Electrical Raceway, Item No. 18 — coordinate accordingly.

4.21 ITEM NO. 21 – WORK TABLE ONE REQUIRED

A. Size and shape as required and as shown on Contract Drawings. All stainless-steel construction.

4.22 ITEM NO. 22 – NOT USED

4.23 ITEM NO. 23 – NOT USED

4.24 ITEM NO. XR24 – FOOD CUTTER EXISTING ONE REQUIRED

A. Existing food cutter, wired for 120 Volt, single-phase, as manufactured by Hobart, Model No. 84181-D, shall be relocated as indicated on Contract Drawings.

B. Unit shall plug into compatible receptacle mounted within Modular Electrical Raceway, Item No. 28 — coordinate accordingly.

4.25 ITEM NO. 25 – EQUIPMENT STAND ONE REQUIRED

A. Size and shape as required and as shown on Contract Drawings. All stainless-steel construction. Provide four (4) plate casters, complete with wheel and rotation brakes.

4.26 ITEM NO. XR26 – FOOD PROCESSOR EXISTING ONE REQUIRED

A. Existing food processor, wired for 120 Volt, single-phase, as manufactured by Robot Coupe, Model No. R2, shall be relocated as indicated on Contract Drawings.

B. Unit shall plug into compatible receptacle mounted within Modular Electrical Raceway, Item No. 28 — coordinate accordingly.

4.27 ITEM NO. XR27 – EQUIPMENT STAND EXISTING ONE REQUIRED

A. Existing stainless-steel equipment stand, measuring 30" long x 30" wide x 34” high, with rolled edge at all sides, and intermediate and bottom shelves, shall be relocated as indicated on Contract Drawings.

4.28 ITEM NO. 28 – MODULAR ELECTRICAL RACEWAY ONE REQUIRED

A. Avtec Model MOD-Raceway, overhead style modular distribution system. Unit shall measure 6'-0" long x 4-1/2" high x 6" wide and be secured to structural members above finished ceiling and installed 7'-0" above finished floor at location indicated on Contract Drawings. Overhead raceway shall be wired for 50 Amps, 120/208 Volt, three-phase operation and include four (4) Avtec link connection plates, 20-Amp, 120 Volt, single-phase, with ground fault interrupted duplex outlet and matching thirty-six (36") inch long, straight blade extension cords, with plug and connector bodies; one (1) Avtec link connection plate, 20-Amp, 208 Volt, single-phase, with ground matching thirty-six (36") inch long, straight blade extension cord with plug and connector body; and additional blank Avtec link plates, where applicable.

B. Food Service Equipment Contractor shall fully coordinate with Electrical Contractor and provide cord drops at locations along MOD to accommodate equipment positioned beneath.

4.29 ITEM NO. 29 – WORK TABLE ONE REQUIRED

A. Size and shape as required and as shown on Contract Drawings. All stainless-steel construction.

4.30 ITEM NO. XRW30 – WORK TABLE EXISTING ONE REQUIRED

A. Existing work table, measuring 10’-0” long x 2’-10” high x 3’-0” high, with 2” wide x 10” high backsplash (with finished rear); rolled edge at front and both ends; 12” wide x full length overshelf (secured via three (3) cantilever brackets); open understructure; six (6) legs and connecting crossrails; and two (2),120 Volt, single-phase convenience outlets mounted within backsplash, shall be relocated as indicated on Contract Drawings and reworked as follows:
   1. Food Service Equipment Contractor shall remove two (2) existing 120 Volt, single-phase convenience outlets mounted within backsplash, and provide and install solid, stainless-steel faceplates at former locations.
   2. Provide and install adjustable feet inserts on all leg assemblies reducing length of legs as required to maintain existing height of table.
   3. Note, Can Opener, Item No. XR31, shall be securely attached to table, at location indicated on Contract Drawings.
   4. Provide and install #18 gauge stainless steel cap between this table and abutting table, Item No. XRW32, full-length of backsplash.

4.31 ITEM NO. XRW31 – CAN OPENER EXISTING ONE REQUIRED

A. Existing can opener, as manufactured by Edlund, shall be relocated from existing work table (not scheduled for reuse) as indicated on Contract Drawings and reworked as follows:
   1. Food Service Equipment Contractor shall install assembly on Work Table, Item No. XRW30, at location indicated on Contract Drawings. Provide and install chrome-plated acorn cap nuts on exposed fasteners beneath table.

4.32 ITEM NO. XR32 – WORK TABLE EXISTING ONE REQUIRED

A. Existing work table, measuring 9’-6” long x 2’-6” wide x 3’-0” high, with 2” wide x 10” high backsplash (unfinished rear); 12” wide x full length overshelf (secured via three (3) cantilever brackets); rolled edge at front and both ends; drawer assembly at left end; and stainless-steel undershelf; shall be relocated as indicated on Contract Drawings, and abut Work Table, Item No. XRW30.

4.33 ITEM NO. 33 – NOT USED

4.34 ITEM NO. 34 – NOT USED

4.35 ITEM NO. 35 – REFRIGERATOR ONE REQUIRED

A. Victory Model RS-2D-S1. 120 Volt, single-phase operation, with grounded cord and plug. Non-C.F.C. Refrigerant, self-contained, air-cooled operation. Full-length doors shall hinge left/right, as shown on Contract Drawings. Provide LED lighting; standard complement of adjustable heavy-duty wire shelves, plus two (2) additional shelves; stainless-steel case back and shroud; and four (4), five (5") inch diameter, heavy-duty swivel casters, two (2) front with locking brakes. Door locks shall be keyed alike with Refrigerator, Item No. 50.

4.36 ITEM NO. 36 – CONVECTION OVEN TWO REQUIRED

A. Southbend Model SLGS/22SC. Natural gas operation with hot surface igniter and flame safety device. 120 Volt, single-phase operation, with grounded cords and plugs for two-speed fan motors and controls. Provide stainless-steel front, both sides and top; four (4), five (5") inch diameter, heavy-duty swivel casters, two (2) front with locking brakes; and one (1) additional rack per deck.

B. Manufacturer shall provide gas-pressure regulator, as required.

C. Food Service Equipment Contractor shall provide and install gas quick-disconnect assembly kit, Dormont Model 1675KIT2S36. Restraining device shall be securely attached to convection oven framing and building floor.

4.37 ITEM NO. XRW37 – RANGE WITH OVEN EXISTING ONE REQUIRED

A. Existing six (6) burner range with oven, as manufactured by U.S. Range, with six (6") high leg set; single deck overshelf; and gas quick-disconnect assembly, shall be relocated as indicated on Contract Drawings, and reworked as follows:
   1. Food Service Equipment Contractor shall provide and install necessary swivel fittings, and required adapters for quick-disconnect, enabling connection to gas service.

4.38 ITEM NO. X38 – VENTILATOR EXISTING ONE REQUIRED

A. Existing ventilator, measuring approximately 17'-6" long x 4'-10" wide, shall remain in its current location with no modifications required.

4.39 ITEM NO. 39 – FIRE SUPPRESSION SYSTEM ONE REQUIRED

A. Provide cooking equipment Ventilator, Item No. X38, with fire suppression system, Ansul Model R-102, with all piping concealed, where possible. System shall be field-tested and certified by local Ansul representative after installation. Fire suppression system shall encompass equipment and installation necessary to comply with current editions, NFPA Bulletin #96, Bulletin #17A, and local authority having jurisdiction. U.L. Listed, wet-chemical type. Automatic controls to flood plenum areas, ducts and surface areas, where required. Exposed piping and conduit shall be kept to a minimum; where exposed, piping and fittings shall be chrome-plated or fitted with tight-fitting, stainless-steel sleeves.

B. Automatic fuel-shutoff device shall be furnished, as required, with all necessary and required micro switches or contactors. Fuel shutoff device shall be mechanically-operated shutoff valve. Note that if all electrical appliances are wired to shunt trip breaker in electrical panel box by Electrical Contractor, then contactors will not be required.

C. Note: Ansul System shall comply with U.L. 300 Standard, Current Edition.

D. File inspection report for one year from date system is put into continuous operation with rating bureau having jurisdiction.

4.40 ITEM NO. 40 – HAND SINK TWO REQUIRED

A. Advance Model 7-PS-64. Provide gooseneck faucet with wrist-action valves, low-flow aerator, stainless-steel tubular wall brackets, and stainless steel basket drain. Securely attach and seal to wall.

4.41 ITEM NO. 41 – CONVECTION STEAMER TWO REQUIRED

A. Cleveland Model 24CGA10.2ES. Natural gas operation. 120 Volt, single-phase operation for Controls, Fan Motors, and Pilotless Ignition Systems. Provide Twin Independent, Atmospheric Gas-Fired Generators; Gas Valve; Water Level Control System; doors hinged left; and six (6") inch high, adjustable stainless-steel legs. Unit shall include cold water condenser to reduce discharge temperature of water to below 140°Fahrenheit. Unit shall accommodate a total of ten (10), 12" x 20" x 2-1/2" deep pans and be provided with easily accessible cleaning port on top of unit, complete with Generator Cleaning Light and Generator Steam Stand-By Mode. Provide a total of one (1) case (six one-gallon containers with quart markings) of Dissolve Descaling Solution.

B. Manufacturer shall provide gas pressure regulator, as required.

C. Food Service Equipment Contractor shall provide and install gas quick disconnect kit, Dormont Model 1675KIT2S36, complete with required adapters.

D. Food Service Equipment Contractor shall provide water treatment system (one system for each convection steamer), Hydro Life Commercial Model 300-Triple (No. 52644), and install on framing of adjacent Work Table, Item No. 42, at locations indicated on Contract Drawings. Each system shall be provided with mounting bracket, pressure gauge, shut-off valve, spanner wrench, four (4) additional Sediment Cartridges, Model 310 (No. 52646); and eight (8) additional Filter Cartridges, Model 350 (No. 52645). Food Service Equipment Contractor shall complete interconnect water filtration system to convection steamer utilizing commercial grade stainless steel braided connectors.

E. Food Service Equipment Contractor shall extend drain lines to floor sink and direct downward into floor sink.

4.42 ITEM NO. 42 – WORK TABLE ONE REQUIRED

A. Size and shape as required and as shown on Contract Drawings. All stainless-steel construction. Provide #14-gauge stainless steel mounting brackets on underside of table to accommodate installation of water treatment systems specified as part of Item No. 41 — coordinate accordingly. Provide flanged feet on two legs of table and secure to building floor, utilizing stainless steel fasteners, to prohibit movement of table.

4.43 ITEM NO. 43 – KETTLE ONE REQUIRED

A. Cleveland Model KGL-40-TSH. Natural gas operation, tilting design with low rim (maximum thirty-six-and-five-eighth (36-5/8") inch high). 120 Volt, single-phase operation, complete with grounded cord and plug for Controls and Electronic Spark Ignition System. Forty (40) gallon capacity. Provide double-pantry faucet assembly with mounting bracket (on right); Spring-Assisted, Stainless-Steel Cover; two (2") inch Tangent Draw-Off Valve; Perforated Disk; Solid Disk; Tilting Kettle Accessory Kit; and Kettle etch marks from five (5) gallons to forty (40) gallons in five (5) gallon increments.

B. Manufacturer shall provide gas-pressure regulator, as required.

C. Food Service Equipment Contractor shall provide and install gas quick disconnect kit, Dormont Model 1675KIT2S36, complete with required adapters.

D. Food Service Equipment Contractor shall align pour path of Kettle with Floor Trough with Grating, Item No. 44, and secure flanged feet to building floor.

4.44 ITEM NO. 44 – FLOOR TROUGH WITH GRATING ONE REQUIRED

A. Size and shape as required and as shown on Contract Drawings. All stainless-steel construction. Grating shall be IKG Industries, close-mesh stainless-steel grating Type CM-2 (Type 304 Stainless Steel), or approved equal. Bearing bars spaced one-half (½") inch centers, interspacing to be five-sixteenth (5/16") inch. Crossbars spaced on four (4") inch centers. Grating to be size indicated on Detail Drawing.

B. Food Service Equipment Contractor shall deliver drain pan to General Contractor for this installation. Food Service Equipment Contractor shall coordinate and cooperate with General Contractor with regard to installation of drain pan. When installed, grating insert shall be flush and level with surrounding kitchen floor. Top and bottom surfaces of grating shall be ground smooth and polished to remove burrs, imperfections, etc.

C. Food Service Equipment Contractor shall coordinate drain to be used by Plumbing Contractor with the fabricated stainless-steel drain pan.

4.45 ITEM NO. 45 – BRAISING PAN ONE REQUIRED

A. Cleveland Model SGL-40-TR. Natural gas operation. 120 Volt, single-phase operation, complete with grounded cord and plug for electronic spark ignition system and controls. Forty (40) gallon capacity, with nine-and-one-half (9-1/2") inch deep pan. Provide manual-tilt

mechanism; spring-assist cover adjustable vent; adjustable leveling feet with rear flanged feet; high limit safety device; anti-splash pouring lip; double-pantry, low-flow faucet with spray hose secured to right end of unit; pouring lip strainer; and gallon etch markings from five (5) gallons to forty (40) gallons in five (5) gallon increments.

B. Manufacturer shall provide gas-pressure regulator, as required.

C. Food Service Equipment Contractor shall provide and install thirty-six (36") inch long, gas quick-disconnect kit, Dormont Model 16100KIT2S36, complete with swivel fittings and required adapters.

D. Food Service Equipment Contractor shall align pour path of unit with Floor Trough with Grating, Item No. 46, and secure flanged feet to building floor.

4.46 ITEM NO. 46 – FLOOR TROUGH WITH GRATING ONE REQUIRED

A. Size and shape as required and as shown on Contract Drawings. All stainless-steel construction. Grating shall be IKG Industries, close-mesh stainless-steel grating Type CM-2 (Type 304 Stainless Steel), or approved equal. Bearing bars spaced one-half (½") inch centers, interspacing to be five-sixteenth (5/16") inch. Crossbars spaced on four (4") inch centers. Grating to be size indicated on Detail Drawing.

B. Food Service Equipment Contractor shall deliver drain pan to General Contractor for this installation. Food Service Equipment Contractor shall coordinate and cooperate with General Contractor with regard to installation of drain pan. When installed, grating insert shall be flush and level with surrounding kitchen floor. Top and bottom surfaces of grating shall be ground smooth and polished to remove burrs, imperfections, etc.

C. Food Service Equipment Contractor shall coordinate drain to be used by Plumbing Contractor with the fabricated stainless-steel drain pan.

4.47 ITEM NO. X47 – VENTILATOR EXISTING ONE REQUIRED

A. Existing ventilator, measuring approximately 19’-0” long x 4’-6” wide, shall remain in its current location with no modifications required.

4.48 ITEM NO. 48 – FIRE SUPPRESSION SYSTEM ONE REQUIRED

A. Provide cooking equipment Ventilator, Item No. X47, with fire suppression system, Ansul Model R-102, with all piping concealed, where possible. System shall be field-tested and certified by local Ansul representative after installation. Fire suppression system shall encompass equipment and installation necessary to comply with current editions, NFPA Bulletin #96, Bulletin #17A, and local authority having jurisdiction. U.L. Listed, wet-chemical type. Automatic controls to flood plenum areas, ducts and surface areas, where required. Exposed piping and conduit shall be kept to a minimum; where exposed, piping and fittings shall be chrome-plated or fitted with tight-fitting, stainless-steel sleeves.

B. Automatic fuel-shutoff device shall be furnished, as required, with all necessary and required micro switches or contactors. Fuel shutoff device shall be mechanically-operated shutoff valve. Note that if all electrical appliances are wired to shunt trip breaker in electrical panel box by Electrical Contractor, then contactors will not be required.

C. Note: Ansul System shall comply with U.L. 300 Standard, Current Edition.

D. File inspection report for one year from date system is put into continuous operation with rating bureau having jurisdiction.

4.49 ITEM NO. XRW49 – ICE MAKER WITH BIN EXISTING ONE REQUIRED

A. Existing Ice Maker with Bin wired for 120 Volt, single-phase operation, with grounded cord and plug, measuring 22” wide x 32” deep, as manufactured by Scotsman, Model C0-322-MA1, installed on Model BH-360S bin, complete with EverPure Water Filter, shall be relocated as

indicated on Contract Drawings and reworked as follows:

1. Food Service Equipment Contractor shall install existing water filter on building wall to left of ice maker at location indicated on Contract Drawings, fully interconnecting filtered water line to ice-making inlet utilizing copper piping.
2. Food Service Equipment Contractor shall extend drain lines to floor sink, and direct downward into floor sink.

4.50 ITEM NO. 50 – REFRIGERATOR ONE REQUIRED

A. Victory Model RIS-2D-S1-PT. 120 Volt, single-phase operation, with grounded cord and plug. Non-C.F.C. Refrigerant; self-contained, air-cooled operation. Full-length doors shall hinge left/right (both sides), as shown on Contract Drawings. Provide full electronic control system (installed on load side of unit); LED lighting; door locks matching that of Refrigerator, Item No. 35; and removable stainless-steel ramps. Note unit shall accommodate rolling in of Racks, Items No. 51, as indicated on Contract Drawings — coordinate accordingly.

B. Food Service Equipment Contractor shall trim and seal to floor utilizing #18-gauge stainless steel angle.

4.51 ITEM NO. 51 – RACK TWO REQUIRED

A. Channel Model AXD-1818/024. All welded aluminum construction, with four (4), five (5") inch diameter, heavy-duty swivel casters and corner bumpers. Units shall be provided with eighteen (18) sets of slides, with three (3") inch ledge spacing, to accommodate 18" x 26" pans.

B. Note racks shall be sized to roll into Refrigerator, Item No. 50 — coordinate accordingly.

4.52 ITEM NO. 52 – HOT FOOD HOLDING CABINET TWO REQUIRED

A. Vulcan Model VPT15. 120 Volt, single-phase operation, with grounded cord and plug. Provide pass-through “Dutch” doors shall hinge left on both sides, as indicated on Contract Drawings; four (4), five (5”) inch diameter, heavy-duty swivel casters, two (2) with locking brakes; full perimeter bumper system; recessed side-mounted handles; top-mounted controls and electronic controller (installed on load side of unit); and minimum two (2”) inches of insulation around full perimeter. Unit shall accommodate fifteen (15) pans, measuring 18” x 26” x 1” deep, or thirty (30) pans, measuring 12” x 20” long x 2-1/2” deep.

4.53 ITEM NO. X53 – STAINLESS-STEEL TRAY SLIDE EXISTING ONE REQUIRED

A. Existing stainless-steel tray slide, measuring approximately 14’-3” long x 1’-4” wide, positioned on top of low height wall, shall remain in its current location with no modifications required.

4.54 ITEM NO. 54 – HOT FOOD SERVING COUNTER ONE REQUIRED

A. Piper Products Model 6-HF-Modified. Unit shall be modified to measure thirty-four (34") inches high. All stainless-steel construction. 120/208 Volt, three-phase operation, with 90 degree grounded cord and plug assembly. Provide #14-gauge stainless-steel top; eight (8”) inch, fold-down, stainless-steel cutting board; stainless-steel bottom shelf; six (6) 1,000-watt hot food wells; common drains and manifold with single drain valve; full-length, cafeteria style protector guard, with combination heat lamp/LED lights; end guards; set of four (4), five (5") inch diameter, swivel-type plate casters, two (2) rear (servers side) with locking brakes; and interlocking mechanism at right end to adjoin to adjacent Utility Counter, Item No. 56.

B. Food Service Equipment Contractor shall extend drain line to floor drain and direct downward into floor drain, securing to underside of counter framing due to mobility.

4.55 ITEM NO. 55 – STAINLESS-STEEL TRAY SLIDE ONE REQUIRED

A. Size and shape as required and as shown on Contract Drawings. All #14-gauge stainless steel construction. Tray slide shall match construction characteristics of existing Tray Slide, Item No. X53, and shall extend full length of wall opening, as shown on Contract Drawings. Securely

attach and seal to wall utilizing hidden stainless steel fasteners.

4.56 ITEM NO. 56 – UTILITY COUNTER **ONE REQUIRED**

A. Piper Products Model 6-ST-Modified. Unit shall be modified to measure thirty-four (34") inches high. All stainless-steel construction. 120 Volt, single-phase operation, complete with grounded cord and plug. Provide #14-gauge stainless-steel top; stainless-steel bottom shelf; two (2) 120 Volt, single-phase receptacles (to enable plugging in of Sandwich Slides, Item Nos. XR57 and No. XR58); interlocking system at each end to attach to adjoining Hot Food Serving Counter, Item No. 54 and Cold Food Serving Counter, Item No. 59; and four (4), five (5") inch diameter, heavy-duty swivel-type plate casters, two (2) rear (servers side) with locking brakes.

4.57 ITEM NO. XR57 – SANDWICH SLIDE **EXISTING ONE REQUIRED**

A. Existing sandwich slide, wired for 120 Volt, single-phase operation with grounded cord and plug, as manufactured by Hatco, Model No. GR2SDS-24D, shall be relocated as indicated on Contract Drawings.

B. Unit shall plug into compatible receptacle mounted within Utility Counter, Item No. 56 — coordinate accordingly.

4.58 ITEM NO. XR58 – SANDWICH SLIDE **EXISTING ONE REQUIRED**

A. Existing sandwich slide, wired for 120 Volt single-phase operations with grounded cord and plug, as manufactured by Hatco, Model No. GR2SDS-24D, shall be relocated as indicated on Contract Drawings.

B. Unit shall plug into compatible receptacle mounted within Utility Counter, Item No. 56 — coordinate accordingly.

4.59 ITEM NO. 59 – COLD FOOD SERVING COUNTER **ONE REQUIRED**

A. Piper Products Model 4-BCM-Modified. Unit shall be modified to measure thirty-four (34") inches high. All stainless-steel construction. 120 Volt, single-phase operation, with grounded cord and plug. Non-C.F.C. Refrigerant, NSF Standard 7 Compliant. Provide #14-gauge stainless-steel top; stainless-steel bottom shelf; insulated and refrigerated cold pan, with stainless-steel perforated false bottom; and one (1") inch drain and shut-off valve; classic double-deck display shelves, with front and side protector guards, and full-length LED lighting; set of four (4), five (5") inch diameter, swivel-type plate casters, two (2) rear (servers side) with locking brakes; and interlocking mechanism at each end to adjoin to adjacent Utility Counters, Items No. 56 and No. 60.

B. Food Service Equipment Contractor shall extend drain line to floor drain and direct downward into floor drain.

4.60 ITEM NO. 60 – UTILITY COUNTER **ONE REQUIRED**

A. Piper Products Model 4-ST-Modified. Unit shall be modified to measure thirty-four (34") inches high. All stainless-steel construction. 120 Volt, single-phase operation, with grounded cord and plug. Provide #14-gauge stainless-steel top; stainless-steel bottom shelf; stainless-steel bottom shelf; one (1) 120 Volt, single-phase duplex receptacle; interlocking system at left end to attach to adjoining Cold Food Serving Counter, Item No. 59; and four (4), five (5") inch diameter, heavy-duty swivel-type plate casters, two (2) rear (servers side) with locking brakes.

4.61 ITEM NO. 61 – REFRIGERATED MERCHANDISER **ONE REQUIRED**

A. Federal Model RSSM-678SC. 208 Volt, single-phase operation, with grounded cord and plug. Non-C.F.C. Refrigerant, self-contained, air-cooled operation. Provide special laminate finish at front and both sides in manufacturer, color, and pattern as selected by the Architect; black interior; black trim; rear air discharge; reflective end glass; electronic temperature control with on-demand defrost; PTC condensate heater; thermometer; condenser air filter; LED lights

below shelves; roll-up air screen; roll-up security cover; sliding rear access doors with locking mechanism; two and one-half (2-1/2”) inch caster assembly; and sound deadening package.

4.62 ITEM NO. 62 – BEVERAGE REFRIGERATOR **ONE REQUIRED**

Not in Food Service Contract — By Vendor

A. Note a 20 amp, 120 Volt, single-phase receptacle has been provided to enable unit to plug into building wall — coordinate accordingly.

4.63 ITEM NO. 63 – ICE CREAM CABINET **ONE REQUIRED**

Not in Food Service Contract By Vendor

A. Note a 20 amp, 120 Volt, single-phase receptacle has been provided to enable unit to plug into building wall — coordinate accordingly.

4.64 ITEM NO. 64 – STAINLESS-STEEL QUEUING RAIL **ONE REQUIRED**

A. Size and shape as required and as shown on Contract Drawings. All stainless-steel construction with brushed finish, extending approximately 34’ in total length, “L-shaped” design. Rails shall be constructed of one-and-five-eighth (1-5/8") inch diameter, #16-gauge stainless-steel with rounded ends. Horizontal supports shall be constructed of matching stainless-steel tubing, fully welded, ground smooth, and polished. Vertical supports shall not exceed forty-eight (48”) inches on center and shall be installed in one-and-eleven-sixteenth (1-11/16") inch inner diameter pipe sleeve anchored in floor with “Porok” fill grout.

4.65 ITEM NO. 65 – CASHIER’S COUNTER **ONE REQUIRED**

A. Piper Products Model 2-CD-Modified. Unit shall be modified to be thirty-four (34") inches high, with tray slide installed at thirty-two (32") inches high. All stainless-steel construction. 120 Volt, single-phase operation, with grounded cord and plug. Provide #14-gauge stainless-steel top; full-length x #16-gauge stainless-steel solid three ribbed style tray slide, with six (6”) extension on right side (Cashier’s point of reference), as indicated on Contract Drawings; plastic laminate at front (side opposite Cashier), and both ends; one (1) 120 Volt, single-phase duplex receptacle; and four (4), five (5") inch diameter, heavy-duty swivel-type plate casters, two (2) rear (at cashiers area) with locking brakes.

B. Particular manufacturer’s standard color as selected by Architect and Owner.

4.66 ITEM NO. 66 – CASHIER’S COUNTER **ONE REQUIRED**

A. Piper Products Model 2-CD-Modified. Unit shall be modified to be thirty-four (34") inches high, with tray slide installed at thirty-two (32") inches high. All stainless-steel construction. 120 Volt, single-phase operation, with grounded cord and plug. Provide #14-gauge stainless-steel top; full-length x #16-gauge stainless-steel solid three ribbed style tray slide, with six (6”) extension on left side (Cashier’s point of reference), as indicated on Contract Drawings; plastic laminate at front (side opposite Cashier), and both ends; one (1) 120 Volt, single-phase duplex receptacle; and four (4), five (5") inch diameter, heavy-duty swivel-type plate casters, two (2) rear (at cashiers area) with locking brakes.

B. Particular manufacturer’s standard color as selected by Architect and Owner.

4.67 ITEM NO. 67 – CASHIERING SYSTEM **TWO REQUIRED**

Not in Food Service Contract By Owner

4.68 ITEM NO. 68 – QUEUING RAIL **FOUR REQUIRED**

A. BSI Crowd Control Model 930/26/26/38-96. Units shall include satin stainless-steel post; black base cover; eighteen (18") inch steel liner; rubberized non-marking base; 7'-6" Replaceable Belt Cassette; four-way connection; and Automatic Belt Lock System. Units shall be positioned as indicated on Contract Drawings, adjustable as desired by Owner.

4.69 ITEM NO. XR69 – SHELVING EXISTING ONE REQUIRED

A. Existing tubular stainless steel, mobile, three-tier shelving unit measuring sixty (60”) inches long x thirteen and one-half (13-1/2”) inches wide x fifty (50”) inches high shall be relocated as indicated on Contract Drawings.

4.70 ITEM NO. XW70 – SOILED DISH TABLE / SCULLERY SINK EXISTING ONE REQUIRED

A. Existing soiled dish table, with pre-rinse sink bowl; deck mounted overhead spray unit; disposer cone; and backsplash at rear and left end; shall be removed from its current location, reworked as follows, and reinstalled within its former location:
   1. Food Service Equipment Contractor shall cut left portion of table, between disposer cone and pre-wash sink; and provide and install new section of table, inclusive of three (3) sink bowls, as indicated on Contract Drawings. Construction characteristics of new section of table shall match those of existing section, utilizing all #14-gauge stainless steel. All welds shall be ground smooth, and polished. Provide two new faucet assemblies with three (3) overflow assemblies and twist handle waste assemblies. Seal to dishwasher with watertight connection.

4.71 ITEM NO. 71 – DISHWASHER WITH BOOSTER HEATER ONE REQUIRED

ADD ALTERNATE FS-2

A. Jackson Model AJX-44. High temperature machine. Left-to-right operation. Motors, controls, and heating elements shall be wired for 208 Volt, three-phase operation. Provide single-point electrical connection for dishwasher and twenty-five (25") inch chamber height opening. Provide Table Limit Switch and install within right backsplash of adjoining Clean Dish Table, Item No. XW72, completely interwired by Food Service Equipment Contractor. Fully automatic, including auto fill; two-hundred-twenty-five (225) rack-per-hour capacity; EnergyGuard™; controls; Electromechanical controls; adjustable conveyor speed; self draining stainless-steel wash pump; stainless-steel scrap baskets; eight (8”) splash shields on both wash and rinse ends; front dress panel; externally operated drain lever; stainless-steel frame and legs; adjustable bullet feet; exhaust vent fan control; and 18 kw wash tank heater. Provide integral 30-kw stainless-steel Booster Heater independently wired for 208 Volt, three-phase operation to provide a minimum 70°Fahrenheit temperature rise. Provide all valves, controls, and water hammer arrestor, as well as the required temperature/pressure gauges; one (1) on incoming line and one (1) on outgoing line. Food Service Equipment Contractor shall extend drain lines to floor sink and direct downward into floor sink.

B. Provide the following racks:
   1. Four (4) Combination Racks, Cambro Model BR258.
   2. Four (4) All-Purpose Racks, Cambro Model PR314.
   3. Two (2) Sheet Pan Racks, Hobart Model SHTPAN-Rack.

C. Provide and install two (2) Jackson vent hoods, one (1) on load end and one (1) on unload end. Vent openings shall measure 4" x 16". Provide #18-gauge stainless-steel vent ducts of sufficient length to extend from top of dishwasher to approximately six (6") inches above finished ceiling where they will be interconnected into the ventilating system by the HVAC Contractor. Ducts shall have both watertight and vaportight connections at joints and at vent exhaust connections.

D. Provide and install thermostatically-controlled Drain Water Tempering Kit to permit cold water to mix with discharge water prior to entering floor sink to reduce water temperature to below 140°Fahrenheit.

E. Provide vent switch, as required, for interconnecting Dishwasher to exhaust fan. Interconnection shall be the responsibility of the Mechanical Contractor.

F. Food Service Equipment Contractor shall provide and install Water Conditioner, EverPure KleenWare Model HTS-11, securely attaching to building wall to left of assembly and interconnecting to incoming water line of Booster Heater by Food Service Equipment Contractor, complete with six (6) additional Replacement Cartridges, Model HT-10.

4.72 ITEM NO. XW72 – CLEAN DISH TABLE EXISTING ONE REQUIRED

A. Existing clean dish table, with backsplash at rear and right end; and stainless-steel undershelf, shall be removed from its current location, be reworked as follows, and reinstalled in its former location:
   1. Food Service Equipment Contractor shall install table limit switch from Dishwasher with Booster Heater, Item No. 71 within right backsplash of table. Seal to dishwasher with watertight connection.

4.73 ITEM NO. 73 – HAND SINK (ADA-COMPLIANT) ONE REQUIRED

A. Advance Model 7-PS-25. Unit shall be provided with deck-mounted, gooseneck faucet, stainless-steel wall-mounting brackets; wrist-action valves, low-volume aerator; and basket drain. Securely attach and seal to building wall at ADA-compliant height.

4.74 ITEM NO. 74 – EYE WASH / FACE WASH STATION ONE REQUIRED

A. T & S Model EW-7360B. Wall-mounted unit shall be provided with chrome-plated brass stay-open ball valve; water inlet; waste outlet; and emergency thermostatic mixing valve. Unit shall be securely attached and sealed to building wall at compliant height within Dishwashing Area at location indicated on Contract Drawings.

4.75 ITEM NO. XW75 – WALL SHELF EXISTING ONE REQUIRED

A. Existing stainless steel wall shelf positioned atop low-height building wall between Kitchen area and Dishwashing area shall remain in its current location, and be reworked as follows:
   1. Food Service Equipment Contractor shall remove shelf, shorten length of unit to accommodate new reduced wall opening size; finish shortened/cut end to match construction characteristics of existing shelf; and securely reattach and seal to wall. All required welds shall be ground smooth and polished.

4.76 ITEM NO. XR76 – SHELVING EXISTING TWO REQUIRED

A. Existing mobile, green coated shelving units, one (1) four4) shelf unit, measuring 60” long x 21” wide x 68” high, and one (1) five (5) shelf unit, measuring 60” long x 24” wide x 73”, shall be relocated as indicated on Contract Drawings.

4.77 ITEM NO. XRW77 – WASHER EXISTING ONE REQUIRED

A. Existing top load washer, wired for 120 Volt, single-phase operation, with grounded cord and plug, as manufactured by Whirlpool, shall be relocated as indicated on Contract Drawings and reworked as follows:
   1. Plumbing Contractor shall provide and install "Guy Gray" water/waste device, Model B-200, in building wall at location indicated on Contract Drawings.

4.78 ITEM NO. XRW78 – DRYER EXISTING ONE REQUIRED

A. Existing front load, electrically operated dryer, wired for 208 Volt, single-phase operation, with grounded cord and plug, as manufactured by Whirlpool, shall be relocated as indicated on Contract Drawings and reworked as follows:
   1. HVAC System Contractor shall provide and extend four (4") inch diameter exhaust ductwork from dryer to exterior of building.

ADDITIONAL ACCEPTABLE MANUFACTURERS

The following listed manufacturers may be considered as acceptable alternates; however, the specified manufacturer's make and model number establishes the minimum required standards. All equipment, capacities, warranties, and specific accessories specified within the named manufacturer's make and model number must be provided with the following listed pre-approved manufacturers. All additional costs incurred in order to provide the above-mentioned equipment and warranties shall be considered a part of this specification.

ITEM NO. 1 – AMERICAN PANEL, BALLY

ITEM NO. 1A & 1B – BOHN/COPELAND, COLDZONE, COOLTEC

ITEM NO. 2 – AMERICAN PANEL, BALLY

ITEM NO. 2A & 2B – BOHN/COPELAND, COLDZONE, COOLTEC

ITEM NO. 3 – MARS

ITEM NO. 4 – NOT IN FOOD SERVICE CONTRACT

ITEM NO. 5 – CAMBRO

ITEM NO. XR6 – EXISTING

ITEM NO. 7 – NOT USED

ITEM NO. 8 – NOT USED

ITEM NO. 9 – FABRICATED

ITEM NO. XW10 – EXISTING

ITEM NO. XR11 – EXISTING

ITEM NO. 12 – FABRICATED

ITEM NO. 13 – FABRICATED

ITEM NO. 14 – NO ALTERNATE

ITEM NO. XR15 – EXISTING

ITEM NO. 16 – FABRICATED

ITEM NO. 17 – FABRICATED

ITEM NO. 18 – HALTON,CADDY

ITEM NO. XR19 – EXISTING

ITEM NO. XR20 – EXISTING

ITEM NO. 21 – FABRICATED

ITEM NO. 22 – NOT USED

ITEM NO. 23 – NOT USED

ITEM NO. XR24 – EXISTING

ITEM NO. 25 – FABRICATED

ITEM NO. XR26 – EXISTING

ITEM NO. XR27 – EXISTING

ITEM NO. 28 – HALTON,CADDY
ITEM NO. 29 – FABRICATED
ITEM NO. XRW30 – EXISTING
ITEM NO. XRW31 – EXISTING
ITEM NO. XR32 – EXISTING
ITEM NO. 33 – NOT USED
ITEM NO. 34 – NOT USED
ITEM NO. 35 – CONTINENTAL, TRAULSEN
ITEM NO. 36 – VULCAN, BLODGETT
ITEM NO. XRW37 – EXISTING
ITEM NO. X38 – EXISTING
ITEM NO. 39 – KIDDE, RANGE GUARD, PYROCHEM
ITEM NO. 40 – EAGLE, JOHN BOOS
ITEM NO. 41 – GROEN
ITEM NO. 42 – FABRICATED
ITEM NO. 43 – NO ALTERNATE
ITEM NO. 44 – IMC/TEDDY, FABRICATED
ITEM NO. 45 – GROEN
ITEM NO. 46 – IMC/TEDDY, FABRICATED
ITEM NO. X47 – EXISTING
ITEM NO. 48 – KIDDE, RANGE GUARD, PYROCHEM
ITEM NO. XRW49 – EXISTING
ITEM NO. 50 – CONTINENTAL, TRAULSEN
ITEM NO. 51 – NEW AGE, CRESCOR
ITEM NO. 52 – WITTCO, CRESCOR
ITEM NO. X53 – EXISTING
ITEM NO. 54 – DELFIELD, LOW-TEMP, FABRICATED
ITEM NO. 55 – FABRICATED
ITEM NO. 56 – DELFIELD, LOW-TEMP, FABRICATED
ITEM NO. XR57 – EXISTING
ITEM NO. XR58 – EXISTING
ITEM NO. 59 – DELFIELD, LOW-TEMP, FABRICATED
ITEM NO. 60 – DELFIELD, LOW-TEMP, FABRICATED
ITEM NO. 61 – STRUCTURAL CONCEPTS, REGAL PINNACLE
ITEM NO. 62 – NOT IN FOOD SERVICE CONTRACT
ITEM NO. 63 – NOT IN FOOD SERVICE CONTRACT
ITEM NO. 64 – FABRICATED

ITEM NO. 65 – DELFIELD, LOW-TEMP, FABRICATED
ITEM NO. 66 – DELFIELD, LOW-TEMP, FABRICATED
ITEM NO. 67 – NOT IN FOOD SERVICE CONTRACT
ITEM NO. 68 – LAVI INDUSTRIES
ITEM NO. XR69 – EXISTING
ITEM NO. XW70 – EXISTING
ITEM NO. 71 – HOBART
ITEM NO. XW72 – EXISTING
ITEM NO. 73 – EAGLE, JOHN BOOS
ITEM NO. 74 – BRADLEY, ENCON
ITEM NO. XW75 – EXISTING
ITEM NO. XR76 – EXISTING
ITEM NO. XRW77 – EXISTING
ITEM NO. XRW78 – EXISTING

END OF SECTION

SECTION 115313
LABORATORY FUME HOODS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Standard laboratory fume hoods.

B. Fume hood base cabinets and stands.

C. Exhaust blowers.

D. Work surfaces.

E. Service fittings and outlets.

F. Airflow indicators and alarms.

G. Piping within fume hoods for service fittings.

H. Wiring within fume hoods for light fixtures and receptacles.

1.02 RELATED REQUIREMENTS

A. Section 061000 - Rough Carpentry: Blocking and nailers for anchoring fume hoods.

B. Section 092216 - Non-Structural Metal Framing: Reinforcements in metal-framed partitions for anchoring fume hoods.

C. Section 096500 - Resilient Flooring: Resilient base applied to base cabinets.

D. Section 123553.19 - Wood Laboratory Casework: Additional requirements for base cabinets for fume hoods.

1.03 REFERENCE STANDARDS

A. ANSI Z9.5 - Laboratory Ventilation.

B. ASHRAE Std 110 - Methods of Testing Performance of Laboratory Fume Hoods.

C. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.

D. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

E. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable.

F. ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass.

G. ASTM D256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics.

H. ASTM D638 - Standard Test Method for Tensile Properties of Plastics.

I. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

J. NFPA 45 - Standard on Fire Protection for Laboratories Using Chemicals.

K. SEFA 1 - Laboratory Fume Hoods.

L. SEFA 2 - Installations.

M. UL 1805 - Standard for Safety Laboratory Fume Hoods and Cabinets.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate installation of fume hoods with laboratory casework and other laboratory equipment.

B. Preinstallation Meeting: Conduct preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

C. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide fume hood exterior and interior dimensions and construction, utility and service requirements and locations.

C. Shop Drawings: Indicate locations, large scale plans, elevations, cross sections, rough-in and anchor placement dimensions and tolerances, clearances required, locations and types of service fittings.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements. Provide documentation of successful Factory Acceptance Testing.

E. Operation Data: Include description of equipment operation and required adjusting and testing.

F. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

G. Project Record Documents: Record actual locations of concealed utility connections.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with minimum three years of documented experience.

C. Preconstruction Testing: Factory-test each type of hood as per referenced standard.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect finished surfaces during handling and installation with protective covering of polyethylene film or another suitable material.

1.08 FIELD CONDITIONS

A. Ambient Conditions: Maintain temperature and relative humidity at occupancy levels during and after installation of fume hoods.

1.09 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

C. Provide one year manufacturer warranty for manufacturer's standard items (listed by part number in manufacturer's official publication).

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Laboratory Fume Hoods:
   1. Labscape, LLC (Basis of Design)

a. HP Series Fume Hood - Single Sided (model # LS-HP-60)
2. Kewaunee Scientific Corp.
3. Mott Manufacturing Ltd.
4. Substitutions: Or equal.

B. Provide laboratory fume hoods from single manufacturer.

C. Provide laboratory fume hoods from same manufacturer as laboratory casework.

2.02 VARIABLE AIR VOLUME (VAV) FUME HOODS

A. Restricted-Bypass Fume Hoods:
1. Provide a compensating bypass arrangement above the sash to open after sash is closed to less than 20 percent open. Bypass to maintain exhaust capacity of at least 25 CFM per square foot of work surface regardless of sash position.
2. Provide an electronic control unit designed to use input from a sensor that monitors face velocity or sash position to modulate a dedicated exhaust damper in order to maintain a near-constant fume hood face velocity.
a. Provide control unit with a manual-override switch that allows the operator to fully open the exhaust damper.
b. Provide control unit with outputs for interfacing with building's HVAC control system.

2.03 PERFORMANCE REQUIREMENTS

A. Fume hoods complying with the following when tested in accordance with ASHRAE Std 110:
1. As-Manufactured (AM) Rating: AM 0.01 (0.01 ppm).
2. As-Installed (AI) Rating: AI 0.10 (0.10 ppm).
3. Average Face Velocity: 100 FPM (0.51 m/s) plus or minus 10 percent with sashes fully open.
4. Face-Velocity Variation: Not more than 10 percent of average face velocity across the face opening with sash(es) fully open.
5. Release Rate: 4.0 L/min.
6. Static-Pressure Loss: Not more than 1/2-inch w.g. (124 Pa) at 100 FPM (0.51 m/s) face velocity with sash fully open when measured at four locations 90 degrees apart around the exhaust duct and at least three duct diameters downstream from duct collar.

2.04 FUME HOODS

A. General Requirements:
1. Comply with SEFA 1.

B. Type 1 , Fume Hood:
1. Ventilation: Variable Air Volume (VAV).
2. Configuration: Standing-height; bench mounted.
3. Nominal Interior Height: 48 inches.
4. Sash Type: Vertical rising.
a. Leak-free enclosure box, manufacturer's standard construction, for vertical rising sash.
b. Glazing: Laminated safety glass.
c. Sash Guides: Corrosion-resistant polyvinyl chloride (PVC) track.
d. Vertical Sash mechanism: Designed to prevent sash drop in case of mechanism failure.
1) Cable: Minimum 3/32 inch (2 mm) thick stainless steel of construction standard with the manufacturer.
e. Vertical Sash Pull: Type 316 stainless steel, with No.4 finish.

5. Top Front Panel: Standard integral grille stamped into panel of same materials as fume hood exterior.
6. Exterior: Sheet steel.
7. Interior Lining: Polypropylene.
8. Service Fittings and Fixtures:
    a. Cup Sink : Drop-in Epoxy, complete with removable stainer and waste fitting, side-mounted at floor-mounted fume hood.
        1) Shape: Round.
        2) Size: 5 inch (127mm) diameter.
    b. Natural Gas Fitting Assembly: Model FXTDMG2.
    c. Water Outlet Fitting Assembly: Model FXTDMW.
    d. Escutcheons: Stainless steel.
9. Access Panels: Provide removable panels on both sides hood exterior and interior lining panels.
10. Work Surface:
    a. Work Top for Fume Hoods Other Than Floor-mounted Type: Epoxy resin.
        1) Edge: Raised rim with rounded edges and corners.

C. Fume Hood Base Cabinets:
1. See Section 123553.19 - Wood Laboratory Casework.
2. Exterior construction: Wood Cabinets.
    a. Standard storage cabinets.
3. Material: Sheet steel.
4. Color/Finish: As indicated on drawings.

D. Fume Hood Base Stands:
1. Leg Shoes: Manufacturer's standard.
2. Structural Performance: Capable of withstanding 50 pounds per foot work top, 75 pounds per foot on work top, plus weight of hood, without permanent deformation or excessive deflection.
3. Structural Performance of Fume Hood Base Stands for Radioisotope Hoods: Capable of withstanding 50 pounds per foot work top, 200 pounds per foot on work top, plus weight of hood, without permanent deformation or excessive deflection.
4. Knee Space: Clear floor space not less than 36 inches wide by 25 inches front-to-back by 27 inches high, unless otherwise indicated.

E. Light Fixtures: UL labeled, vaporproof, one-tube, T-5 fluorescent light fixtures. Number and length of fixtures as necessary for fume hood width. Mounted above sealed safety glass panel. White baked-enamel finish on fixture interior.

205 FABRICATION

A. General: Assemble fume hoods in factory to greatest extent possible. Disassemble fume hoods only as necessary for shipping and handling limitations, or as necessary to permit movement through a 35 inches by 79 inches clear door opening.

B. Ends: Fabricated with double-wall end panels. Close area between double walls at front of fume hood and as needed to house sash counterbalance weights, utility lines, and remote-control valves.

C. Lining Assembly: Unless otherwise indicated, assembled with stainless-steel fasteners or epoxy adhesive, concealed where possible. Joints sealed by filling with chemical-resistant sealant during assembly.
1. Punched fume hood lining side panels for service fittings and remote controls. Removable plug buttons for holes not used for indicated fittings.

D. Stainless-Steel Lining Assembly: Fully-welded unit consisting of end, back, and top panels, and work top with spill-containing raised edges; reinforced to form a rigid assembly.
   1. For perchloric acid and radioisotope fume hood linings: Coved corners and completely welded seams; surfaces ground smooth, and polished as needed to produce uniform, directionally textured finish with no evidence of welds and free of cross scratches. Passivated and rinsed surfaces; embedded foreign matter removed, leaving surfaces clean.

E. Rear Baffle: Same material as fume hood lining, unless otherwise indicated, at rear of hood with openings at top and bottom, with corrosion-resistant fasteners. Fabricated for removal to facilitate cleaning behind baffle.
   1. Epoxy-coated, stainless-steel screen at bottom baffle opening to prevent light items from being drawn into the rear exhaust plenum.

F. Exhaust Plenum: Full width of fume hood, sized and configured to provide uniform airflow, of same material as hood lining, and with duct stub for exhaust connection.
   1. Duct-Stub Material: Epoxy-coated steel, unless otherwise indicated.

G. Airfoil: At bottom of fume hood face opening, with 1 inch gap between bottom of airfoil and work top. Sash to close on top of airfoil. Designed to direct airflow across work.
   1. Fabricated from 14 gage, 0.0781 inch stainless steel with No.4 finish.

H. Finished Back Panels: Where rear surfaces of fume hoods are exposed to view, provide finished back panels matching rest of fume hood enclosure.

I. Perchloric Acid Fume Hood Washdown System: System consisting of stainless-steel spray nozzles, washdown valve, and associated piping. Design system to thoroughly rinse all surfaces of fume hood interior, including areas behind and above baffles, and to direct rinse water toward drain trough at rear of work top. Provide T-fitting for extending system to additional spray nozzles in exhaust ducts.

J. Demonstration (teaching) Fume Hoods: Single chamber fume hood, with independently-operable sashes on opposite faces of fume hood. Construction similar to standard models.

K. Comply with requirements of other sections for factory installation of water and laboratory gas service fittings, piping, electrical devices, and wiring. Securely anchor fittings, piping, and conduit to fume hoods, unless otherwise indicated.

206 MATERIALS

A. Steel Sheet: Cold-rolled, commercial steel (CS) sheet, complying with ASTM A1008/A1008M; matte finish; suitable for exposed applications.

B. Stainless-Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304, stretcher-leveled standard of flatness.
   1. For perchloric acid fume hoods, use Type 316L instead of Type 304.

C. Epoxy: Factory molded, modified epoxy-resin formulation with smooth, nonspecular finish.
   1. Physical Properties:
      a. Flexural Strength: Not less than 10,000 pounds per square inch.
      b. Modulus of Elasticity: Not less than 2,000,000 pounds per square inch.
      c. Hardness (Rockwell M): Not less than 100.
      d. Water Absorption (24 Hours): Not more than 0.02 percent.
      e. Heat Distortion Point: Not less than 260 degrees F.
      f. Flame-Spread Index: 25 or less according to ASTM E84.
   2. Chemical Resistance: As follows when tested with indicated reagents according to NEMA LD 3, Test Procedure 3.4.5:

a. No Effect:
3. Color: Black.

D. Laminated Safety Glass: ASTM C1172.

E. Polycarbonate Glazing: Clear, uncoated polycarbonate sheet manufactured by extrusion process and complying with the following requirements:
1. Impact Resistance: 12 to 16 foot-pounds of force per inch in accordance with ASTM D256, Method A.
2. Elongation and Modulus of Elasticity: 110 percent maximum and 340,000 pounds per square inch, respectively, in accordance with ASTM D638.
3. Heat Deflection: 270 degrees F at 264 pounds per square inch, in accordance with ASTM D638.
4. Flame-Spread Index: 25 or less, in accordance with ASTM E84.

F. 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.

G. Fasteners: Stainless-steel, where exposed to fumes.

207 ACCESSORIES

A. Airflow Monitors/Indicators and Alarms: Provide each fume hood with a airflow monitor/indicator complete with an audible and visual alarm that activates when airflow sensor reading is outside of preset range.
1. Source: Fume hood manufacturer.
2. Airflow Monitor/Indicator Functionality:
a. Type: A sensor module that monitors fume hood face velocity, and a display module that presents data as digital readout.
1) Input power: 9 to 30 V AC/DC. Include power supply module or functionality.
2) Display Range: 0 to 1,000 FPM.
3) Alarm Condition Range: 50 to 250 FPM.
4) Mounting: Flush.
5) Readings: Remote sensor inserted in airflow stream.
6) Accuracy: Maximum plus or minus 5 percent of set point.
7) Visual Status Display: Green, yellow, and red LEDs.
8) Airflow Display: Digital display of face velocity reading.
9) Operating temperature: 55 to 86 degrees F .
3. Airflow Alarm functionality: Audible (85 dB @ 4 inch distance), and visual alarm that activates when airflow sensor reading is outside of preset range.
a. Reset and test mode.
b. Programmable Switch: Designed to silence audible alarm and automatically reset when airflow returns to within preset range. Warning light to stay on when alarm is silenced.
c. Capability for integration with BAS (Building Automation System) via BACnet.

B. Fume Hood Controller: Airflow Indicator/monitor with built-in electronics to control a dedicated exhaust fan and/or exhaust valve.

C. Sash Alarms: Audible and visual alarm that activates when sash is opened beyond preset position.
1. Programmable silence and test switches.

D. Sash Stops: Spring-loaded stops to limit hood opening to 18 inches height. Manually releasable to open sash fully, and to reset automatically when sash is lowered below set level.

E. Sash Locks

2.08 EXHAUST BLOWERS

A. Dedicated exhaust blower at each fume hood indicated to be individually exhausted, of airflow capacity recommended by fume hood manufacturer.
   1. Type: Direct drive.
   2. Materials: Epoxy-coated steel.
   3. Controls: On/Off using Fan switch located on fume hood post.
   4. Model selection coordinated with building electrical services.
   5. Model selection coordinated with expected static pressure losses in exhaust ductwork.

2.09 SOURCE QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Factory testing of each type of fume hood.

C. Non-Complying Work: See Section 014000.

PART 3 EXECUTION

3.01 EXAMINATION

A. Locate concealed framing, blocking, and reinforcements that support fume hoods by field measurements before being enclosed, and indicate measurements on Shop Drawings.

B. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of fume hoods.

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

3.02 INSTALLATION

A. General: Install fume hoods according to manufacturer's written instructions. Install level, plumb, and true; shim as required, using concealed shims, and securely anchor to building and adjacent laboratory casework. Securely attach access panels but provide for easy removal and secure reattachment. Where fume hoods abut other finished work, apply filler strips and scribe for accurate fit, with fasteners concealed where practical.

B. Large Components: Ensure that large components can be moved into final position without damage to other construction.

C. Comply with indicated requirements for installing water and laboratory gas service fittings, and electrical and telecommunications devices.
   1. Install fittings in accordance with shop drawings, installation requirements in SEFA 2, and manufacturer's written instructions. Set bases and flanges of sink and work top-mounted fittings in sealant recommended by manufacturer of sink or work-top material. Securely anchor fittings to fume hoods.

D. Exhaust Blowers:
   1. Turn over to appropriate trade contractor(s) for installation.

3.03 FIELD QUALITY CONTROL

A. Field test fume hoods as specified below.
   1. General: Test fume hoods as installed to assess airflow velocity. Perform tests with static mode (set sash position) conditions. Conduct testing as outlined below for ALL hoods provided on the Project.
   2. Preparation:
      a. Inspect each fume hood to confirm its installation complies with drawings and specifications.

b. Inspect laboratory space to verify that construction complies with drawings and specified requirements.
c. Do not proceed with fume hood testing until an acceptable TAB report has been received.

3. Operating Conditions Tests:
   a. Conduct face velocity tests to confirm that target velocities are being achieved within acceptable tolerances.
   b. Conduct airflow indicator/monitor tests to confirm acceptable variation from corresponding measured value. Calibrate and adjust device to function within specified accuracy parameters.
   c. In projects with VAV lab ventilation systems, conduct response time and stability tests to confirm how the HVAC supply and exhaust systems respond to different sash opening positions.
4. Containment Performance Tests:
   a. Conduct airflow visualization tests (local smoke challenges) to provide a visual indication of fume hood's capture performance.

B. Field test installed fume hoods in accordance with requirements of Section 230593.

C. Reporting Requirements: Comply with Section 5 of NEBB Fume Hood Testing (FHT) Standard, current edition. Organize and include, at a minimum, the following information:
1. Report title.
2. Report certification.
3. Table of contents.
4. Report summary/ remarks.
5. Appropriate forms.
6. Instrument calibration.
7. List of abbreviations used.
8. A room layout drawing for each tested item. Identify: walls; doors; fume hood(s); other present environmental enclosures (e.g. biological safety cabinet(s), laminar flow hood(s), canopy hood(s), etc.); location and airflow pattern of all air supply, return, and exhaust grilles, registers and diffusers.

3.04 ADJUSTING

A. Adjust moving parts for smooth, near silent, accurate sash operation with one hand only. Adjust sashes for uniform contact of rubber bumpers. Verify that counterbalances operate without interference.

3.05 CLEANING

A. Clean finished surfaces, including both sides of glass; touch up as required; and remove or refinish damaged or soiled areas to match original factory finish, as approved by Architect.

3.06 DEMONSTRATION

A. Demonstrate proper operation of fume hoods and their accessories to Owner's designated representative.

END OF SECTION

SECTION 123553.19
WOOD LABORATORY CASEWORK

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Standard and custom wood cabinets and cabinet hardware.

B. Tables.

C. Wall shelving.

D. Service enclosures.

E. Acid storage cabinets.

F. Solvent storage cabinets.

G. Countertops.

H. Laboratory sinks.

I. Pegboards.

J. Laboratory emergency equipment plumbing fixtures.

K. Service fittings and outlets.

1.02 RELATED REQUIREMENTS

A. Section 016000 - Product Requirements: Requirements for sustainably harvested wood.

B. Section 016116 - Volatile Organic Compound (VOC) Content Restrictions: VOC limitations for adhesives and sealants.

C. Section 061000 - Rough Carpentry: Blocking and nailers for anchoring casework.

D. Section 079200 - Joint Sealants: Sealing joints between casework and countertops and adjacent walls, floors, and ceilings.

E. Section 092116 - Gypsum Board Assemblies: Reinforcements in metal-framed partitions for anchoring casework.

F. Section 092216 - Non-Structural Metal Framing: Reinforcements in metal-framed partitions for anchoring casework.

G. Section 096500 - Resilient Flooring: Resilient wall base.

H. Section 123600 - Countertops: Additional requirements for countertops.

I. Section 224000 - Plumbing Fixtures for non-laboratory sinks.

J. Section 224300 - Healthcare Plumbing Fixtures: Additional emergency equipment.

K. Section 260533.23 - Surface Raceways for Electrical Systems: Surface raceway systems.

1.03 DEFINITIONS

A. Exposed: Portions of casework visible when drawers and cabinet doors are closed, including end panels, bottoms of cases more than 42 inches above finished floor, tops of cases less than 72 inches above finished floor and all members visible in open cases or behind glass doors.

B. Semi-Exposed: Portions of casework and surfaces behind solid doors, tops of cases more than 72 inches above finished floor and bottoms of cabinets more than 30 inches but less than 42 inches above finished floor.

C. Concealed: Sleepers, web frames, dust panels and other surfaces not generally visible after installation and cabinets less than 30 inches above finished floor.

1.04 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design.

B. ANSI A135.4 - Basic Hardboard.

C. ANSI Z358.1 - American National Standard for Emergency Eyewash and Shower Equipment.

D. ASTM C920 - Standard Specification for Elastomeric Joint Sealants.

E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

F. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.

G. AWI (QCP) - Quality Certification Program.

H. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards.

I. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.1.

J. BHMA A156.9 - American National Standard for Cabinet Hardware.

K. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood.

L. ICC (IFC) - International Fire Code.

M. NEMA LD 3 - High-Pressure Decorative Laminates.

N. NFPA 1 - Fire Code.

O. NFPA 30 - Flammable and Combustible Liquids Code.

P. NFPA 70 - National Electrical Code.

Q. SEFA 1 - Laboratory Fume Hoods.

R. SEFA 2 - Installations.

S. SEFA 3 - Laboratory Work Surfaces.

T. SEFA 7 - Laboratory Fixtures.

U. SEFA 8W - Laboratory Grade Wood Casework.

V. SEFA 11 - Liquid Chemical Storage Cabinets.

W. WI (CCP) - Certified Compliance Program (CCP).

1.05 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate installation of casework with related items.
   1. Service Fixtures: Coordinate location and characteristics of service connections.
   2. Equipment and Instruments: Coordinate installation of casework with equipment and scientific instruments.

B. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

C. Keying Conference: Conduct conference prior to ordering keys. Incorporate conference decisions into keying submittal.

1.06 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Component dimensions, configurations, construction details, joint details, attachments; manufacturer's catalog literature on hardware, accessories, and service fittings, if any.

C. Shop Drawings: Indicate casework types, sizes, and locations, using large scale plans, elevations, and cross sections. Include rough-in and anchors and reinforcements placement dimensions and tolerances, clearances required, and utility locations, if any. Include coordinated information for laboratory equipment specified in another section and/or furnished by Owner.

D. Samples For Color Selection: Wood samples, fully finished, for color and species selection. Minimum Sample Size: 2 inches by 3 inches.

E. Certificate: Submit labels and certificates required by quality assurance and quality control programs.

F. Test Reports: From independent laboratory indicating compliance with referenced chemical-resistance standards for cabinet finish and liner materials.

G. Manufacturer's installation instructions.

H. Manufacturer's Qualification Statement.

I. Installer's Qualification Statement.

J. Maintenance Data: Manufacturer's recommendations for care and cleaning.

K. Finish touch-up kit for each type and color of materials provided.

1.07 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than three years of documented experience and approved by manufacturer.

C. Quality Certification:
   1. Comply with AWI (QCP) woodwork association quality certification service/program in accordance with requirements for work specified in this section: www.awiqcp.org/#sle.
   2. Comply with WI (CCP) woodwork association quality certification service/program in accordance with requirements for work specified in this section: www.woodworkinstitute.com/#sle.
   3. Provide labels or certificates indicating that the installed work complies with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade or grades specified.
   4. Provide designated labels on shop drawings as required by certification program.
   5. Provide designated labels on installed products as required by certification program.
   6. Submit certifications upon completion of installation that verifies this work is in compliance with specified requirements.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Protect items provided by this section, including finished surfaces and hardware items during handling and installation. For metal surfaces, use polyethylene film or other protective material standard with the manufacturer.

B. Acceptance at Site:
   1. Do not deliver or install casework until the conditions specified under Part 3, Examination Article of this section have been met. Products delivered to sites that are not enclosed and/or improperly conditioned will not be accepted if warping or damage due to unsatisfactory conditions occurs.

C. Storage:

1. Store casework in the area of installation. If necessary, prior to installation, temporarily store in another area, meeting the environmental requirements specified under Part 3, "Site Verification of Conditions" paragraph of this section.

1.09 MOCK-UP

A. Provide full size base cabinet complete with drawers, door, adjustable shelf and countertop.

B. See Section 014000 - Quality Requirements for additional requirements.

C. Locate where directed.

D. Mock-up may remain as part of the Work.

1.10 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective work within a five year period after Date of Substantial Completion, at no additional cost to Owner. Defects include, but are not limited to:
   1. Ruptured, cracked, or stained finish coating.
   2. Discoloration, or lack of finish integrity.
   3. Cracking or peeling of finish.
   4. Failure of hardware.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Wood Laboratory Casework:
   1. Basis of Design; Identified products as provided by Labscape, LLC
   2. Kewaunee Scientific Corp.
   3. Mott Manufacturing
   4. Substitutions: Or equal.

B. Countertops: Epoxy Resin

C. Sinks and Cup Sinks: Epocy Resin

D. Water and Gas Service Fittings:

E. Obtain casework from single source and manufacturer, unless otherwise indicated.

2.02 WOOD LABORATORY CASEWORK

A. Wood Laboratory Casework: Solid wood and wood panel construction; each unit self-contained and not dependent on adjacent units or building structure for rigidity; in sizes necessary to avoid field cutting except for scribes and filler panels. Include adjustable levelers for base cabinets.
   1. Style: Flush overlay. Ease doors and drawer fronts slightly at edges.
   2. Cabinet Nominal Dimensions: Unless otherwise indicated, provide cabinets of widths and heights indicated on drawings, and with following front-to-back dimensions:
      a. Base Cabinets: 23 1/4 inches.
      b. Tall Cabinets: 24 inches.
      c. Upper Cabinets: 12 inches.
   3. Construction: Joints doweled, glued and screwed, except drawers may be lock-shoulder jointed; with interior of units smooth and flush; cabinet bottom flush with top of face frame; without gaps or inaccessible spaces or areas where dirt or moisture could accumulate.
   4. Structural Performance: In addition to the requirements of SEFA 3, SEFA 7, and SEFA 8W, components safely support the following minimum loads:

5. Factory-finish all exposed and semi-exposed surfaces with the same finish.
    a. Finish Performance: Provide finish on all surfaces having chemical resistance of Level 0 (no change) or Level 1 (slight change of gloss or slight discoloration) according to SEFA 8W and no visible effect when surface is exposed to:
        1) Hot water at temperature between 190 degrees F and 205 degrees F trickled down the test surface at 45 degree angle for 5 minutes.
        2) Constant moisture in the form of 2 by 3 by 1 inch thick cellulose sponge kept continually saturated with water and in contact with test surface for 100 hours.
    b. Preparation: Wood sanded smooth, free from dust and mill marks.
    c. Coating: Clear, superior-quality, chemical-resistant acyclic urethane; applied in accordance with manufacturer instructions, force-dried, sanded and wiped clean.
    d. Coats: Multiple coats as required to achieve minimum 1.5 mil dry film thickness.
    e. Appearance: Clear satin gloss; not cloudy or muddy.

B. Acid Storage Cabinets: Construction identical to other cabinets, with following exceptions:
    1. Completely lined with corrosion-resistant liner material; stainless steel fasteners for all connections and hardware inside cabinets.
    2. Shelves: Removable, same material as cabinet, covered with corrosion-resistant liner.
    3. Bottom Pan: Liquid-tight liner covering entire bottom of acid-storage cabinet.
    4. Vents: Comply with SEFA 1.
        a. Locate acid-storage cabinet vents in accordance with manufacturer's instructions.
        b. Vent each acid-storage cabinet separately.
        c. Seal penetrations with chemical-resistant sealant.

C. Solvent (Flammable and Combustible Liquids) Storage Cabinets: Construction identical to other cabinets, with following exceptions:
    1. Construct to NFPA 30 and applicable OSHA requirements.
    2. Fire Resistance: Maximum internal temperature of 325 degrees F at the center, and 1 inch from top of the cabinet when cabinet is subjected to a ten minute fire test that simulates fire exposure of a standard time-temperature curve specified in ASTM E119.
    3. Shelves: Full depth, adjustable.
    4. Bottom Pan: 2 inches deep, liquid-tight pan covering entire bottom of cabinet.
    5. Cabinet Hardware: UL-listed.
        a. Hinges: Full-length stainless steel continuous (piano) hinges.
        b. Manual-closing Doors: 180 degree opening. Three-point latch arrangement, self-latching when pushed closed.
        c. Door Handles: Manufacturer's standard, with slip-resistant grip.
            1) Provide manufacturer's standard cylinder lock and key set.
    6. Vents: Provide venting capable of achieving ten air changes per hour.
        a. Tie into building lab exhaust system.
        b. Vent Connections: 1-1/2 inch minimum diameter, corrosion-resistant piping having flame spread index of 25 or less when tested in accordance with ASTM E84.
        c. Vent each cabinet separately with sufficient mixing distance for incompatible chemicals.
        d. Provide minimum of two vents with fire arrestor for each cabinet.
    7. Signage: Provide manufacturer's standard signage reading "FLAMMABLE - KEEP FIRE AWAY" or similar message in bright red color.

D. Tables: With standard aprons manufactured of not less than 3/4 by 3 1/2 inch solid lumber, machined to receive corner blocks, and bolted to 2 1/8 by 2 1/8 inch solid hardwood legs. 3/8 inch leveling devices, and slip-on type black PVC shoes.

E. Wall Shelving: At locations indicated.
   1. Adjustable Shelf Supports: Standard back-mounted system using single-slotted surface mounted stainless steel shelf standards, in lengths indicated, with coordinated cantilevered shelf brackets, no.4 finish, designed for nominal 1 inch spacing adjustments.

F. Apron Frames: Construction similar to other cabinets, fabricated from solid wood panels.

G. Countertop Panel-Type Supports: Materials similar to adjacent casework, 1-1/2 inch in width, with front-to-back and toe space dimensions matching base cabinet. Designed to be secured in a concealed fashion to countertop material. Include two leveling devices per support panel.

H. Vertical Service Drop Enclosures: Where indicated on drawings, for service drops to wood casework.
   1. Frames: Unless otherwise standard with the manufacturer, channel strut frames, with members at all corners, bottom, mid-height, and top of enclosure. Designed for anchorages at the bottom to countertop, and at top to miscellaneous metal support framing.
   2. Enclosures: Consisting of fixed and removable (access) panels, in configuration standard with the manufacturer.
      a. Extent: Up to underside of ceiling.
      b. Rear Panel: Fixed panel, constructed like other casework closure panels,
      c. Side Panels: Fixed panels,
      d. Front Panels:
         1) Fixed Panel: Decorative panel specified below.
         2) Removable (Access) Panel: Wood panel, constructed like other casework closure panels.
         3) Decorative Panel: Wood-veneer panel.
      e. Attachment: Use corrosion-resistant metal mounting hardware and fasteners.

203 CABINET HARDWARE

A. Manufacturer's standard types, styles, and finishes.

B. Conform to BHMA A156.9 requirements.

C. Finish of exposed stainless steel components: No.4 finish.

D. Locks: Provide locks on casework drawers and doors where indicated. Lock with 5 pin cylinder and 3 keys per lock.
   1. Hinged Doors: Cam type lock, bright chromium plated over nickel on base material.
   2. Tall Hinged Doors: Three-point latching system.
   3. Keying: Key locks alike within a space; key each room separately.
   4. Master Key System: All locks operable by master key.

E. Label Holders: Manufacturer's standard, sized to hold standard label cards for drawer fronts and cabinet doors indicated, stainless steel with No.4 finish.
   1. Attachments: Screws, with finish matching label holders.

F. Shelves in Cabinets:
   1. Shelf Standards and Rests: Vertical standards with rubber button fitted rests, satin chromium plated over nickel on base material.

G. Swinging Doors:
   1. Hinges: Offset pin, number as required by referenced standards for width, height, and weight of door.
      a. European-Style Hinges: For overlay doors, concealed. Steel, nickel-plated, 110 degree opening angle.

2. Catches: Magnetic.
3. Pulls: Chrome wire pulls, 4 inches wide.
4. Sliding Doors:
    a. Pulls: Steel, recessed circular design.
        1) Steel Finish: Bright chromium plated over nickel on base material.
    b. Track Assembly: Nylon track with solid bearing followers.
5. Drawers:
    a. Pulls: Chrome wire pulls, 4 inches wide.
    b. Slides: Steel, full extension arms, ball bearings; self-closing; capacity as recommended by manufacturer for drawer height and width.

204 COUNTERTOPS

A. Countertops:
    1. Epoxy Resin Countertops: Filled epoxy resin molded into homogenous, non-porous sheets; no surface coating and color and pattern consistent throughout thickness; with integral or adhesively seamed components.
        a. Flat Surface Thickness: 1 inch, nominal.
        b. Surface Finish: Smooth, non-glare.
        c. Color: Black.
        d. Exposed Edge Shape: 1/8 inch bevel chamfer.
        e. Drip Edge: Drip groove 1/8 inch wide and deep, located 1/2 inch back from edge on underside of each exposed edge.
        f. Back and End Splashes: Same material, same thickness; separate for field attachment.
        g. Fabricate in accordance with manufacturer's standard requirements.

205 SINKS

A. Laboratory sinks.
    1. General: Manufacturer's adjustable support system for undermount sink installation.
    2. Sink types and sizes are indicated on drawings.
    3. Sink Type: Rectangular : Single-bowl.
        a. Material: Epoxy
        b. Mounting: Undermount.
        c. Outlet: 1-1/2 inch NPS outlet with tailpiece.

206 PEGBOARDS

A. Epoxy pegboards with pre-drilled or punched holes in a staggered pattern, designed to accept removable white polypropylene pegs. With each pegboard include a stainless steel drip-trough with drain outlet and matching diameter 36 inches long PVC drain hose.
    1. Size: As indicated on drawings.

207 LABORATORY EMERGENCY EQUIPMENT PLUMBING FIXTURES

A. See Section 224300 for emergency equipment plumbing fixtures not intended for installation in laboratory casework or for recessing into partitions.

208 SERVICE FITTINGS

A. General: Comply with requirements of SEFA 7.

B. Water Service Fittings and Fixtures:
    1. Water Fitting Type: Gas / Cold Water Combo - Student Stations:
        Basis of Design: Sheldon Labs - Unicast #80020
    2. Escutcheons: Polished chrome.

C. Electrical Fittings and Fixtures:
   1. Electrical Fittings, General: Types indicated, for mounting on laboratory casework, including, as appropriate, grounding screws, and mounting accessories and fasteners.

2.09 MATERIALS

A. Wood-Based Materials:
   1. Solid Wood: Air-dried to 4.5 percent moisture content, then tempered to 6 percent moisture content before use.
   2. Composite Wood Panels: Containing no urea-formaldehyde resin binders.

B. Exposed Solid Wood: Clear, dry, sound, plain sawn, selected for compatible grain and color, no defects.

C. Exposed Hardwood Plywood: Veneer core; HPVA HP-1 Grade AA, Type I; same species as exposed solid wood, clear, compatible grain and color, no defects. Band exposed edges with solid wood of same species as veneer.

D. Semi-Exposed Solid Wood: Dry, sound, plain sawn, no appearance defects, any species similar in color and grain to exposed portions.

E. Concealed Solid Wood or Plywood: Any species and without defects affecting strength or utility.

F. Hardboard: ANSI A135.4, Class 1, tempered.

G. Solid Epoxy Resin: Modified epoxy resin and non-asbestos inert fillers cast into sheets.

H. Solvent-Resistant Liner Material: High-density, asbestos-free, non-combustible, calcium-silicate-based panel consisting of autoclaved Portland cement, mineral fillers and synthetic fibers.

I. Solvent-Resistant Liner Material: Polypropylene.

J. Sealant for Use in Casework Construction: Manufacturer's recommended type.

K. Sealant for Use in Casework Installation:
   1. Manufacturer's recommended type.
   2. One component, clear silicone base sealant, chemical curing complying with ASTM C920, Type S, Grade NS, Class 25, Use NT, when tested to glass and aluminum, anti-fungus composition.

PART 3 EXECUTION

3.01 EXAMINATION

A. Site Verification of Environmental Conditions:
   1. Do not deliver casework until the following conditions have been met:
      a. Building has been enclosed (windows and doors sealed and weather-tight).
      b. An operational HVAC system that maintains temperature and humidity at occupancy levels has been put in place.
      c. Ceiling, overhead ductwork, piping, and lighting have been installed.
      d. Installation areas do not require further “wet work” construction.

B. Verify adequacy of support framing and anchors.

C. Verify that service connections are correctly located and of proper characteristics.

3.02 INSTALLATION

A. Perform installation in accordance with manufacturer's instructions and with SEFA 2.

B. Large Components: Ensure that large components can be moved into final position without damage to other construction.

C. Use anchoring devices to suit conditions and substrate materials encountered. Use concealed fasteners to the greatest degree possible. Use exposed fasteners only where allowed by approved shop drawings, or where concealed fasteners are impracticable.

D. Set casework items plumb and square, securely anchored to building structure.
   1. Base Cabinets: Examine floor levelness and flatness of installation space. Do not proceed with installation if encountered floor conditions required more than 3/4 inch leveling adjustment. When installation conditions are acceptable, for each space, establish the high point of the floor. Set and make level and plumb first cabinet in relation to this high point.
   2. Wall Cabinets: Examine wall surfaces in installation space. Do not proceed with installation if the following conditions are encountered:
      a. Maximum variation from plane of masonry wall exceeds 1/4 inch in 10 ft and 1/2 inch in 20 ft or more, and/or maximum variation from plumb exceeds 1/4 inch per story.

E. Align cabinets to adjoining components, install filler and/or scribe panels where necessary to close gaps.

F. Fasten together cabinets in continuous runs, with joints flush, uniform and tight. Misalignment of adjacent units not to exceed 1/16 inch. In addition, do not exceed the following tolerances:
   1. Variation of Tops of Base Cabinets from Level: 1/16 inch in 10 feet.
   2. Variation of Faces of Cabinets from a True Plane: 1/8 inch in 10 feet.
   3. Variation of Adjacent Surfaces from a True Plane (Lippage): 1/32 inch.
   4. Variation in Alignment of Adjacent Door and Drawer Edges: 1/16 inch.

G. Separate dissimilar metals to prevent galvanic action.

H. Base Cabinets: Fasten cabinets to service space framing and/or wall substrates, with fasteners spaced not more than 16 inches on center. Bolt adjacent cabinets together with joints flush, tight, and uniform.

I. Wall Cabinets: Fasten to hanging strips, and/or wall substrates. Fasten each cabinet through back, near top, at not less than 16 inches on center.

J. Install hardware uniformly and precisely. Set hinges snug and flat in mortises.

K. Vented Cabinets: Install in strict compliance with manufacturer's written installation instructions.
   1. Install vent kits and connect to fume hood exhaust system.
   2. Use only rigid materials for venting. No flexible materials permitted.

L. Coordinate installation of work of this section with installation of fume hoods and laboratory equipment.

M. Countertops: Install countertops in one true plane, with ends abutting at hairline joints, and no raised edges.

N. Deliver sinks, cup sinks, and service fittings in properly marked boxes, accompanied with written instructions, for supervised installation by appropriate trade contractor(s).

O. Replace units that are damaged, including those that have damaged finishes.

3.03 ADJUSTING

A. Adjust operating parts, including doors, drawers, hardware, and fixtures to function smoothly.

3.04 CLEANING

A. Clean casework and other installed surfaces thoroughly.

3.05 PROTECTION

A. Do not permit finished casework to be exposed to continued construction activity.

B. Protect casework and countertops from ongoing construction activities. Prevent installers from standing on or storing tools and materials on casework or countertops.

C. Repair damage that occurs prior to Date of Substantial Completion, including finishes, using methods prescribed by manufacturer; replace units that cannot be repaired to like-new condition.

END OF SECTION

SECTION 142423 - HYDRAULIC PASSENGER ELEVATORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes modernizing the elevator, bringing everything to current code compliance. Elevator contractor shall perform all work necessary to achieve the intent of this project, including but not necessarily limited to the work specified herein.

B. Passenger Elevator Summary

1.	No. of Elevators:	One (1).
2.	Classification:	Passenger.
3.	Identification No.:	Car 1.
4.	Rated Capacity:	2,000 pounds.
5.	Rated Speed:	100 feet per minute.
6.	Operational Control:	Simplex / collective-selective.
7.	Floors Served:	1, 2.
8.	No. of Openings:	Two (2).
9.	Car Door:	Single speed side opening.
10.	Hall Door:	Single speed side opening.
11.	Driving Machine:	
	a. Present:	Hydraulic / direct-acting (inverted).
	b. Future:	Hydraulic / direct-acting (dual jack).
12.	Control System:	Microprocessor, solid-state, non-proprietary.

1.2 ALTERNATES

A. ADD ALTERNATE #9 - Install a new controller rather than refurbishing and re-using the existing controller.

1.3 DEFINITIONS

A. Consultant: CBA Elevator Consultants, 190 Main Street, Suite 402, Hackensack, NJ 07601.

B. Contractor: Shall mean the person, firm, entity or corporation named in the Contract Documents who will execute the work. It shall include all his employees, subcontractors and suppliers.

C. Cab Company: Company that will furnish and install the cab interior.

D. Code: All applicable laws and codes, including but not limited to the electrical, fire, building, and elevator codes designated by any authority having jurisdiction.

E. Work: Shall mean the services, materials, labor, and all other equipment required for complete and proper installation by the elevator contractor.

F. Provide: Shall mean to supply, install and connect up complete and ready for safe and regular operation

particular work referred to unless specifically indicated otherwise by the consultant.

G. Approved/Accepted/Reviewed: As applied to materials, products and workmanship shall mean that acceptance or review by the consultant is required.

H. Install: Shall mean to erect, mount, and connect complete with related accessories.

I. Supply/furnish: Shall mean to purchase, procure, acquire, and deliver new, complete with related accessories.

J. Wiring: Shall mean conduit, fittings, wire, junction and outlet boxes, switches, cutouts, receptacles and related items.

K. Concealed: Shall mean in masonry or other construction, installed in furred spaces, within double partitions, or hung ceilings, in trenches, in crawl spaces or in enclosures.

L. Exposed: Shall mean not installed underground or "concealed" as defined above.

M. Current Issues/Current Editions: As applied to reference standards and governing codes shall mean the latest published issue or edition available during the bidding period.

N. Best/First-Class/First-Grade/Similar: As applied to materials, products and workmanship shall mean that, in the consultant's opinion, there are no superior qualities of materials or products on the market, and there is no better class of workmanship.

O. Substantial Completion/Beneficial Use: Shall mean that the progress of the work, or on any portion of the work, is sufficiently complete in accordance with the Contract Documents, and as reviewed by the consultant, so that the owner can utilize the work for its intended purpose.

P. Notice-To-Proceed: Shall mean a written document from the consultant or owner allowing the elevator contractor to commence only that portion of the work stated in the written document.

1.4 ACTION SUBMITTALS

A. Product Data: Include names and addresses of the manufacturers, together with catalog information or other identifying description for all items specified.

B. Shop Drawings: Show material type and gauge, general dimensions, methods of attachment, location, and size of reinforcements and openings, and a general arrangement of components. Matter submitted for review shall be accompanied by complete information concerning the material, articles and/or design proposed for use in sufficient detail to show compliance with the Contract Documents, and shall be reviewed without exceptions before incorporation into the work. Each drawing submitted shall provide a clear space approximately 4 inches x 4 inches for consultant's use and stamp. Review thereof will not be construed as relieving the elevator contractor of compliance with the Contract Documents, even if such review is made in writing, unless the attention of the consultant is called to the noncomplying features by letter accompanying the submitted matter. Review of drawings, cuts and samples by the consultant shall not be construed as a complete check or approval of the detailed dimensions, weights, gauges and similar details of the proposed articles. The conformance of such details with the contract requirements, together with the necessary coordination of dimensions and details between the various elements of the work, and between the various subcontractors and suppliers, shall be solely the responsibility of the elevator contractor, approval of submitted matter notwithstanding. All submitted material shall be tendered complete, and at one time. PARTIAL SUBMITTALS WILL NOT BE CONSIDERED. In general, the items to be submitted shall include but shall not be necessarily limited to the following:

1. Provide company organizational chart with phone numbers.
2. Schedule of work showing commencement and completion dates and phasing, for each elevator.
3. Elevator car and hall fixture drawings.
4. Cab enclosure drawings.
5. Review of drawings, schedules and other submitted matter will be general and shall not be construed as:

    a. Permitting any departure from the contract requirements
    b. Relieving the elevator contractor of the responsibility for any errors, including details, dimensions, materials, etc.
    c. Approving departures from details furnished by the consultant.

C. Hoistway and Machine Room plan and section drawings: Fully detailed elevator layout drawings are required on ALL elevator modernizations or installations even if the Authority Having Jurisdiction (AHJ) does not require it. The drawing set shall include:

1. Machine Room Plans.
2. Overhead.
3. Shaft/Hoistway Plan.
4. Inside Cab Dimensions.
5. Pit Plan.
6. Hoistway Section.
7. Machine Mounting Details.
8. All Reactions including structural loads, electrical loads, heating.

D. Permit Application Forms.

E. Variations: If drawings, schedules or other submitted matter show variations from the contract requirements because of standard shop practice or for other reasons, the elevator contractor shall describe such variations in his letter of transmittal. If acceptable, the consultant may accept in writing, any or all such variations. If the elevator contractor fails to describe such variations, and does not have the consultant's acceptance in writing, he shall not be relieved of the responsibility for executing the work in accordance with the contract, even though such drawings or schedules may have been accepted.

F. Samples: Where submissions are called for in the specifications, or when otherwise required by the consultant, the elevator contractor shall submit duplicate samples of materials, appliances, finish or other items included in the work. Such samples shall be in all respects equal to that to be provided for the work and shall be approved by the consultant before the work is executed. Samples shall be submitted in ample time before work is installed, to permit sufficient time for consultant's consideration. Samples shall be accompanied by a label, or shall be properly marked, indicating the type and brand of material, its place of origin, the name of the producer and address, serial numbers, the elevator contractor's name and the name of the project for which the material is intended.

1.5 CLOSEOUT SUBMITTALS

A. Instruction to owner's personnel: At the owner and/or elevator consultant's request, the elevator contractor shall provide a competent instructor who together with a representative from the elevator consultant's office, shall meet with the owner's personnel to fully and adequately instruct the owner's personnel in the proper operation of all equipment installed by the elevator contractor.

B. The following printed information shall be furnished upon completion:

1. Three (3) sets, neatly bound instructions explaining all operating features, including all apparatus

in the car control panels and elevator monitoring apparatus.

2. Three (3) sets of printed instructions and recommendations for maintenance of all elevator equipment.
3. Three (3) lubrication charts, indicating all lubrication points and type of lubrication recommended for all equipment.
4. One complete parts catalog for all replaceable parts.
5. Three complete sets of as-built controller prints.
6. Three complete sets of all wiring diagrams.
7. Diagnostic test device complete with access codes, adjusters manuals and setup manuals for adjustment, diagnosis and troubleshooting of elevator system and performance of routine safety tests. Manufacturer of diagnostic test device shall update, reprogram, recharge, etc., device for as long as the controls remain in place. Further, elevator contractor warrants, by submitting their bid that any SIM card or related device shall remain with the control system, and that elevator contractor's personnel shall never remove such a device from the control system under any circumstances. This requirement shall remain in effect for the lifetime of the elevator control equipment.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Provide the following extra parts:

1. Three sets of keys to operate all keyed switches and locks shall be furnished upon completion of the work.
2. Elevator contractor shall provide a list of extra parts inventory (fuses, brushes, spare wires, and other typically consumed parts, etc.). Elevator contractor shall furnish all inventory listed to owner.

1.7 LICENSES AND PERMITS

A. Licenses, which may be required for completion of work, are to be obtained and paid for by the elevator contractor.

B. Elevator contractor shall, at his own cost, secure any necessary municipal, state and federal permits and licenses required for all performance of all work to be done hereunder. The elevator contractor shall provide owner and consultant with copies of all such permits, licenses and approvals upon their issuance.

1.8 STORAGE OF EQUIPMENT AND MATERIALS

A. In the event that it is necessary for elevator contractor to stockpile or to store quantities of material or equipment on the job site, elevator contractor shall inform owner of such necessity and owner shall offer available space, if any is available, for storage of such materials or equipment. Elevator contractor shall use said space only for such purpose. Any and all materials which may be stored in such space or which may be brought onto the job site at any time by elevator contractor shall be left at elevator contractor's sole risk. The owner shall not be responsible to elevator contractor for loss of or damage to said materials or equipment for any cause whatsoever. It is expressly understood and agreed that elevator contractor assumes all risk of loss or damage to such materials and equipment, except as heretofore provided, and that owner shall not require to furnish or supply watchmen at any time. Elevator contractor shall take necessary measures to protect any such storage area and shall be responsible for any and all damages. Provide suitable storage space for tools and materials brought to the site by the elevator contractor. Elevator contractor must specify at the beginning of the project the details of storage space required. Storage space requested shall be reasonable and in accordance with the projected schedule.

B. The elevator contractor shall confine storage of materials to limits approved by the owner and he shall not necessarily encumber the premises or overload any portion of it with materials to a greater extent than it is calculated to bear. Elevator contractor shall not store hazardous materials such as solvents, paints, thinners, etc., unless in approved containers.

1.9 OWNER RESPONSIBILITIES

A. Open Violations

1. It is the owner's responsibility to confirm that the elevator is current with all mandated inspections and tests. The elevator contractor shall verify with the Authority Having Jurisdiction the status of all mandated inspections, tests, and any outstanding violations or fines incurred.

B. HAZARDOUS MATERIALS

1. If hazardous materials are encountered, owner will remove any hazardous materials under a separate contract.

1.10 WARRANTY AND GUARANTEE

A. Provide special project warranty effective starting with the acceptance of the conveying system and continuing for one year after acceptance of the last elevator by the owner, which shall be signed by elevator contractor, Installer, and Manufacturer, agreeing to replace/repair/restore defective materials and workmanship of the elevator work during warranty period. "Defective" is hereby defined to include, but not by way of limitation, operation or control system failures, performances below required minimums, excessive wear, unusual deterioration or aging of materials or finishes, unsafe conditions, the need for excessive maintenance, abnormal noise or vibration, and similar unusual, unexpected and unsatisfactory conditions.

B. The elevator contractor shall guarantee that the materials and workmanship installed, refurbished, and repaired, under this contract, shall be free of all faults, imperfections, flaws, and damage in every respect. The elevator contractor also assures and warrants that he will make good any defect, which may develop within one (1) year from the date of final acceptance of the completed installation. Such guarantee shall be delivered in writing, to the owner, before final payment will be made. Neither final payment nor any provision of the contract documents shall relieve the elevator contractor of his responsibility to remedy faulty materials or workmanship and to pay all expenses for damages to other work resulting therefrom.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Codes and Ordinances: All the work covered by these specifications is to be done in full accord with all federal, state and local codes, ordinances, and elevator safety orders as are in effect at the time of the execution of the contract. All of the requirements of the local Authority Having Jurisdiction (AHJ) are to form a part of these general conditions and are to be fulfilled by the elevator contractor and his subcontractors. The entire elevator system, including all elevator equipment and work, shall be in accordance with the latest requirements:

1. ASME A17.1: Safety Code for Elevators and Escalators.
2. ASME A17.2: Guide for Inspection of Elevators, Escalators, and Moving Walks.

3. ASME A17.3: Safety Code for Existing Elevators and Escalators.
4. ANSI A117.1: Accessible and Usable Buildings and Facilities.
5. ADA: The Americans with Disabilities Act, Civil Rights Law – Title III.
6. NFPA 70: National Electric Code (NEC).
7. OSHA: Occupational Safety and Health Administration.

B. Code Compliance: The following code shall be the applicable code for this project and shall be identified on all required municipal permits:

1. ASME A17.1-2016 and IBC-2018 NJ Edition and Chapter 30.

C. Work is to comply with all applicable Local Laws. All of the work covered by the specifications, including design, clearance, construction, workmanship and quality is to be done in strict accordance with all national, state and local codes, ordinances and elevator safety orders in effect at the time a contract for this work is executed. For any discrepancies, the code shall take precedent. Compliance is not limited to any changes or amendments imposed by the appropriate authorities to all laws specified.

D. The elevator contractor shall immediately inform the owner of any work or materials which violate any of the above laws and regulations and any work done by the elevator contractor causing such violations shall be corrected by the elevator contractor at his own expense.

E. Upon completion of the elevator and prior to the acceptance test and subsequent turnover to use by the owner and the building adjust the elevator to meet the following performance requirements.

1. Contract Speed: +/- 20 percent (Max).
2. Leveling Accuracy: +/- 1/2 inch.
3. Floor-to-Floor Time: 18.0 Seconds.
4. Door Opening Time: 2.40 Seconds.
5. Door Closing Time: 3.50 Seconds.
6. Dwell Time (Car Call): 3.0 Seconds (adjustable to 10 seconds).
7. Dwell Time (Hall Call): 5.0 Seconds (adjustable to 20 seconds).
8. Reduced Dwell Time: 1.0 Seconds (adjustable to 10 seconds).
9. Lobby Dispatch Time: 5.0 Seconds (adjustable to 60 seconds).
10. Nudging Time: More than 20 Seconds.
11. Door Closing Force: Less than 30 Pounds.
12. Horizontal Vibration: 30.0 milli-g.
13. Vertical Vibration: 30.0 milli-g.
14. Noise Level: 70 dBA (inside car).

2.2 SIGNAGE - NEW

A. Signage:

1. Machine Room Temperature and Humidity - Provide a sign in the machine room stating the range of temperature and humidity as specified by the equipment manufacturer and as required by A17.1.
2. Crosshead Data Plate - Provide a crosshead data plate that lists the rated capacity and rated speed of the elevator and complies with A17.1.
3. Buffer Data Plate – Provide a permanent buffer marking plate indicating the manufacturer's name, identification number, rated impact speed and stroke on or adjacent to the buffers and complying with A17.1.
4. Car / Hoistway Door Bypass – Provide a warning sign adjacent to the car and hoistway door bypass switches "Jumpers shall not be used to bypass hoistway door or car-door electric contacts."
5. Floor Numbers - Provide new 4 inch floor numbering on the hoistway side of the hoistway doors

and/or walls at intervals as require by Code.

6. Refuge Areas – Clearly mark using code complaint tape or paint indicating where the refuge areas are and where there are any striking hazards.

B. Identification of Equipment

1. Properly identify the following equipment with the car number assigned to it. Paint, engrave, or securely attach the number on:

a.	Driving Machine:	2 inches.
b.	Controller:	2 inches.
c.	Transformers:	2 inches.
d.	Governors:	2 inches.
e.	Buffers:	2 inches.
f.	Main Disconnect:	2 inches.
g.	Crosshead:	2 inches.
h.	Car Operating Panel:	½ inch.
i.	Main Egress:	3 inches.
j.	Hoistway Doors:	4 inches (shaft side).

C. ADA Accessibility Requirements – Confirm that the elevator shall conform to the Elevator Code, Municipal Code, and ADA Accessibility requirements and include:

1. Provide markings on the car operating panel (COP) adjacent to the floor and control buttons on a contrasting color background to the left of the buttons. Letters and numbers shall be a minimum of 5/8 inch and raised 0.03-inch with Braille indications.
2. Provide floor designations at each entrance on both sides of jamb at a height of 60 inches above the floor. Designations shall be 2 inches high, raised 0.03-inch with Braille indications and shall be as selected and approved by the owner. Provide samples for approval.
3. The centerline of the new hall push button station shall be 42 inches above the floor line.
4. Provide an audible signal to tell passengers that the car is stopping or passing a floor served by the elevator. See VOICE ENUNCIATION for further details.
5. Provide control non-interference door dwell timing features in accordance with ADA requirements. See PERFORMANCE REQUIREMENTS for further details.

2.3 CAB ENCLOSURE - NEW

A. Provide new cab enclosure with new finishes. The owner and/or his representatives shall select the finish and design of the cab enclosure. Construct elevator cab to accommodate the door operator, hangers, interlocks and all accessory equipment provided under other sections of these specifications, including firefighter phones, card readers and CCTV.

B. Design Details: Texturized steel shell.

1. Shell: 14 gauge enamel texturized stainless steel walls (5-WL or equal).
2. Canopy: Reinforced 14 Ga. furniture steel. Underside painted baked enamel reflective white with vandal-resistant LED downlights. Arrange for hinged top emergency exit.
3. Base/Reveal/Frieze: 20 gauge brushed No. 4 (satin) stainless steel.
4. Lighting: Vandal-resistant LED lights.
5. Return/column: 14 gauge steel with cut-out for applied car operating panels. Finish is brushed #4 (satin) stainless steel.
6. Transom: 14 gauge steel to match return and entrance column finish.
7. Door: Brushed No. 4 (satin) stainless steel.
8. Handrail: Rounded flat satin stainless steel.

9. Fan: Two speed fan.
10. Protection: Pad Buttons (all walls).
11. Top Exit: Secure top of car escape hatch.

2.4 PROTECTIVE PADS - NEW

A. Provide one set of heavy duty pads with rubber coated eyelets to hang from pad buttons.

2.5 CCTV (SECURITY) CAMERA

2.6 CAR SILL - NEW

A. Material:

1. Nickel-Silver.

2.7 CAB FLOORING - NEW

A. Rubber floor tile with stainless steel studs.

2.8 CAR OPERATING PANEL - NEW

A. The car station shall contain a series of push buttons to correspond to the landings served. The push buttons shall illuminate individually when pressing a button for the desired floor. These lights shall extinguish after answering the call. The main panel shall include on the cover:

1. Key-operated stop switch, that when activated shall remove electric power from the driving-machine motor and brake. Activation of the key-operated stop switch shall not cancel registered car or corridor calls, and after releasing the switch, the car shall continue to answer its registered calls.
2. An illuminated alarm button connected to a bell under or on top of the car.
3. Door open button.
4. Door close button.
5. Cutout for card access reader, include all necessary shielded wiring.
6. In a separate locked service panel include the following:

a. Car light key switch.
b. Fan key switch.
c. Inspection key switch for use with access operation and the top-of-car operating station.
d. Independent key switch.
e. One spare key switch reserved for future use.
f. Emergency light test button.
g. GFCI duplex receptacle.

7. Incorporate the emergency lighting, fire controls, auxiliary signals, and mandated engraving to comply with all applicable elevator and fire codes as well as ADA requirements.

2.9 VOICE ENUNCIATION - NEW

A. Digitized floor annunciation to indicate the floor at which the car is about to stop. The verbal announcement indicating the floor shall complete prior to the initiation of the door opening. Shall comply with all current code requirements. Incorporate or locate this in either the car station or the car position indicator.

2.10 EMERGENCY TELEPHONE - NEW

A. Provide an automatic dialing, hands-free telephone in the car-operating panel. The system shall comply with ADA requirements. See the article entitled "emergency communication" for detailed requirements.

2.11 EMERGENCY LIGHTING - NEW

A. Provide an emergency light unit

1. A minimum of two (2) bulbs or LED's of approximately equal wattage.
2. Illumination for a minimum of four (4) hours.
3. Not less than 0.2 fc when measured 48 inches above the car floor and 12 inches in front of car operating panel.
4. A permanent connection to the car light branch circuit.

B. Location:

1. Incorporate in the car lighting

2.12 CAR POSITION INDICATOR - NEW

A. Location:

1. Incorporate/include in car operating panel (COP)/car station detailed above.

B. Provide LED type readout in the car station to show floor locations. The LED characters shall be 2" high with a screen flush with panel surface of the fixture cover. Install one transmitter per elevator to supply digital position indicator.

2.13 EMERGENCY COMMUNICATIONS - NEW

A. General Information:

1. Provide two-way communications system between the car and a location staffed by authorized personnel and that complies with Section 2.27 of the A17.1 Elevator Code and Section 407.4.10 of the A117.1 Accessibility Code.
2. When the two-way communications location is not staffed 24 hours a day, by authorized personnel, the means of two-way communications shall automatically be directed within 30 seconds to an additional on- or off-site location, staffed by authorized personnel, where an appropriate response can be taken.
3. Install interface unit and phone handset in the machine room to allow for communication between the machine room and the elevator. Interface unit shall be Electronic Micro Systems, Ring

Communications, or equal.

B. Emergency Telephone (In-Car):

1. Provide an automatic dialing, hands-free telephone in the car, mounted as an integral part of the car operating panel.
2. Pressing the emergency alarm button or HELP push button in the car panel shall initial the telephone. It shall automatically dial a programmed number to alert the security personnel that there is a problem in the elevator. Calls shall terminate externally and not from within the car. Pressing any button that initiates the call twice shall NOT stop placing the call.
3. If the first number dialed does not answer, the auto dialer shall dial a second programmable number.
4. The system shall have a ring-back feature to allow placing calls to the elevator. It shall answer the incoming call automatically and shut off after an adjustable programmed time.
5. Provide an audible and visual signal once establishing the communication link.
6. Rechargeable batteries shall ensure operation under all conditions. The alternate power source shall be capable of providing power for the means of emergency communications for at least 4 hours.
7. Install the communication unit in the elevator and wiring within the hoistway, terminating the wiring in the elevator machine room. Install a suitable and identifiable junction box in the machine room.
8. The emergency telephone system shall require a maximum of one telephone line.
9. The system must provide line sharing capability to eliminate the need for a dedicated telephone line.
10. The line sharing function must ensure that the emergency telephones always receive dialing priority even if the line is in use and that the emergency telephones can be called into from an on-site location.

C. Line Verification/Monitoring:

1. The two-way communications means within the car shall include a means to verify operability of the telephone line where:

    a. Verification of the telephone line operability shall be automatically performed.
    b. Verification may be continuous or periodic.
    c. Periodic verification shall be at least daily.
    d. Verification shall not require activation of the two-way communications link(s).

2. If means other than a telephone line (VOIP, network, intercom, etc.) is used for the two-way communications, similar verification of this equivalent means shall be performed.

D. Designated Landing Signals:

1. If the verification means determines that the telephone line or equivalent means is not functional, an audible and illuminated visual signal shall be activated. A minimum of one visual and one audible signal shall be provided for each group of elevators controlled by a "FIRE RECALL" switch.
2. The visual signal shall:

    a. Be located at the designated landing in the vicinity of the "FIRE RECALL" switch and visible to elevator user(s).
    b. Be labeled "ELEVATOR COMMUNICATIONS FAILURE" in red letters a minimum of ¼ (0.25) inches high.
    c. Illuminate intermittently.
    d. Continue illuminating intermittently until the telephone line or equivalent means is

functional.

3. The audible signal shall:

    a. Be 10 dBA minimum above ambient, but shall not exceed 80 dBA measured at the designated landing "FIRE RECALL" switch.
    b. Sound at least once every 30 seconds with a minimum duration of half a second.
    c. Continue to sound until silenced by authorized personnel or the telephone line or equivalent means is functional.

4. A means to silence the audible signal shall be provided and shall be accessible only to authorized personnel. The signal when silenced shall remain silent for a period of no less than 12 hours or until activated by the next failed periodic verification.
5. The verification means shall continue to monitor the operability of the telephone line or equivalent means while the telephone line or equivalent means is not functional on a continuous basis or periodically with intervals of not more than 5 minutes.
6. When the verification determines that the operability of the telephone line or equivalent means has been restored after being nonfunctional, the audible signal shall be silenced unless the signal has already been silenced and the illuminated visual signal shall be extinguished.

2.14 ACCESS CONTROL SYSTEM

2.15 MACHINE ROOM ENCLOSURE - REFURBISH

A. Equipment:

1. All elevator machinery and control equipment shall be located in the machine room.
2. Any work required facilitating removal of existing equipment and installation of new equipment in the machine room and repair thereof shall be the responsibility of the elevator contractor.
3. The placement of any new equipment shall meet all current and applicable codes including, but not limited to, ASME A17.1 and all local codes and ordinances.

B. Electrical System:

1. Provide new electric wiring from the main disconnect switch to the terminals of the new elevator controller in its location as shown on the approved layout drawing, inclusive of a normal/standby 120 VAC, 15 Amp supply at each controller.
2. If necessary for code compliance, provide auxiliary main line disconnect switch to maintain line of sight of any controller and moving equipment.

2.16 EQUIPMENT ISOLATION - NEW

A. Vibration:

1. Provide sound-reducing vibration isolation elements at all support points of elevator controllers, solid-state motor drives, isolation transformers and hoisting motors. All bolts through isolation elements, where necessary, are to incorporate resilient washers and bushings.
2. The elements for controllers, motion control, and isolation transformers shall be similar to ribbed neoprene pads, type mini super w pads, as manufactured by Mason Industries or approved equal, at 45 durometer.
3. Elements between the hoisting machine and machine support beams or between car sling and platform shall be similar to triple (3) layer ribbed neoprene pads, separated by appropriate steel

shims as manufactured by Mason Industries or approved equal, type Super W pads, at 50 durometer, loaded for 180 psi.

B. Electrical:

1. Provide electrical isolation as necessary to maintain the harmonic distortion and electrical noise within acceptable levels permitted by the appropriate governing authorities.
2. Provide transformers, chokes, and filters as needed in order to minimize audible noise and radio frequency interference to acceptable levels.

2.17 OPERATIONAL CONTROL SYSTEM – REFURBISH and ADD ALT #9

A. ADD ALT #9 - Approved Manufacturers:

1. GAL.
2. MCE.
3. SmartRise.
4. Approved Equal (must be non-proprietary).
5. A "Non-proprietary" controller product is one that is regularly sold by the manufacturer to other installers and one for which the manufacturer will provide technical support to other elevator contractors maintaining the product.
6. The owner / consultant shall retain the right to change or assign a controller manufacturer or product to the elevator contractor.

B. ADD ALT #9 - General Information:

1. Provide new solid-state microprocessor controller designed to the applicable ASME code as adopted and/or modified by local and state law or the local authority having jurisdiction.
2. Paint all machine room enclosures provided by the control manufacturer (control cabinet, isolation transformers, ripple filters, resistor boxes, etc.) the same color.
3. Provide rubber floor mats at the front and at the rear of controller (if serviceable parts are located in the rear).

C. ADD ALT #9 - Machine Display:

1. Provide a monitor or an LCD display in the machine room that allows troubleshooting and can display the status of the elevators. The monitor display shall display car position, registered hall and car calls, and status of the car, etc. The troubleshooting functions should include the ability to register car calls and hall calls. Controller shall include security features in order to allow any elevator contractor to lockout car calls or hall calls on an individual basis without software changes. Fire service shall override all lockouts, as required by Code.
2. Elevator contractor shall provide any passwords or passcodes set on either the LCD display or the control system in writing to the building owner and consultant. Anytime making changes to passwords or passcodes, elevator contractor shall give in writing all new updates to building owner and consultant.

D. ADD ALT #9 - Car Controller:

1. Design:

a. Electromechanical relays shall be used on safety circuits as required by the Code.
b. Relays shall be designed to ensure long life and quiet reliable operation without overheating or excessive wear. Provide contacts supplying highly inductive loads with arc deflectors or suppressers.

c. Mount large resistors so that heat generated is dissipated from the enclosure without heating other components or wiring.
d. All controller wiring shall be copper and done in a neat workmanlike manner. Make all connections to studs or terminals by means of solder-less connections lugs or similar connections. Label all studs and terminals for connections of board and external wiring.
e. Symbols or letters shall identify all devices on the controller, either permanently marked on or adjacent to each device. All fuse holders shall be permanently marked with ampere rating.

2. Programming:

a. Provide equipment to protect the drive motor and solid-state motor drive as applicable against overload, phase reversal, low voltage, and single phase in all three phases.
b. Controller shall regulate car speed to +/- 5% of contract velocity in either direction with any load up to full load.
c. Calls shall register after establishing the direction of travel and only register in that direction.
d. Parking shall be adjustable to allow each car to park at any floor.
e. All date-sensitive functions of the elevator control system shall use a 4-digit year-tracking system.
f. Controller shall provide efficient, smooth operation with step-less acceleration and deceleration of the elevator-driving machine independent of the load in the car.
g. All memory chips shall be of the non-volatile type to provide for an automatic restart on power-up conditions.

3. Special Services: The controller shall include the following programming with necessary outputs and inputs, even if not used at present:

a. Fire Emergency Operation: Shall meet all national and local code requirements.
b. Emergency Power Operation.
c. Emergency Terminal Stopping
d. Independent Service Operation:

1) Each car operating station shall be equipped with a key-operated switch labeled "IND". When placed in the "on" position, this switch shall cause the elevator to bypass all corridor calls and to travel directly to any floor chosen by registration of a car call. During Independent Service Operation, the elevator doors shall remain open at any landing until applying continuous pressure to the "door close" push button.
2) In case elevator is operating on the Independent Service mode and the Fire Emergency Recall system becomes activated, following a period not less than 10 seconds nor more than 30 seconds, the elevator shall automatically override Independent Service Operation and engage Phase I - Fire Emergency Recall Operation.

E. BASE - Refurbish operational control system (controller), this shall include reusing the existing controller and adjusting as necessary including board replacements to modify to meet current elevator code. The pricing shall be broken down as follows:

1. Installation of new circuit boards to salvage existing controller. Refer to specification section 012200.
2. Installation of associated software upgrades to salvage existing controller. Refer to specification section 012200.

2.18 MOTION CONTROL SYSTEM - NEW

A. Solid-State Motor Starter:

1. For use with hydraulic elevator pump motors, the system shall include:

a. Prevent high inrush current and eliminate voltage dips when pump motors start.
b. Adjustable current limit (10% - 450% of starter rating).
c. Shall include dynamic stall protection.
d. Shall include motor wiring detection (reverse phase protection).
e. Shall include LCD display and keypad with full starter diagnostic information.

2. Approved Manufacturers:

a. Siemens.
b. Approved Equal.

3. The solid-state motor start applies to both the BASE and ADD ALT #9 BIDS.

2.19 DRIVING MACHINE - NEW

A. Location: Machine Room.

B. Hydraulic Power Unit:

1. Pump Motor and Tank: Provide a fully enclosed self-contained pump unit with structural steel base to support the storage tank and with an integral oil-tight drip pan with drain. Mount the assembly on vibration sound dampeners designed to isolate the unit from the building structure. Construct the storage tank of welded sheet steel complete with a tight fitting cover, a protected vent, an oil level gauge, a drain and a filtering screen over the suction inlet. Provide for storage capacity equal to the volume needed to lift the elevator to the top landing, plus more than 12 gallons (US) reserve.

a. Design the system for 500-psi maximum working pressure with cold oil, or indicate the maximum working pressure. Design the system such that the pump delivers oil directly into the cylinder at the necessary pressure and in sufficient quantity to force the plunger to lift the fully loaded car at the contract speed. Arrange equipment in the machine room to allow their removal, by dolly or other conventional means, without having to dismantle or remove any other major components. Provide any additional structural members required for the installation of the equipment, such as shelf angles or plunger support steel. Provide all required anchor bolts and beams, templates, inserts, signal boxes and sleeves in the walls or floors.

1) Submersible pump drive assembly (under oil).

b. Starts per hour: 80 elevator starts per hour.

2. Oil: Shall be the proper grade and weight as specified by power unit manufacturer with an ISO 4406:99 cleanliness level of 14/13/11.
3. Muffler/silencer:

a. The muffler shall reduce pulsation and deliver quiet operation, which may be present in the

flow of the hydraulic fluid.
b. A silencer that contains an internal bladder and pressurized by air is not acceptable.
c. Limit the increase of ambient noise in the cab to under 4dB (A-scale) when the elevator travels UP or DOWN anywhere in the hoistway.

4. Tank Heater: Furnish and install a thermostatically controlled tank heater, isolated heating element and flexible sealed connecting conduit and wiring.
5. Oil Cooler: The cooling unit shall be thermostatically controlled to help maintain the oil at a proper operating temperature.

a. Design shall use:

1) Forced-air (external radiator).
2) Chilled water.
3) Heat pipe.

6. Control Valve: The control valve shall control flow for up and down directions hydraulically and shall include an integral check valve. A control section including control solenoids shall direct the main valve and control: up and down starting, acceleration, transition from full speed to leveling speed, up and down stops, pressure relief and manual lowering. Shall be a load compensated valve. All of these functions shall be fully adjustable to provide maximum smoothness and to meet contract conditions. It shall include:

a. Relief valve: Externally adjustable, capable of bypassing the total oil flow without increasing back pressure more than 10 percent above that needed to barely open the valve.
b. Check valve: Designed to support the fully loaded elevator at rest on a column of oil, and to close quietly without allowing any perceptible reverse flow.
c. Up-start valve: Externally adjustable to bypass oil flow during initial start to relieve load on the motor; to close slowly and to provide for smooth UP-starts.
d. Up-level valve: Externally adjustable, and designed to assure smooth UP- stops.
e. Down valves: Externally adjustable, and designed to control drop-away speed, lowering speed, Down-leveling speed as well as stopping, to provide for smooth starts and stops in the down direction.
f. Manual valve: Designed to permit lowering the elevator at slow speed in the event of power failure or for adjusting purposes.
g. Shut-off valve: Designed to isolate oil in the storage tank and permit adjust- ing the elevator without having to remove oil from the tank.
h. Low pressure Switch: Designed to activate by loss of positive pressure at the top of the cylinder, and prevent the operation of the lowering valve or valves.

2.20 PIPING / OIL LINE - NEW

A. Provide new pipe between pump unit and hydraulic cylinder meeting the following:

1. Type: Schedule 80 pipe
2. Furnish and install an adequate number of metal pipe supports under the oil supply line.
3. Install the proper fittings to permit the removal of valves without dismantling the remaining pipe.
4. Run the piping from tank to cylinder using the minimum number of bends required.
5. Labeling: "Elevator Hydraulic Line"

a. In letters that are at least 3/4" high in a contrasting color.
b. Apply a marking to accessible piping that is located outside the elevator machine room or hoistway; it shall be visible after installation and applied at intervals less than 120 inches.

B. Provide new fittings for the pipe as follows:

1. Shall be a grooved piping system (i.e. Victaulic).

C. Provide new shut-off valves as follows:

1. Type: ball valves.
2. Quantity: Two (2).
3. Locations: One (1) in the machine room, one (1) in the elevator pit.

2.21 EMERGENCY LOWERING UNIT - NEW

A. Provide a new emergency lowering unit (battery back-up) to comply with the following:

1. Shall automatically activate during power loss.
2. Shall keep doors closed until proper floor level is reached.
3. Automatically opens doors at lowest landing.
4. Safely shutdown elevator until normal power is restored.
5. Differentiates between actual power failure and manual operation of elevator disconnect switch.

2.22 CAR TOP GUARD RAILINGS - NEW

A. Provide top of car guard rails on the outside perimeter of the car top on all sides where the perpendicular distance between the edges of the car top and the adjacent hoistway enclosure exceeds 12 inches horizontal clearance.

B. These shall meet all local and state code requirements.

2.23 ALARM BELLS - NEW

A. Provide one (1) new alarm bell. Locate the bell either underneath the platform or on top of the car.

B. Alarm bell shall ring when operating the Alarm Button inside the elevator.

2.24 SELECTOR / LEVELING DEVICE - NEW

A. Incorporate the solid-state selector into the new microprocessor based operational controls. The selector / leveling device shall:

1. It shall determine the position in the hoistway through either a fixed tape or by an encoder.
2. It shall provide accurate control, rapid acceleration, and retardation without discomfort to the rider.
3. It shall include absolute floor encoding; that during the elevator power up sequence causes the elevator to move to the closest floor to identify its position.
4. It shall automatically bring the car to a stop within 1/4 of an inch of the floor for which a stop has been initiated under all conditions of load for both "up" and "down" travel. This system shall correct for overtravel, undertravel, and rope stretch.

2.25 DOOR REOPENING DEVICE - NEW

A. Provide a new infrared matrix door reopening device system with independent power supplies.

1. Approved manufacturers: Janus, Tri-tronics, or equal.
2. Provide protection in line with doors and in front of door path; 3D type with visual indicators when doors are in motion.
3. Protective field not less than 71" above the car sill
4. A minimum of 47 light beams and positioned correctly to conform to applicable codes, A17.1 and A117.1
5. The door protection system shall have a modular design to permit on board test operation and replacement of all circuit boards without removing the complete unit.
6. If the power to the unit fails, the doors shall remain open.
7. Nudging Action: In the event continually obstructing a detector edge for a predetermined time interval (no less than 20 seconds) after initiating automatic door closing, a buzzer shall sound and the doors shall close at a gentle reduced speed. Timers shall be individually adjustable. This feature must be adjustable for reduced car door closing force. This feature shall also have the capability of being turned off on demand.

2.26 TOP OF CAR STATION - NEW

A. Top of car run box shall have an inspection switch that overrides all other inspection switches, with up, down, and enable push buttons and a stop switch. Install a guarded light on top of the car. The inspection station shall comply with all current code requirements, including operational and labeling requirements.

1. The top of car run box may contain a lighting fixture for the top of the car and an approved 120 Volt grounded GFCI duplex receptacle.

2.27 LOAD WEIGHING - NEW

A. Provide a means to detect if the load exceeds the rated capacity of the elevator. If an overload is detected, the elevator doors must reopen, elevator is to be taken out of service and the doors must remain open. A voice notification and visual signal must indicate that the car is overloaded. Once the overload condition is removed the elevator should automatically be returned to normal service.

1. System accuracy of plus or minus 4% of the elevator capacity.
2. Types of devices allowed:

    a. A high-pressure switch to monitor hydraulic pressure to the piston.
    b. A device consisting of four strain gauge load cells located at each corner of the car platform and supporting a free-floating car platform and cab with summing circuits to calculate the actual load under varying conditions of eccentric loading.

2.28 CAR GUIDE RAILS - NEW

A. Install new car guide rails, brackets, fishplates, backings support, and related attachments.

1. Align to +/- 1/8-inch plumb to produce a smooth, quiet ride and to achieve the ride quality criteria stated herein.
2. Provide the guide rail inserts to the General Contractor for installation.

2.29 CAR GUIDE SHOES - NEW

A. Provide non-lubricated swivel sliding guide shoes shall have an adjustable metal base, rigidly bolted to the top and bottom of each side of the car.

1. Swivel sliding guide design shall allow the car to float between the rails in a controlled manner.
2. The sliding guides shall include quiet, with low-friction molybdenum-disulfide filled nylon gibs.
3. Provide grease fittings for lubrication of the bearings.
4. Equip sliding guides with adjustable stops to control float.
5. Guides shall include 16-gauge steel guards.
6. Prior to the installation of the sliding guides, wash down the rails, check and repair rail joints for proper mesh.

2.30 DOOR OPERATOR - NEW

A. Approved Manufacturers:

1. GAL.
2. Approved equal.

B. Model

1. MOVFR – heavy-duty closed-loop door operator

C. The unit shall have the ability to adjust torque, opening speeds, closing speeds, nudging speed and soft start. It shall have proper filtering to eliminate audible noises.

1. The door operator shall have the capability to operate at an average opening speed of 2 feet per second. This type of operator shall have the designation of a high-speed operator. Automatic closing of the car and hoistway door shall be required, and the closing speed shall be approximately 1 foot per second. This closing speed shall reduce as required to limit the kinetic energy of the closing doors to the values permitted by the ASME Code.
2. The doors shall operate smoothly without slamming in either the opening and closing direction. They shall cushion their final movement in both directions of travel either by individual dashpots or by other equally effective approved methods. Electrical power shall open and close doors.
3. In case of interruption or failure of electric power from any cause, the door operating mechanism shall instantly permit emergency manual operation of both the car door and the hoistway door within the floor landing zones, and the hoistway door shall continue during emergency operation to be self-locking and self-closing. The door operator shall operate in conjunction with or be equipped with all interlocks and safety contacts specified.
4. All car-door linkage construction shall be of heavy steel members. All pivot points shall have either ball or roller bearings, or bronze-bushed bearings of ample size. All brackets and other supports required to support door-operating mechanism shall be furnished and installed.
5. The door operation shall be adjustable to allow for adjustment of the premature door opening time within the landing zone. Either the door operator or the door reopening device shall control the amount of time the door remains open.
6. Controls shall automatically compensate for load changes such as: wind conditions, different weight door panels, or other unique conditions.
7. Provide nudging to limit speed and torque in conjunction with door close signaling/closing and timing devices as permitted by ASME A17.1 and/or otherwise modified by the AHJ. The signal control system shall initiate nudging operation and not the door protective device.

2.31 CAR DOOR CONTACT - NEW

A. A new electrical contact shall be provided and arranged to operate with the car doors so that the elevator cannot operate unless the doors are closed or within the tolerance allowed by ASME Code. The car door contact/switch shall not be accessible by passengers inside the car.

2.32 CAR DOOR HANGERS - NEW

A. New car door hangers shall be compatible with the new door operator.

2.33 CAR DOOR TRACK - NEW

A. New car door tracks shall be compatible with the new door operator.

2.34 CAR DOOR CLUTCH - NEW

A. Provide a new car door clutch assembly that is compatible with new release roller assembly and includes a door restrictor compatible with applicable code.

2.35 HOISTWAY DOOR FRAMES - NEW

A. Applicable floors:

1. All floors.

B. Material (14 gauge):

1. Stainless steel.

C. Finish:

1. Brushed #4 (Satin).

D. Jambs with 2 inches wide square jamb profile with standard configuration.

E. Frame assembly: Knocked-down frame with butt joint with flush head.

1. The frames shall set flush with the edge of the sill on the hoistway side and shall be mortised and reinforced for all necessary hardware.
2. The frame shall have the surfaces coated with an acid and water resisting filler. All voids between the wall and buck on the hoistway side shall be filled, made smooth and finished to match adjacent surfaces. The front face of the jambs shall aesthetically cover the existing wall cutouts and adjoin the surrounding wall with no gaps. Include all filler strips, molding, etc., as required to provide for a finished installation.

2.36 HOISTWAY DOOR PANELS - NEW

A. Applicable floors:

1. All floors.

B. Material (14 gauge):

1. Stainless steel.

C. Finish:

1. Brushed #4 (Satin).

D. Flush hollow metal door panel with 1 -1/2 hour fire rating and UL label.

1. Panel surfaces coated with an acid and water resisting filler.
2. Panels shall include continuous vertical members for reinforcing and shall have sound deadening material inside.
3. New sight guards shall match hoistway door finish.
4. Panel shall include two removable door gibs to run in existing sill grooves with a minimum code-compliant clearance. The gibs mounting shall permit their replacement without removing the door panels from the hangers.
5. Provide escutcheons with metal ferrules at each opening. Sample requires approval by owner or owner's representative.
6. Provide new rubber hoistway door astragals as required by panel design.

2.37 HOISTWAY SILL - NEW

A. Applicable Floors:

1. All floors

B. Type:

1. Nickel-Silver.

C. Provide proper supports and grout in all gaps and voids under the sills.

2.38 HOISTWAY DOOR HANGER - NEW

A. Provide new hangers for hoistway doors of the heavy-duty sheave type, consisting of two (2) ball bearing sheaves not less than 3-1/2 inches in diameter enclosed in steel housings.

1. All sheave wheels shall rotate in grease packed precision ball bearing.
2. Each hanger shall be equipped with two (2) ball bearing upthrust rollers not less than 1 inch in diameter with eccentric adjustment.

2.39 HOISTWAY DOOR TRACK - NEW

A. Provide new tracks not less than 3-1/2 inches in height, and shall be of high carbon cold rolled or drawn steel, shaped, and finished to permit free movement of sheaves.

2.40 HOISTWAY DOOR ROLLER - NEW

A. Provide new rollers for the hoistway doors of the heavy-duty sheave type, consisting of ball bearing sheaves enclosed in steel housings.

1. All sheave wheels shall rotate in grease packed precision ball bearing.

2.41 HOISTWAY DOOR INTERLOCK - NEW

A. Approved manufacturers:

1. GAL.
2. Approved equal.

B. Provide new, positive electro-mechanical interlock. Interlock release roller assembly will include one fixed roller attached to the door mounting plate and one moveable roller that activate the interlock release assembly.

1. Interlock shall prevent operation of elevator by normal operating devices, unless all hoist- way doors are locked in the closed position. Interlock shall also prevent opening of hoistway doors from landing side, unless car is within that landing zone and is either stopping or stopped. Interlocks shall be unlockable from elevator car in case of power failure, only within the landing zone. Entrances with center-parting doors shall be provided with interlock keeper mounted to both fast door panels.

2.42 HOISTWAY DOOR CLOSER - NEW

A. Install new mechanical closers to assure self-closing of all shaft doors, independently and irrespective of the position of the car.

1. Closers shall have a similar mounting as at present. Each hall door panel shall be equipped with a mechanical closer.

2.43 HOISTWAY DOOR GIB - NEW

A. Provide each door panel with two new removable plastic composition guides, arranged to run in sill grooves with a minimum clearance. The guide mounting shall permit their replacement without removing the door from the hangers.

2.44 HOISTWAY DOOR SAFETY RETAINER - NEW

A. Provide one new steel safety retainer (aka: "Z bar" or "fire gib") guide on the underside of all doors and

securely fasten to the underside of the door with steel countersunk machine screws. Mount the safety retainer adjacent to and in between the removable guides. The safety retainer shall meet all local code requirements for size and location. Provide new safety retainer as described in ASME A17.1 on all openings.

2.45 HOISTWAY LIMITS - NEW

A. Provide new terminal slowdown limits and normal terminal stopping devices conforming to Code requirements. This shall include emergency terminal speed reducing devices in the up direction where the car speed exceeds 50 feet per minute and conforms to Code requirements. Arrange the new upper and lower terminal slowdown limits to stop the car automatically from any speed obtained under normal operation within the top clearance and bottom overtravel.

1. Terminal stopping devices that are mechanically operated by cams shall be fitted with rollers having a rubber or other approved composition tread to provide practically silent operation when actuated by the cam.
2. Terminal stopping devices that are not mechanically operated (i.e.: magnetic proximity) shall be provided by the manufacturer of the control equipment, intended for use as a terminal limit, and designed for reliable operation in the hoistway environment.

2.46 CYLINDER AND JACK - NEW

A. Cylinder: Dual Holeless - Twin direct acting hydraulic cylinder without well-holes.

1. Provide oil hydraulic plunger and cylinders of sufficient size to lift and sustain the gross load to the height. They shall be factory tested to assure adequate strength and the absence of leaks. Each cylinder shall be constructed of steel pipe of sufficient thickness and suitable for the operating pressure. The top of each cylinder shall be equipped with a cylinder head with a drip ring to collect any oil seepage as well as an internal guide ring and self-adjusting packing. Each plunger shall be constructed of selected steel tubing or pipe of proper diameter machined true and smooth with a fine polished finish. Each plunger shall be provided with a stop ring electrically welded to it to prevent the plunger from leaving the cylinder. Each plunger and cylinder shall be installed plumb and shall operate freely with minimum friction.

a. A steel packing gland with a phenolic guide bearing, wiper ring and packing espe- cially designed for hydraulic elevator service shall be provided.
b. Multiple section jacks, if provided, shall have machined threaded couplings with O-Ring seals to prevent leakage.

2. A portion of each jack shall include permanent markings indicating:

a. The name or trademark of the organization manufacturing the hydraulic jack.
b. The manufacturer’s designation of the type or model.
c. The year of manufacture.

2.47 WIRING AND CONDUIT - NEW

A. Provide new wiring in the hoistway, pit, and machine room adequate for the proper operation of the elevator. All material used and method of installation shall conform to the National Electrical Code (NFPA 70) and/or local Building Code.

1. Conductors shall be copper. The minimum size of conductors, exclusive of those that form an

integral part of control devices and/or cabinets, shall be a minimum no. 14 for lighting or power circuits and no. 18 for operating, control and signal circuits.

2. Provide ten percent (10%) spare wires and not less than two (2) spare wires between the controller, selector, hoistway junction box, and starter panel. Properly tag or clearly and indelibly mark all spares.
3. All wiring shall be labeled and identified at the terminal in the machine room, shaft box, elevator cab junction box, and push-button stations within the cab and shall agree with the submitted wiring diagrams.
4. Install strain boxes no more than 80 feet apart.
5. Flexible metal conduit may be used for short connections if it is not subject to moisture, oil, or embedment in concrete.
6. Connections to the controller and/or drive shall be made in a manner that minimizes transmission of vibration or noise to the building.
7. Do not use threadless (compression) fittings with rigid galvanized steel conduit. Electrical connections to machinery shall allow for one foot of lateral motion.
8. Remove all abandoned or unused electrical conduit from the hoistway, pit, and machine room.
9. Existing wire raceway may be reused.
10. New wire raceway shall be zinc-coated rigid steel conduit, intermediate electrical conduit, electrical metallic tubing (EMT), or metal wireways and outlet boxes.

2.48 TRAVELING CABLES - NEW

A. Provide new traveling cables designed for elevator service compliant with current elevator and electrical codes and shall be sufficiently flexible to readily adapt to all changes in the position of the elevator cab and hang straight without twist. The cables shall be capable of bending 360 degrees with an inside radius of one (1) foot without any permanent set and without cracking of the outer covering. The open loop shall show no tendency to twist upon itself. Traveling cables shall contain shielded wires for the intercommunication system and sufficient coaxial cable for a CCTV system.

1. Conductors shall be copper. The minimum size of conductors shall be a minimum no. 14 for lighting or power circuits and no. 18 for operating, control and signal circuits.
2. Traveling cable(s) shall contain at least:

    a. Four (4) shielded pairs for a total of 8 wires
    b. One (1) coaxial cable
    c. Ten percent (10%) spare wires for each wire size and not less than two (2) spare wires for each wire size in each traveling cable. Properly tag or clearly and indelibly mark all spares.

3. Terminating Coaxial Cable

    a. Terminate one end on one of the top corners of the elevator cab along with a duplex GFCI outlet dedicated for camera power only.
    b. Terminate one end of the coaxial cable in the machine room, in a separately identified box

4. Directly suspend traveling cables exceeding 100 feet in length from the steel supporting core cables to relieve the conductors from strain.
5. Install beam pads as necessary to prevent chafing of traveling cables.

2.49 CONVENTIONAL DISPATCHING HALL STATIONS - NEW

A. Applicable Floors

1. All floors.

B. Provide new flush-mounted hall button stations.

1. Stations shall include new up and down pushbuttons at all intermediate landings and single button at terminal landings. All buttons shall have acknowledge lights.
2. Hall button stations shall be ADA compliant.
3. Elevator contractor shall not use surface mounted hall button stations.
4. Elevator contractor may use extended plates, but must remove old covers and boxes completely.

C. New main lobby 1st Floor floor hall pushbutton station shall include:

1. Pushbuttons.
2. Fire service signals and key switches.

2.50 HALL POSITION INDICATOR - NEW

A. Applicable Floors:

1. All floors.

B. Location:

1. Above the entrance door and incorporate in the hall lantern and gong.

C. Provide 2 inch LED digital position indicator to show floor landings.

2.51 CONVENTIONAL DISPATCHING HALL LANTERNS AND GONGS - NEW

A. Applicable Floors

1. All floors.

B. The hall lantern shall indicate which car will stop in response to the corridor call and indicate the direction that the car is traveling five (5) seconds before arrival. The lantern shall remain illuminated until the doors start to close.

1. Incorporate a new multi-stroke gong in the new lantern fixture to sound when illuminating the lantern to call the attention to the waiting passengers and to meet handicapped requirements.
2. Intermediate floor fixtures shall have both "up" and "down" indications. The terminal floors shall have only one (1) indication.
3. New hall lanterns and gongs shall meet all A.D.A. compliance requirements.

2.52 HALL ACCESS STATION - NEW

A. Applicable Floors

1. 1st and 2nd floors.

B. Install an approved five-pin or five-disk key switch at the location(s) indicated above to permit moving the elevator at inspection speed with the hoistway doors open at that particular landing only. The car will only travel a distance necessary for authorized persons to obtain access to the top of car or pit area.

2.53 PIT LADDER

A. Provide and install a new code complaint pit ladder that complies with the following (Rule2.2.4.2):

1. Extend not less than 48 inches above the lowest landing sill height.
2. Ladder rungs, cleats, or steps shall be a minimum of 16 inches wide; if there are obstructions, the reduced width shall be not less than 9 inches.
3. Rungs, cleats, or steps shall be spaced 12 inches on center.
4. With not less than 4.5 inches distance between the rungs and the wall (from the centerline of rung to the wall).
5. Side rails shall have a clear distance of not less than 4.5 inches from their centerline to the nearest permanent object.

2.54 OVERSPEED VALVE - NEW

A. Provide an overspeed valve installed and mounted within 12 inches of the hydraulic jack with the following characteristics:

1. Shall trip not less than 110% nor greater than 140% of the elevator rated speed in the down direction, but in no case shall exceed 60 feet per minute above the rated elevator speed.
2. The average deceleration rate shall be not less than 6.44 ft/s2 nor more than 32.2 ft/s2.
3. Any peak deceleration rate in excess of 80.5 ft/s2 shall have a duration of not greater than 0.04 seconds.

2.55 SCAVENGER PUMP - NEW

A. Provide an electrically operated scavenger pump that provides means to return oil to the system. System shall be equipped with a brass float assembly as manufactured by Leland Pump Company or equal.

2.56 SPRING BUFFERS - NEW

A. Furnish and install new spring buffers.

1. Clean and paint all supporting steel.
2. Attach the buffers to the pit channel or pit plate with removable helical coil springs with internal stop pipes.
3. Install all necessary buffer support steel, hardware, and inspection platforms as required by code.

2.57 PIT STOP SWITCHES - NEW

A. Provide new pit stop switches as per code requirements.

2.58 CAR FRAME - NEW

A. Provide new car frame of required size with new rubber isolation pads.

1. Car frame shall be painted with rust inhibitor type paint.

2.59 PLATFORM - NEW

A. Provide new isolated platform.

1. The car platform shall consist of a steel frame with necessary steel stringers all securely welded together.
2. The isolation frame and platform shall be so braced and reinforced that no strain will be transmitted to the elevator car.
3. Provide platform with two layers of 3/4 inch exterior grade plywood. Cover the underside of the car platform with sheet steel.
4. Provide a NEW code-compliant platform or toe guard at each car entrance opening to extend below the car opening for safety.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Measurements and Inspection: Complete responsibility for detailed dimensions lies with the elevator contractor. In the execution of the work, the elevator contractor must verify all dimensions with the actual conditions.

1. Prepare written report, endorsed by elevator contractor, listing conditions detrimental to performance of the work.
2. Proceed with work only after unsatisfactory conditions have been corrected.
3. The elevator contractor shall verify with the Authority Having Jurisdiction the status of all mandated inspections, tests, and any outstanding violations or fines incurred.

3.2 INSTALLATION

A. Complete the work with skilled workers in strict accordance with the accepted shop drawings and other submittals.

B. Comply with the code, manufacturer's instructions and recommendations.

C. Coordinate work with the work of other trades for proper time and sequence to avoid construction delays and to insure right-of-way system. Use lines and levels to insure dimensional coordination of the work.

D. Accurately and rigidly secure supporting elements within the hoistway to within the tolerance established.

E. Provide and install motors, switches, controls, safety and all operating devices in strict accordance with the submitted wiring diagrams and applicable codes and regulations having jurisdiction.

F. After installation, touch up in the field surfaces of shop primed elements, which have become scratched or damaged.

G. Lubricate operating parts of system, as recommended by the manufacturer.

H. Bevel any ledges, setback, recess, or projection in the hoistway that measures 4 inches or more in width shall be beveled at an angle of not less than 75 degrees from horizontal. Each bevel plate shall be

constructed to conform to ASME A17.1 elevator safety code. Provide patching of hoistway walls.

I. Elevator contractor is responsible for cutting and patching of walls and floors.

3.3 PAINTING OF COMPONENTS / EQUIPMENT

A. Before shipment, all parts made of structural steel section and plates shall be thoroughly cleaned to remove all loose mill scale, rust and foreign matter. Except where encased in concrete, all these parts shall be given one coat of rustproof paint, applied thoroughly and evenly, and well worked into the joints and other spaces. Parts that will be inaccessible after assembly shall be given two shop coats.

B. Machine finished surfaces shall be protected against corrosion by effective means approved by the owner as soon as the machining is completed. All new machinery and equipment shall be given a shop finish of the best quality paint normally used by the manufacturer of the machinery or equipment. After final adjustment of all machinery, work, metal fittings, etc., exposed in the hoistways or elsewhere, all shall be painted one coat in the field. All machinery, cabinets, etc., shall be painted the same color and numbered as required by code. All surface holes and imperfections shall be filled with iron filler thoroughly rubbed in and smoothed off. Upon completion of the installation, all equipment, new and existing, shall be thoroughly cleaned and touched-up as required, and given two additional coats of machine enamel and a coat of high-grade waterproof varnish.

C. Completely clean and paint the following areas:

1. The machine room and pit area shall be painted by the elevator contractor at the completion of the project, using an appropriate paint approved by the owner.

3.4 FINAL CLEAN-UP

A. Upon completion of the work covered by the contract, the elevator contractor shall leave the completed Project ready for use without the need of further cleaning of any kind and with all work in perfect order. In addition, upon completion of all work the elevator contractor shall remove from the vicinity of the work and from the building's rubbish, unused materials, and other materials belonging to him or used under his direction during construction and legally dispose of same. If during this period, he impairs the use or appearance of the property, he shall restore such areas, affected by the work, to their original condition. In the event of his failure to do so, the same shall be removed by the owner at the expense of the elevator contractor, and he and his guarantee shall be liable therefore.

B. Upon completion of modernization for the elevator thoroughly clean all elevator motor rooms and hoistway enclosures including overheads, secondaries, hoistway enclosures, setbacks, sills, pits, car tops and all related elevator equipment.

3.5 ACCEPTANCE AND TURNOVER

A. Testing and Inspection:

1. The elevator contractor shall secure and pay for all inspections and tests required for the work. Provide proper facilities, at all times, for inspections and tests of work by consultant and authorities having jurisdiction. Furnish labor, equipment, materials and services necessary to conduct all tests and inspections.
2. Upon completion of installation of all equipment and when same is in full operating condition, coordinate with the owner to completely test all equipment, both for the governing authorities and for compliance with the requirements of the Contract Documents. All necessary equipment for

testing and the cost of same shall be included as part of this contract. All tests shall be performed in accordance with the requirements of the governing code.

3. If tests show that the equipment is in any way defective, of poor workmanship, at variance with the requirements of the Contract Documents, or dangerous or objectionable in operation, the elevator contractor shall make all necessary changes and remedy all defects at his expense, to the satisfaction of the consultant, and also pay, as hereinbefore noted, for all subsequent tests until all equipment is acceptable.
4. Upon completion of satisfactory tests, secure and furnish to the consultant certificates from all authorities having jurisdiction, that the conveying systems and related equipment have been inspected and approved.
5. Review and acceptance of equipment by the consultant is contingent upon prior approval of the above referenced authorities and compliance by the elevator contractor with all requirements of such authorities and the Contract Documents.
6. Elevator contractor shall provide at least TEN (10) DAYS prior written notice to the owner and consultant regarding the exact date on which work will be tested by the authority having jurisdiction.

END OF SECTION 142423

SECTION 220500
COMMON WORK RESULTS FOR PLUMBING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Piping materials and installation instructions common to most piping systems.

B. Dielectric fittings

C. Escutcheons

D. Grout

E. Plumbing demolition

F. Equipment installation requirements common to equipment sections

G. Painting and finishing

H. Concrete bases

I. Supports and anchorages

1.02 RELATED REQUIREMENTS

A. Section 01 3000 - Administrative Requirements: Submittal procedures, project meetings, progress schedules and documentation, reports, coordination.

B. Section 01 6000 - Product Requirements: Fundamental product requirements, substitutions and product options, delivery, storage, and handling.

C. Section 01 7000 - Execution Requirements: Examination, preparation, and general installation procedures; preinstallation meetings; cutting and patching; cleaning and protection; starting of systems; demonstration and instruction; closeout procedures except payment procedures; requirements for alterations work.

D. Section 01 7800 - Closeout Submittals: Project record documents, operation and maintenance (O&M) data, warranties and bonds.

E. Section 01 7900 - Demonstration and Training: Detailed requirements.

F. Section 02 4100 - Demolition: Selective demolition, site demolition, structure removal.

1.03 ABBREVIATIONS AND ACRONYMS

A. The following are industry abbreviations for plastic materials:
   1. ABS: Acrylonitrile-butadiene-styrene plastic
   2. CPVC: Chlorinated polyvinyl chloride plastic
   3. PE: Polyethylene plastic
   4. PVC: Polyvinyl chloride plastic

B. The following are industry abbreviations for rubber materials:
   1. EPDM: Ethylene-propylene-diene terpolymer rubber
   2. NBR: Acrylonitrile-butadiene rubber

1.04 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.05 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

B. Refer to individual specification sections.

1.06 QUALITY ASSURANCE

A. Designer Qualifications: Perform design under direct supervision of a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

C. Installer Qualifications: Company specializing in performing the work of this section with minimum 5 years of experience.

D. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

E. All components used in the domestic water system shall be lead free and shall conform to the safe drinking water act, as amended 01-04-2011 Section 1417.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.08 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for plumbing installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

C. Coordinate requirements for access panels and doors for plumbing items requiring access that are concealed behind finished surfaces.

D. Coordinate installation of plumbing systems with all other Trades.

1.09 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Refer to individual specification sections for additional warranty requirements.

PART 2 PRODUCTS

2.01 JOINING MATERIALS

A. Refer to individual Division 22 piping Sections for special joining materials not listed below.

B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

C. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

2.02 DIELECTRIC FITTINGS

A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure, and temperature.

C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 degrees F.
   1. Available Manufacturers:
      a. Capitol Manufacturing Co. or equal
      b. Central Plastics Company.
      c. Watts Industries, Inc.; Water Products Div.
      d. Zurn Industries, Inc.; Wilkins Div.

D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.
   1. Available Manufacturers:
      a. Capitol Manufacturing Co. or equal
      b. Central Plastics Company.
      c. Watts Industries, Inc.; Water Products Div.
      d. Substitutions: See Section 01 6000 - Product Requirements.

E. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
   1. Available Manufacturers:
      a. Advance Products & Systems, Inc. or equal
      b. Calpico, Inc.
      c. Central Plastics Company.
      d. Pipeline Seal and Insulator, Inc.
   2. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig minimum working pressure where required to suit system pressures.

F. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 degrees F.
   1. Available Manufacturers:
      a. Calpico, Inc. or equal
      b. Lochinvar Corp.
      c. Substitutions: See Section 01 6000 - Product Requirements.

G. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 degrees F.
   1. Available Manufacturers:
      a. Perfection Corp. or equal
      b. Precision Plumbing Products, Inc.
      c. Sioux Chief Manufacturing Co., Inc.
      d. Victaulic Co. of America.

2.03 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.

C. One-Piece, Cast-Brass Type: With set screw.
   1. Finish: Polished chrome-plated.

D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
   1. Finish: Polished chrome-plated.

E. One-Piece, Stamped-Steel Type: With set screw and chrome-plated finish.

F. Split-Plate, Stamped-Steel Type: With concealed hinge, set screw, and chrome-plated finish.

G. One-Piece, Floor-Plate Type: Cast-iron floor plate.

H. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

2.04 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

B. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, non gaseous, and recommended for interior and exterior applications.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 EXECUTION

3.01 PLUMBING DEMOLITION

A. Refer to Division 01 Section "Cutting and Patching" and Division 02 Section "Selective Structure Demolition" for general demolition requirements and procedures.

B. Disconnect, demolish, and remove plumbing systems, equipment, and components indicated to be removed.
   1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
   2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material. All ends of pipe shall be capped.
   3. Equipment to Be Removed: Disconnect and cap services and remove equipment.
   4. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
   5. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
   6. Refer to demolition notes on Drawings.

C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

D. Relocation of Existing Plumbing Work:
   1. Where existing plumbing systems pass through renovated areas to serve other portions of the building, they shall be suitably relocated or modified to avoid conflict with new work.
   2. Remove, relocate and extend existing installations to accommodate new construction.

3. Repair adjacent construction and finishes damaged during demolition and extension work.
4. Maintain access to existing plumbing installations that remain active. Modify installation or provide access panels as appropriate.
5. Extend existing installations using materials and methods compatible with existing plumbing installations or as specified.

E. Maintaining Existing Services:
1. The Owner will occupy portions of the existing building during construction, and the plumbing systems associated with these portions of the building shall be kept in operation as much as possible. The duration of outages shall be kept to a minimum and they shall be scheduled and approved in advance by the Owner. Where necessary, provide temporary connections as required to maintain service. Refer to Division 02 Section "Selective Structure Demolition."

F. Demolition Notes:
1. Refer to individual notes on Drawings.

G. Examination:
1. Verify existing piping arrangements are as shown on Drawings.
2. Verify that abandoned piping serve only abandoned facilities.
3. Demolition Drawings are based on casual field observation and existing record documents. Report discrepancies to Engineer / Architect before disturbing existing installation.

H. Preparation:
1. Disconnect plumbing and drainage systems in walls, floors, and ceilings scheduled for removal.
2. Provide temporary water, drainage, and storm systems connections to maintain existing systems in service during construction.
3. Remove existing ceilings for installation of new plumbing and fire protection systems.

I. After construction, repair all areas surrounding the work to their condition prior to commencement of work. The Contractor shall replace any damaged tiles or ceiling grids caused by his work. The Contractor shall be responsible to provide the Owner with a Drawing indicating which ceiling tiles are already damaged and receive approval from the Owner that Drawings are accurate prior to the removal of any ceiling tiles.

3.02 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 22 Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation.
   1. Provide 2-inch clearance between insulated piping and other obstructions.

K. Select system components with pressure rating equal to or greater than system operating pressure.

L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:
   1. New Piping:
      a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
      b. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
      c. Insulated Piping: One-piece, stamped-steel type with spring clips.
      d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
      e. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece or split-casting, cast-brass type with polished chrome-plated finish.
      f. Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type with concealed or exposed-rivet and hinge.
      g. Bare Piping in Equipment Rooms: One-piece, stamped-steel type with set screw.
      h. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.
   2. Existing Piping: Use the following:
      a. Chrome-Plated Piping: Split-casting, cast-brass type with chrome-plated finish.
      b. Insulated Piping: Split-plate, stamped-steel type with concealed or exposed-rivet hinge and spring clips.
      c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-casting, cast-brass type with chrome-plated finish.
      d. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-casting, cast-brass type with chrome-plated finish.
      e. Bare Piping in Unfinished Service Spaces: Split-plate, stamped-steel type with concealed or exposed-rivet hinge and set screw or spring clips.
      f. Bare Piping in Equipment Rooms: Split-plate, stamped-steel type with set screw or spring clips.
      g. Bare Piping at Floor Penetrations in Equipment Rooms: Split-casting, floor-plate type.

M. Verify final equipment locations for roughing-in.

N. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.03 PIPE JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 22 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

E. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators.

F. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.04 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

B. Install unions, in piping NPS 2 and smaller, at final connection to each piece of equipment.

C. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.05 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install plumbing equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.

E. Install plumbing equipment in accordance with manufacturers written instructions.

F. Install water heaters and pressure vessels with required minimum state and local codes space requirements.

G. Install pressure relief valves in all pressure vessels to comply with all State and Local code requirements.

3.06 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.
6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
7. Use 3000-psi 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section "Cast-in-Place Concrete."

3.07 ERECTION OF METAL SUPORTS AND ANCHORAGES

A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor plumbing materials and equipment.

B. Field Welding: Comply with AWS D1.

3.08 GROUTING

A. Mix and install grout for plumbing equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

3.09 VISIT TO SITE

A. Prior to submission of bid, visit site and become familiar with existing conditions. Bids, as submitted, will be interpreted to include all costs and changes made necessary by existing conditions.

B. Verify, in field, the size, the location and elevation of all underground services affected by this work before proceeding with construction. Notify the Owners's Representative immediately in the event the location of existing utilities vary appreciably from those shown on Drawings.

3.10 RECORD DRAWINGS

A. Record Drawing shall indicate all valves with valve tag numbers noted on Drawings.

B. Ceiling access panels for all plumbing valves, cleanouts, traps, and other items of the plumbing system that require maintenance shall be shown on the Record Drawings.

3.11 ACCESS DOORS

A. Access doors furnished under this Contract must be compatible with the system in which they are to be installed including applicable ratings. In addition, access doors must be sized to allow for use of normal maintenance using normal tools and equipment.

B. This Contractor shall provide minimum 14 gauge stainless steel access panels for access to the rear connection and for maintenance of all rear-mounted security fixtures where access in not provided. Size shall be as indicated on the Drawings.

C. Refer to Division 08 Section "Access Doors and Panels".

3.12 CLOSEOUT ACTIVITIES

A. See Section 01 7800 - Closeout Submittals, for closeout submittals.

B. See Section 01 7900 - Demonstration and Training, for additional requirements.

C. See Section 01 7700 - Closeout Procedures.

D. Demonstrate proper operation of equipment to Owner's designated representative.

E. Demonstration: Demonstrate operation of system to Owner's personnel.
   1. Use operation and maintenance data as reference during demonstration.
   2. Conduct walking tour of project.

3. Briefly describe function, operation, and maintenance of each component.

F. Training: Train Owner's personnel on operation and maintenance of system.
   1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
   2. Provide minimum of two hours of training.
   3. Instructor: Manufacturer's training personnel.
   4. Location: At project site.

3.13 PROTECTION

A. Protect installed plumbing fixtures and equipment from subsequent construction operations.

END OF SECTION

SECTION 220519
METERS AND GAUGES FOR PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pressure gauges and pressure gauge taps.

B. Thermometers and thermometer wells.

1.02 REFERENCE STANDARDS

A. ASME B40.100 - Pressure Gauges and Gauge Attachments.

B. ASTM E1 - Standard Specification for ASTM Liquid-in-Glass Thermometers.

C. ASTM E77 - Standard Test Method for Inspection and Verification of Thermometers.

1.03 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide list that indicates use, operating range, total range and location for manufactured components.

C. Project Record Documents: Record actual locations of components and instrumentation.

1.04 FIELD CONDITIONS

A. Do not install instrumentation when areas are under construction, except for required rough-in, taps, supports and test plugs.

PART 2 PRODUCTS

2.01 PRESSURE GAUGES

A. Manufacturers:
   1. Dwyer Instruments, Inc or equal
   2. Moeller Instrument Company, Inc
   3. Omega Engineering, Inc
   4. Or equal.

B. Pressure Gauges: ASME B40.100, UL 393 drawn steel case, phosphor bronze bourdon tube, rotary brass movement, brass socket, with front recalibration adjustment, black scale on white background.
   1. Case: Steel with brass bourdon tube.
   2. Size: 4-1/2 inch diameter.
   3. Mid-Scale Accuracy: One percent.
   4. Scale: Psi and kPa.

2.02 PRESSURE GAUGE TAPPINGS

A. Gauge Cock: Tee or lever handle, brass for maximum 150 psi.

B. Needle Valve: Brass, 1/4 inch NPT for minimum 150 psi.

C. Pulsation Damper: Pressure snubber, brass with 1/4 inch connections.

D. Syphon: Steel, Schedule 40, 1/4 inch angle or straight pattern.

2.03 STEM TYPE THERMOMETERS

A. Manufacturers:
   1. Dwyer Instruments, Inc or equal
   2. Omega Engineering, Inc

3. Weksler Glass Thermometer Corp
4. Or equal

B. Thermometers - Adjustable Angle: Red- or blue-appearing non-toxic liquid in glass; ASTM E1; lens front tube, cast aluminum case with enamel finish, cast aluminum adjustable joint with positive locking device; adjustable 360 degrees in horizontal plane, 180 degrees in vertical plane.
   1. Size: 9 inch scale.
   2. Window: Clear Lexan.
   3. Stem: 3/4 inch NPT brass.
   4. Accuracy: 2 percent, per ASTM E77.
   5. Calibration: Degrees F.

2.04 THERMOMETER SUPPORTS

A. Socket: Brass separable sockets for thermometer stems with or without extensions as required, and with cap and chain.

2.05 TEST PLUGS

A. Manufacturers:
   1. Texas Fairfax Inc. or equal
   2. Peterson Equipment Company.
   3. Sisco Manufacturing Co..
   4. Or equal.

B. Test Plug: 1/4 inch or 1/2 inch brass fitting and cap for receiving 1/8 inch outside diameter pressure or temperature probe with neoprene core for temperatures up to 200 degrees F.

C. Test Kit: Carrying case, internally padded and fitted containing one 2-1/2 inch diameter pressure gauges, one gauge adapters with 1/8 inch probes, two 1 inch dial thermometers.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install thermometer sockets adjacent to controls systems thermostat, transmitter, or sensor sockets. Refer to Section 230943.

C. Provide instruments with scale ranges selected according to service with largest appropriate scale.

D. Install gauges and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.

E. Adjust gauges and thermometers to final angle, clean windows and lenses, and calibrate to zero.

F. Locate test plugs adjacent thermometers and thermometer sockets.

END OF SECTION

SECTION 220553
IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Pipe markers.

D. Ceiling tacks.

1.02 RELATED REQUIREMENTS

A. Section 099123 - Interior Painting: Identification painting.

1.03 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems.

1.04 SUBMITTALS

A. List: Submit list of wording, symbols, letter size, and color coding for mechanical and plumbing identification.

B. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

C. Product Data: Provide manufacturers catalog literature for each product required.

D. Manufacturer's Installation Instructions: Indicate special procedures, and installation.

E. Project Record Documents: Record actual locations of tagged valves.

PART 2 PRODUCTS

2.01 IDENTIFICATION APPLICATIONS

A. Piping: Pipe markers

B. Pumps: Nameplates.

C. Small-sized Equipment: Tags.

D. Valves: Tags and ceiling tacks where located above lay-in ceiling.

E. Water Heaters: Nameplates.

F. Specialties: Tags

2.02 NAMEPLATES

A. Manufacturers:
   1. Brimar Industries, Inc. or equal
   2. Kolbi Pipe Marker Co.
   3. Seton Identification Products

B. Description: Laminated three-layer plastic with engraved letters.
   1. Letter Color: White.
   2. Letter Height: 1/4 inch.
   3. Background Color: Black.
   4. Plastic: Comply with ASTM D709.
   5. Fasteners: Stainless-steel rivets or self-tapping screws.
   6. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

7. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

203 TAGS

A. Manufacturers:
   1. Advanced Graphic Engraving or equal
   2. Brady Corporation
   3. Brimar Industries, Inc.
   4. Kolbi Pipe Marker Co.
   5. Seton Identification Products

B. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.

C. Valve Tag Chart: Typewritten letter size list in anodized aluminum frame.
   1. Valve-tag schedule shall be included in operation and maintenance data.
   2. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space),normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

204 PIPE MARKERS

A. Manufacturers:
   1. Brady Corporation or equal
   2. Brimar Industries, Inc
   3. Kolbi Pipe Marker Co
   4. Seton Identification Products

B. Comply with ASME A13.1.

C. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.

D. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

E. Color code as follows:
   1. Potable, Cooling, Boiler, Feed, Other Water: Green with white letters.
   2. Domestic Hot Water and Return: Yellow with black letters
   3. Fire Quenching Fluids: Red with white letters.
   4. Sanitary DWV, Plumbing Traps, and Storm Drainage Piping: Green with white letters.
   5. Natural Gas: Yellow with black letters

205 CEILING TACKS

A. Manufacturers:
   1. Craftmark or equal
   2. Brady Co.
   3. Bunting, Inc

B. Description: Steel with 3/4 inch diameter color coded head.

C. Color code as follows:
   1. Plumbing Valves: Green.
   2. Plumbing traps and cleanouts: Green.

PART 3 EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.02 INSTALLATION

A. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install tags with corrosion resistant chain.

C. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.

D. Use tags on piping 3/4 inch diameter and smaller.

E. Pipe Label Installation:
   1. Identify service, flow direction, and pressure.
   2. Install in clear view and align with axis of piping.
   3. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.
   4. Pipes with OD, including insulation less than 6:
      a. Pretensioned pipe markers. Use size to insure a tight fit.
   5. Pipes with OD, including insulation 6 inches and larger:
      a. Shaped pipe markers. Use size to match pipe and secure with fasteners.

F. Nameplate Installation:
   1. Where valves, cleanouts, traps, etc., are located above removable tile ceilings or above access panels, provide identification labels on the corners of the tile or access panels. Nameplate shall be secured with screws or rivets or adhesive as recommended by the manufacturer.

G. Equipment Label Installation:
   1. Install on each major item of plumbing equipment.
   2. Locate equipment labels where accessible and visible.
   3. Name plate shall include all specific data, such as model number, serial number, motor data, horsepower, sizes, capacities, flows, working pressures, and similar factors as applicable. Pumps shall include head in feet and impeller sizes. The Contractor shall be responsible for furnishing and installing the identification plate if not provided by the equipment manufacturer.
      a. Water Heaters
      b. Pumps

END OF SECTION

SECTION 220719
PLUMBING PIPING INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Piping insulation.

1.02 RELATED REQUIREMENTS

A. Section 078400 - Firestopping.

B. Section 221005 - Plumbing Piping: Placement of hangers and hanger inserts.

1.03 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

B. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials.

C. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 GLASS FIBER

A. Manufacturers:
   1. Knauf Insulation; Earthwool 1000 Degree Pipe Insulation or equal
   2. Owens Corning Corporation; Fiberglas Pipe Insulation ASJ
   3. Owens Corning Corporation; VaporWick Pipe Insulation

B. Vapor Barrier Jacket: White Kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm-inches.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that piping has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Exposed Piping: Locate insulation and cover seams in least visible locations.

C. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.

D. Glass fiber insulated pipes conveying fluids below ambient temperature:
   1. Provide vapor barrier jackets, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
   2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.

E. For hot piping conveying fluids 140 degrees F or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.

F. Glass fiber insulated pipes conveying fluids above ambient temperature:
   1. Provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples.
   2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.

G. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet above finished floor): Finish with canvas jacket sized for finish painting.

END OF SECTION

SECTION 221005
PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pipe, pipe fittings, specialties, and connections for piping systems.
   1. Sanitary sewer.
   2. Domestic water.
   3. Flanges, unions, and couplings.
   4. Pipe hangers and supports.
   5. Valves.

1.02 RELATED REQUIREMENTS

A. Section 220553 - Identification for Plumbing Piping and Equipment.

B. Section 220719 - Plumbing Piping Insulation.

C. Section 330110.58 - Disinfection of Water Utility Piping Systems.

1.03 REFERENCE STANDARDS

A. ANSI Z223.1 - National Fuel Gas Code.

B. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300.

C. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.

D. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

E. ASTM B42 - Standard Specification for Seamless Copper Pipe, Standard Sizes.

F. ASTM B75/B75M - Standard Specification for Seamless Copper Tube.

G. ASTM B88 - Standard Specification for Seamless Copper Water Tube.

H. ASTM B302 - Standard Specification for Threadless Copper Pipe, Standard Sizes.

I. ASTM B813 - Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube.

J. ASTM D2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.

K. ASTM D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems.

L. ASTM D2729 - Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

M. ASTM D2855 - Standard Practice for the Two-Step (Primer & Solvent Cement) Method of Joining Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Piping Components with Tapered Sockets.

N. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation.

O. MSS SP-80 - Bronze Gate, Globe, Angle and Check Valves.

P. NSF 61 - Drinking Water System Components - Health Effects.

Q. NSF 372 - Drinking Water System Components - Lead Content.

1.04 QUALITY ASSURANCE

A. Perform work in accordance with applicable codes.

B. Valves: Manufacturer's name and pressure rating marked on valve body.

PART 2 PRODUCTS

201 GENERAL REQUIREMENTS

A. Potable Water Supply Systems: Provide piping, pipe fittings, and solder and flux (if used), that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

202 SANITARY SEWER PIPING, ABOVE GRADE

A. PVC Pipe: ASTM D2729.
   1. Fittings: PVC.
   2. Joints: Solvent welded, with ASTM D2564 solvent cement.

203 DOMESTIC WATER PIPING, ABOVE GRADE

A. Copper Tube: ASTM B88 (ASTM B88M), Type L (B), Drawn (H).
   1. Mechanical Press Sealed Fittings: Double pressed type, NSF 61 and NSF 372 approved or certified, utilizing EPDM, non toxic synthetic rubber sealing elements.
      a. Manufacturers:
         1) Apollo Valves or equal
         2) Grinnell Products
         3) Viega LLC

204 FLANGES, UNIONS, AND COUPLINGS

A. Unions for Pipe Sizes 3 Inches and Under:
   1. Ferrous pipe: Class 150 malleable iron threaded unions.
   2. Copper tube and pipe: Class 150 bronze unions with soldered joints.

B. Flanges for Pipe Size Over 1 Inch:
   1. Ferrous Pipe: Class 150 malleable iron threaded or forged steel slip-on flanges; preformed neoprene gaskets.
   2. Copper Tube and Pipe: Class 150 slip-on bronze flanges; preformed neoprene gaskets.

C. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

205 PIPE HANGERS AND SUPPORTS

A. Provide hangers and supports that comply with MSS SP-58.
   1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
   2. Overhead Supports: Individual steel rod hangers attached to structure or to trapeze hangers.
   3. Trapeze Hangers: Welded steel channel frames attached to structure.
   4. Vertical Pipe Support: Steel riser clamp.
   5. Rooftop Supports for Low-Slope Roofs: Steel pedestals with bases that rest on top of roofing membrane, not requiring any attachment to the roof structure and not penetrating the roofing assembly, with support fixtures as specified; and as follows:
      a. Bases: High density polypropylene.
      b. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
      c. Steel Components: Stainless steel, or carbon steel hot-dip galvanized after fabrication in accordance with ASTM A123/A123M.
      d. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports; corrosion resistant material.

e. Height: Provide minimum clearance of 6 inches under pipe to top of roofing.

B. Plumbing Piping - Water:
   1. Hangers for Pipe Sizes 1/2 Inch to 1-1/2 Inches: Malleable iron, adjustable swivel, split ring.

2.06 BALL VALVES

A. Manufacturers:
   1. Apollo Valves or equal
   2. Grinnell Products
   3. Nibco, Inc

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

D. Install piping to maintain headroom, conserve space, and not interfere with use of space.

E. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

F. Provide access where valves and fittings are not exposed.

G. Copper Pipe and Tube: Make soldered joints in accordance with ASTM B828, using specified solder, and flux meeting ASTM B813; in potable water systems use flux also complying with NSF 61 and NSF 372.

H. PVC Pipe: Make solvent-welded joints in accordance with ASTM D2855.

3.02 APPLICATION

A. Install unions downstream of valves and at equipment or apparatus connections.

B. Install gate valves for shut-off and to isolate equipment, part of systems, or vertical risers.

C. Provide spring loaded check valves on discharge of water pumps.

END OF SECTION

SECTION 221006
PLUMBING PIPING SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Drains.

B. Cleanouts.

C. Hose bibbs.

D. Washing machine boxes and valves.

E. Water hammer arrestors.

F. Sanitary waste interceptors.

G. Mixing valves.

H. Exterior penetration accessories.

1.02 RELATED REQUIREMENTS

A. Section 221005 - Plumbing Piping.

B. Section 223000 - Plumbing Equipment.

1.03 REFERENCE STANDARDS

A. ASME A112.6.3 - Floor and Trench Drains.

B. ASSE 1011 - Performance Requirements for Hose Connection Vacuum Breakers.

C. NSF 61 - Drinking Water System Components - Health Effects.

D. NSF 372 - Drinking Water System Components - Lead Content.

E. PDI-WH 201 - Water Hammer Arresters.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Manufacturer's Instructions: Indicate Manufacturer's Installation Instructions: Indicate assembly and support requirements.

C. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Specialties in Potable Water Supply Systems: Provide products that comply with NSF 61 and NSF 372 for maximum lead content.

2.02 DRAINS

A. Manufacturers:
   1. Jay R. Smith Manufacturing Company
   2. Josam Company
   3. Zurn Industries, LLC
   4. or equal.

B. Floor Drains:
   1. Manufacturers:
      a. Jay R. Smith Manufacturing Company:
      b. Zurn Industries

c. Josam
d. or equal

C. Floor Drain (FD-1):
1. ASME A112.6.3; lacquered cast iron or stainless steel, two piece body with double drainage flange, weep holes, reversible clamping collar, and round, adjustable nickel-bronze strainer.

D. Floor Drain (FD-2):
1. ASME A112.6.3; lacquered cast iron or stainless steel, two piece body with double drainage flange, weep holes, reversible clamping collar, and round, adjustable round nickel bronze strainer with removable perforated sediment bucket.

E. Floor Sink (FS-2):
1. Square lacquered cast iron body with integral seepage pan, epoxy coated interior, aluminum dome strainer, nickel bronze frame, grate as per drawings.

203 CLEANOUTS

A. Manufacturers:
1. Jay R. Smith Manufacturing Company or equal
2. Josam Company:
3. Zurn Industries, LLC:
4. or equal.

B. Cleanouts at Interior Finished Floor Areas
1. Lacquered cast iron body with anchor flange, reversible clamping collar, threaded top assembly, and round gasketed scored cover in service areas and round gasketed depressed cover to accept floor finish in finished floor areas.

204 HOSE BIBBS

A. Manufacturers:
1. Jay R. Smith Manufacturing Company or equal
2. Watts Regulator Company
3. Zurn Industries, LLC: Z-1333

B. Interior Hose Bibbs:
1. Bronze or brass with integral mounting flange, replaceable hexagonal disc, hose thread spout, chrome plated where exposed with lockshield and removable key, integral vacuum breaker in compliance with ASSE 1011.

205 WASHING MACHINE BOXES AND VALVES

A. Box Manufacturers:
1. IPS Corporation/Water-Tite
2. Oatey Supply Chain Services, Inc
3. Viega LLC
4. or equal.

B. Valve Manufacturers:
1. IPS Corporation/Water-Tite:
2. Viega LLC: www.viega.com/#sle.
3. Zurn Industries, LLC:
4. or equal.

C. Description: Plastic preformed rough-in box with brass long shank valves with wheel handles, socket for 2 inch waste, slip in finishing cover.

2.06 WATER HAMMER ARRESTORS

A. Manufacturers:
   1. Jay R. Smith Manufacturing Company:
   2. Watts Regulator Company, a part of Watts Water Technologies:
   3. Zurn Industries, LLC:
   4. or equal.

B. Water Hammer Arrestors:
   1. Stainless steel construction, bellows type sized in accordance with PDI-WH 201, precharged suitable for operation in temperature range minus 100 to 300 degrees F and maximum 250 psi working pressure.

2.07 SANITARY WASTE INTERCEPTORS

A. Grease Interceptors:
   1. Construction:
      a. Material: Epoxy coated fabricated steel.
      b. Rough-in: On floor.
      c. Accessories: Multi-weir baffle assembly, integral deep seal trap, removable integral flow control, sediment bucket.
      d. Cover: Steel, epoxy coated, non-skid with gasket, securing handle, and enzyme injection port, recessed for floor finish.
   2. Unit Rating: 25 gpm flow and 50 lbs grease capacity.

2.08 MIXING VALVES

A. Thermostatic Mixing Valves:
   1. Manufacturers:
      a. Leonard Valve Company or equal
      b. Lawler Manufacturing Co. Inc.
      c. Bradley Corp.
      d. or equal.
   2. Valve: Chrome plated cast brass body, stainless steel or copper alloy bellows, integral temperature adjustment.
   3. Accessories:
      a. Check valve on inlets.
      b. Volume control shut-off valve on outlet.
      c. Stem thermometer on outlet.
      d. Strainer stop checks on inlets.

2.09 EXTERIOR PENETRATION ACCESSORIES

A. Sealing Systems for Roof Penetrations: Premanufactured components and accessories as required to preserve integrity of roofing system and maintain roof warranty; suitable for piping, cables, and roofing system to be installed; designed to accommodate existing penetrations where applicable.

B. Plumbing Ventilation Thru Roof Accessories - Retrofit:
   1. Plumbing Pipe Extension Kit: Extends roof plumbing pipes above minimum clearance from roof surface per local codes and Authority Having Jurisdiction (AHJ).

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.

C. Install floor cleanouts at elevation to accommodate finished floor.

D. Install water hammer arrestors complete with accessible isolation valve on hot and cold water supply piping to lavatory sinks, washing machine outlets, or [_____].

E. Install air chambers on hot and cold water supply piping to each fixture or group of fixtures (each washroom). Fabricate same size as supply pipe or 3/4 inch minimum, and minimum 18 inches long.

END OF SECTION

SECTION 221123
FACILITY NATURAL-GAS PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pipe, pipe fittings, valves, and connections for natural gas piping systems.

1.02 RELATED REQUIREMENTS

A. Section 078400 - Firestopping.

B. Section 083100 - Access Doors and Panels.

C. Section 099113 - Exterior Painting.

D. Section 099123 - Interior Painting.

1.03 REFERENCE STANDARDS

A. ANSI Z21.18/CSA 6.3 - Gas Appliance Pressure Regulators.

B. ANSI Z21.80/CSA 6.22 - Line Pressure Regulators.

C. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300.

D. ASME B31.1 - Power Piping.

E. ASME B31.9 - Building Services Piping.

F. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

G. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.

H. MSS SP-70 - Cast Iron Gate Valves, Flanged and Threaded Ends.

I. MSS SP-85 - Cast Iron Globe & Angle Valves, Flanged and Threaded Ends.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Welder Certificate: Include welders certification of compliance with ASME BPVC-IX.

C. Project Record Documents: Record actual locations of valves.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with applicable codes.

B. Valves: Manufacturer's name and pressure rating marked on valve body.

C. Welding Materials and Procedures: Comply with ASME BPVC-IX and applicable state labor regulations.

D. Welder Qualifications: Certified in accordance with ASME BPVC-IX.

E. Identify pipe with marking including size, ASTM material classification, and ASTM specification.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary protective coating on cast iron and steel valves.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 PRODUCTS

201 NATURAL GAS PIPING, ABOVE GRADE

A. Steel Pipe: ASTM A53/A53M, Schedule 40 black.
   1. Fittings: ASME B16.3, malleable iron, or ASTM A234/A234M, wrought steel welding type.
   2. Joints: Threaded or welded to ASME B31.1.

202 FLANGES, UNIONS, AND COUPLINGS

A. Unions for Pipe Sizes 3 Inches and Under:
   1. Ferrous pipe: Class 150 malleable iron threaded unions.

203 PIPE HANGERS AND SUPPORTS

A. Provide hangers and supports that comply with MSS SP-58.
   1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
   2. Overhead Supports: Individual steel rod hangers attached to structure or to trapeze hangers.
   3. Trapeze Hangers: Welded steel channel frames attached to structure.
   4. Vertical Pipe Support: Steel riser clamp.
   5. Floor Supports: Concrete pier or steel pedestal with floor flange; fixture attachment.
   6. Hangers for steel gas pipe shall be provided with PVC coated hanger assemblies.
   7. Hangers for Pipe Sizes 1/2 inch to 1-1/2 inches: Carbon steel, adjustable swivel, split ring.
   8. Hangers for Pipe Sizes 2 inches and over: Carbon steel, adjustable clevis.

B. Hanger Fasteners: Attach hangers to structure using appropriate fasteners, as follows:
   1. Concrete Wedge Expansion Anchors: Complying with ICC-ES AC193.

204 BALL VALVES

A. Manufacturers:
   1. Apollo Valves or equal
   2. Milwaukee Valve Company
   3. Nibco, Inc

205 MANUAL GAS SHUTOFF VALVES

A. General Requirements:
   1. All valves used in the gas piping system shall be certified and UL/AGA listed for required gas pressure.

B. General Requirements for Metallic Valves, NPS 2 and Smaller: Comply with ASME B16.33. UL/AGA
   1. CWP Rating: 125 psig.
   2. Threaded Ends: Comply with ASME B1.20.1.
   3. Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.
   4. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch and smaller.

C. General Requirements for Metallic Valves, NPS 2-1/2 and Larger: Comply with ASME B16.38. UL/AGA.
   1. CWP Rating: 125 psig.
   2. Flanged Ends: Comply with ASME B16.5 for steel flanges.
   3. Tamperproof Feature: Locking feature for valves.

D. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim: MSS SP-110.
   1. Body: Bronze, complying with ASTM B 584, UL / AGA stamped
   2. Ball: Chrome-plated bronze.
   3. Stem: Bronze; blowout proof.
   4. Seats: Reinforced TFE; blowout proof.
   5. Packing: Threaded-body packnut design with adjustable-stem packing.
   6. Ends: Threaded, flared, or socket.
   7. CWP Rating: 600 psig.
   8. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
   9. Service: Suitable for natural-gas service.
   10. Manufacturers:
      a. Nibco T-585-70-UL
      b. Substitutions: See Section 01 6000 - Product Requirements.

E. Bronze Plug Valves: MSS SP-78.
   1. Body: Bronze, complying with ASTM B 584.UL/AGA
   2. Plug: Bronze.
   3. Ends: Threaded, socket, or flanged.
   4. Operator: Square head or lug type with tamperproof feature where indicated.
   5. Pressure Class: 125 psig.
   6. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
   7. Service: Suitable for natural-gas service.

F. Cast-Iron, Lubricated Plug Valves: MSS SP-78.UL/AGA
   1. Body: Cast iron, complying with ASTM A 126, Class B.
   2. Plug: Bronze or nickel-plated cast iron.
   3. Seat: Coated with thermoplastic.
   4. Stem Seal: Compatible with natural gas.
   5. Ends: Threaded or flanged.
   6. Operator: Square head or lug type with tamperproof feature where indicated.
   7. Pressure Class: 125 psig.
   8. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
   9. Service: Suitable for natural-gas service.

206 GAS PRESSURE REGULATORS

A. General Requirements:
   1. Single stage and suitable for natural gas.
   2. Steel jacket and corrosion-resistant components.
   3. Elevation compensator.
   4. End Connections: Threaded for regulators NPS 2 and smaller; flanged for regulators NPS 2-1/2 and larger.

B. Service Pressure Regulators: Comply with ANSI Z21.80.
   1. Body and Diaphragm Case: Cast iron or die-cast aluminum.
   2. Springs: Zinc-plated steel; interchangeable.
   3. Diaphragm Plate: Zinc-plated steel.
   4. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.

5. Orifice: Aluminum; interchangeable.
6. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
7. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.
8. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.
9. Overpressure Protection Device: Factory mounted on pressure regulator.
10. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.
11. Maximum Inlet Pressure: 100 psig.

C. Line Pressure Regulators: Comply with ANSI Z21.80.
1. Body and Diaphragm Case: Cast iron or die-cast aluminum.
2. Springs: Zinc-plated steel; interchangeable.
3. Diaphragm Plate: Zinc-plated steel.
4. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.
5. Orifice: Aluminum; interchangeable.
6. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
7. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.
8. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.
9. Overpressure Protection Device: Factory mounted on pressure regulator.
10. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.

D. Appliance Pressure Regulators: Comply with ANSI Z21.18.
1. Body and Diaphragm Case: Die-cast aluminum.
2. Springs: Zinc-plated steel; interchangeable.
3. Diaphragm Plate: Zinc-plated steel.
4. Seat Disc: Nitrile rubber.
5. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
6. Factory-Applied Finish: Minimum three-layer polyester and polyurethane paint finish.

E. Regulator may include vent limiting device, instead of vent connection, if approved by authorities having jurisdiction.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that excavations are to required grade, dry, and not over-excavated.

3.02 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.03 GAS PIPING SYSTEMS INSTALLATION

A. General gas service installation:
1. The Contractor shall contact the supplying gas company to coordinate all work related to the new gas service.

a. Perform site survey, research public utility records, and verify existing utility locations. Contact utility-locating service for area where Project is located.

2. Comply with NFPA 54, International Fuel Gas Code, and Gas Company's printed rules and installation for installation and purging of natural-gas piping.
3. All material and workmanship, both interior and exterior, shall meet the Gas Company's requirements.
4. All work downstream of the gas meter shall be provided by the Contractor under supervision of the Gas Company.
5. The Contractor shall obtain all approved certificates before start of any work; pay all required fees, and other charges required by the local authorities.
6. All gas regulators, except the main gas regulator at the Utilities gas meter set, shall be set by the contractor to provide required pressure.
7. The building's gas regulators pressure shall be calibrated when the building gas consumption is near full load.
8. When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting main buildings gas service regulator(s) to suit actual occupied conditions. Provide up to two visits for this purpose.
9. Identify all underground gas piping systems on "Record Drawings" by use of dimensions from fixed reference points.

B. Indoor piping installation:
1. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
2. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
3. Install natural-gas piping at uniform grade of 2 percent down toward drip and sediment traps.
4. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.
   a. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.
5. Extend individual relief vent connections for all interior service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap. Vent piping shall be copper and shall be at least two pipe sizes larger than connection to regulator with minimum diameter of 3/4".
6. Concealed Location Installations:
   a. Above Accessible Ceilings: Natural-gas piping and fittings may be installed in accessible spaces without containment conduit.
   b. Prohibited Locations:
      1) Do not install natural-gas piping in or through circulating air ducts, clothes or trash chutes, chimneys or gas vents (flues), ventilating ducts or elevator shafts.
      2) Do not install natural-gas piping in solid walls or partitions.
7. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.
8. Connect branch piping from top or side of horizontal piping.
9. Do not use natural-gas piping as grounding electrode.
10. Gas Pressure Regulator:

a. Verify all gas pressure is the correct pressure for the installation. Provide sensing line as required to control outlet pressure under all flow conditions. Adjustment of gas pressure regulators shall be performed by manufacturer representatives of the gas regulators, under actual load conditions. Provide written verification to Engineer and Owner that all gas pressure regulators are providing the required pressure.
b. Install pressure gage upstream and downstream from each line pressure regulator.

C. Outdoor piping installation:
1. Comply with requirements of Gas Company for all underground service and house piping.
2. The Contractor shall contact the Gas Company providing the service and coordinate all work related to the new gas service.
3. All work shall be provided by the Contractor under supervision of the Gas Company and/or by the Gas Company at the Contractor's expense.
4. The Contractor shall obtain all approved certificates before start of any work; pay all tapping fees, and other charges required by the local authorities.
5. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
a. Install steel pipe for sleeves smaller than 6 inches in diameter.
b. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.
6. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

D. Inserts:
1. Provide inserts for placement in concrete formwork.
2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.

E. Pipe Hangers and Supports:
1. Install in accordance with ASME B31.9.
2. Support horizontal piping as indicated.
3. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
4. Place hangers within 12 inches of each horizontal elbow.
5. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
6. Support vertical piping at every floor. Support riser piping independently of connected horizontal piping.
7. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

F. Painting of natural gas systems:
1. Painting shall be performed by the contractor installing the gas piping.
2. Paint exposed, exterior metal piping, valves, service regulators, service meters and meter bars and piping specialties, except components, with factory-applied paint or protective coating. Painting of exterior piping systems and components is specified in Section 09

9113.
a. Alkyd System: MPI EXT 5.1D.
1) Prime Coat: Alkyd anti - corrosive metal primer.
2) Intermediate Coat: Exterior alkyd enamel matching topcoat.
3) Topcoat: Exterior alkyd enamel semi gloss.
4) Color: Yellow or as recommended by the gas company.

3. Paint exposed, interior metal piping, valves, service regulators, service meters and meter bars, and piping specialties, except components, with factory-applied paint or protective coating. Painting of interior piping systems and components is specified in Section 09 9123.
a. Latex Over Alkyd Primer System: MPI INT 5.1Q.
1) Prime Coat: Alkyd anti - corrosive or Quick-drying alkyd metal primer.
2) Intermediate Coat: Interior latex matching topcoat.
3) Topcoat: Interior latex (flat).
4) Color: Yellow or as recommended by the Utility and Owner.

4. Damage and Touchup: Repair marred and damaged factory-applied finishes with materials and by procedures to match original factory finish.

G. Test and Inspections:
1. Test, inspect, and purge natural gas according to NFPA 54 and the International Fuel Gas Code and authorities having jurisdiction.
2. Natural-gas piping will be considered defective if it does not pass tests and inspections.
3. Prepare test and inspection reports.

3.04 APPLICATION

A. Outdoor piping systems:
1. Aboveground natural-gas piping shall be one of the following:
a. Steel pipe with malleable-iron fittings and threaded joints.
b. Steel pipe with wrought-steel fittings and welded joints.
c. Piping joining methods shall be approved by the supplying gas company.

B. Indoor piping systems for system pressure of .5 PSIG or less:
1. Aboveground, branch piping NPS 1 and smaller shall be one of the following:
2. Steel pipe with malleable-iron fittings and threaded joints.
3. Aboveground, distribution piping shall be one of the following:
a. NPS 2 and Smaller: Steel pipe with malleable-iron fittings and threaded joints.
b. NPS 2 1/2 and Larger: Steel pipe with wrought-steel fittings and welded joints.
4. Aboveground, distribution piping, within individual science rooms only or as indicated on drawings shall be one of the following:
a. NPS 2 and Smaller: Corrugated flexible stainless steel tubing.
b. Note: all corrugated flexible stainless steel piping systems shall be installed by Gastite certified installers and in accordance with Gastite design and installation guide latest edition.

C. Indoor piping systems for system pressure of between .5 PSIG and 2 PSIG:
1. Aboveground, branch piping NPS 1 and smaller shall be one of the following:
2. Steel pipe with malleable-iron fittings and threaded joints.
3. Aboveground, distribution piping shall be one of the following:
a. NPS 2 and Smaller: Steel pipe with malleable-iron fittings and threaded joints.
b. NPS 2 1/2 and Larger: Steel pipe with wrought-steel fittings and welded joints.

D. Above Ground Manual Gas Shutoff Valve Schedule:

1. Valves for pipe sizes NPS 2 and smaller at service meter/ building shutoff, shall be one of the following:
    a. One-piece, bronze ball valve with bronze trim.
    b. Two-piece, full-port, bronze ball valves with bronze trim.
    c. Bronze plug valve.
2. Valves for pipe sizes NPS 2-1/2 and larger shall be one of the following: Type shall as approved by supplying gas company
    a. Bronze plug valve.
    b. Cast-iron, Nonlubricated plug valve.
3. Distribution piping valves for pipe sizes NPS 2 and smaller shall be one of the following:
    a. One-piece, bronze ball valve with bronze trim.
    b. Two-piece, full-port, bronze ball valves with bronze trim.
    c. Bronze plug valve.
4. Distribution piping valves for pipe sizes NPS 2-1/2 and larger shall be one of the following:
    a. Bronze plug valve.
    b. Cast-iron, Nonlubricated plug valve.
5. Valves in branch piping for single appliance shall be one of the following:
    a. One-piece, bronze ball valve with bronze trim.
    b. Two-piece, full-port, bronze ball valves with bronze trim.
    c. Bronze plug valve.

3.05 SCHEDULES

A. Pipe Hanger Spacing:
1. Metal Piping:
    a. Pipe Size: 1/2 inches to 1-1/4 inches:
        1) Maximum Hanger Spacing: 6.5 ft.
        2) Hanger Rod Diameter: 3/8 inches.
    b. Pipe Size: 1-1/2 inches to 2 inches:
        1) Maximum Hanger Spacing: 10 ft.
        2) Hanger Rod Diameter: 3/8 inch.
    c. Pipe Size: 2-1/2 inches to 3 inches:
        1) Maximum Hanger Spacing: 10 ft.
        2) Hanger Rod Diameter: 1/2 inch.

END OF SECTION

SECTION 223000
PLUMBING EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Water Heaters:
   1. Commercial gas fired.

B. Diaphragm-type compression tanks.

1.02 REFERENCE STANDARDS

A. ASME BPVC-VIII-1 - Boiler and Pressure Vessel Code, Section VIII, Division 1: Rules for Construction of Pressure Vessels.

1.03 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

B. Certifications:
   1. Water Heaters: NSF approved.
   2. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 WATER HEATERS - REFER TO DRAWINGS

A. Manufacturers:
   1. A.O. Smith Water Products Co; HW 670 nat or equal
   2. Bock Water Heaters, Inc
   3. Rheem Manufacturing Company

B. Hydronic heating Boiler:
   1. Boiler shall have an input rating of 670,000 BTU per hour, an output rating of 543,000 BTU when fired using natural gas. The boiler shall be design certified by an ANSI approved/accredited independant rating laboratory. The boiler shall bear the ASME "H" stamp and shall be National Board registered for 160 PSI working pressure. Boiler shall be up flow type having all non-ferrous waterways and employing a copper finned heat exchanger and a tightly wound copper coil combustion chamber. Boiler shall be equipped with an electric gas valve of the step opening type, an adjustable limit control which will break the electric circuit on temperature rise, intermittant ignition with a 1 second shutdown in the event of pilot flame failure, a gas pressure regulator properly set for the gas to be supplied and a coil limit switch for shut-off in the event of excessive water tempteature, a certified draft diverter and a fully illustrated instruction manual. Certified for combustible flooring. Outer jacker shall be of baked enamel finish. The coil, heat exchanger and burner shall have a ten tear limited warrenty as outlined in the written warrenty.

2.02 DIAPHRAGM-TYPE COMPRESSION TANKS - REFER TO DRAWINGS

A. Manufacturers:
   1. Amtrol Inc or equal
   2. Bell & Gossett, a xylem brand
   3. Taco, Inc

B. Construction: Welded steel, tested and stamped in accordance with ASME BPVC-VIII-1; supplied with National Board Form U-1, rated for working pressure of 125 psig, with flexible

EPDM diaphragm sealed into tank, and steel legs or saddles.

C. Accessories: Pressure gauge and air-charging fitting, tank drain; precharge to match existing psig.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install plumbing equipment in accordance with manufacturer's instructions, as required by code, and complying with conditions of certification, if any.

B. Coordinate with plumbing piping and related fuel piping work to achieve operating system.

C. Domestic Water Storage Tanks:
   1. Provide steel pipe support, independent of building structural framing members.
   2. Clean and flush prior to delivery to site. Seal until pipe connections are made.

END OF SECTION

SECTION 224000
PLUMBING FIXTURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Classroom Sinks.

B. Laboratory sinks.

C. Hydration Stations.

D. Emergency Showers

E. Water closets

F. Urinals

G. Lavatories

H. Lavatory Systems

1.02 RELATED REQUIREMENTS

A. Section 064100 - Architectural Wood Casework: Preparation of counters for sinks and lavatories.

B. Section 123600 - Countertops: Preparation of counters for sinks and lavatories.

C. Section 221005 - Plumbing Piping.

D. Section 221006 - Plumbing Piping Specialties.

E. Section 223000 - Plumbing Equipment.

1.03 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

B. ASME A112.18.9 - Protectors/Insulators for Exposed Waste and Supplies on Accessible Fixtures; 2011 (Reaffirmed 2017).

C. ANSI Z358.1 - American National Standard for Emergency Eyewash and Shower Equipment; 2014.

D. ASME A112.6.1M - Supports for Off-the-Floor Plumbing Fixtures for Public Use; 1997 (Reaffirmed 2017).

E. ASME A112.18.1 - Plumbing Supply Fittings; 2018.

F. ASME A112.19.5 - Flush Valves and Spuds for Water Closets, Urinals, and Tanks; 2017.

G. ASSE 1070 - Performance Requirements for Water Temperature Limiting Devices; 2015.

H. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2017.

I. NSF 61 - Drinking Water System Components - Health Effects; 2017.

J. NSF 372 - Drinking Water System Components - Lead Content; 2016.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.

C. Manufacturer's Instructions: Indicate installation methods and procedures.

D. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016000 - Product Requirements, for additional provisions.
   2. Extra Faucet Washers: One set of each type and size.
   3. Extra Lavatory Supply Fittings: One set of each type and size.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept fixtures on site in factory packaging. Inspect for damage.

B. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

1.07 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Provide five year manufacturer warranty for electric water cooler.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Refer to drawings for plumbing fixture specifications.

B. Potable Water Systems: Provide plumbing fittings and faucets that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

2.02 REGULATORY REQUIREMENTS

A. Comply with applicable codes for installation of plumbing systems.

B. Perform work in accordance with local health department regulations.

2.03 LABORATORY SINK LES-1,HC

A. Single Compartment Epoxy Resin Bowl by others, Faucet by Plumbing Contractor: Refer to architectural drawings and Architectural specifications; Plumbing Contractor is to make all final connections.
   1. Drain: 1-1/2-inch by 1-1/2" chrome plated with cast brass P-trap
   2. Drain Location: Off-Centered rear.
   3. Faucet Holes: Single hole
   4. Supplies: Chrome plated copper with stops as specified under lavatory supplies and stops.

B. Faucet Manufacturers:
   1. T&S Brass Model BL-5700-01 or approved equal
   2. Chicago Faucet
   3. Zurn

C. Faucet:
   1. Single hole deck mounted mixing faucet with polished chrome plated brass body, Polished chrome plated swivel/rigid gooseneck with serrated tip outlet, include lock washer to convert swivel gooseneck to rigid, Quarter turn compression cartridges with spring checks, 4” metal vandal proof wristblade handles with blue and red buttons. Stainless Steel Supply hoses with 1/2" NPSM Male inlets. Faucet shall meet ADA ANSI/ICC

A117.1 requirements and be tested and certified to industries standards: ASME A112.18.1/CSA B125.1, and certified to NSF/ANSI 61, section 9 by CSA. T&S Brass model BL-5700-01 or approved equal.

2. Thermostatic Mixing Valve: In-line Mini bronze Thermostatic Mixing valve, meeting ASSE 1070 for “Point of Use” individual temperature control application

204 LABORATORY SINK LES-2,HC

A. Single Compartment Epoxy Resin Bowl by others, Faucet by Plumbing contractor: Refer to Architectural drawings and Architectural Specifications; Plumbing Contractor is to make all final connections.
   1. Drain: 1-1/2-inch by 1-1/2" chrome plated with cast brass P-trap.
   2. Drain Location: Off-Centered rear.
   3. Faucet Holes: Single hole
   4. Supplies: Chrome plated copper with stops as specified under lavatory supplies and stops.

B. Faucet Manufacturers:
   1. T&S Brass BL-5700-08 or approved equal
   2. Chicago Faucet
   3. Zurn

C. Faucet:
   1. Single hole deck mount mixing faucet. Quarter -turn Eterna cartridges with Spring checks, 4-arm handles, swivel Vacuum Breaker Nozzle, Serrated tip with 0.5 GPM flow control & 18" Flexible Stainless Steel Supply hoses with 1/2" NPSM Male inlets. Faucet shall meet ADA ANSI/ICC A117.1 requirements and be tested and certified to industries standards: ASME A112.18.1/CSA B125.1, and certified to NSF/ANSI 61, section 9 by CSA. Chicago Faucet Model 201-AHA8-317VPHCP or approved equal.

205 LABORATORY SINK LES-3,HC (BY CASEWORK SUPPLIER)

A. Single Compartment Epoxy Resin Bowl by others, Faucet by others: Refer to Architectural drawings and Architectural Specifications.
   1. Drain: 1-1/2-inch by 1-1/2" chrome plated with cast brass P-trap.
   2. Drain Location: Off-Centered rear.
   3. Supplies: Chrome plated copper with stops as specified under lavatory supplies and stops.

B. Faucet Manufacturers:
   1. T&S Brass Model BL-5707-03 or approved equal
   2. Chicago Faucet
   3. Zurn

C. Faucet:
   1. Combination science table deck mount vandal resistant laboratory faucet, quarter-turn Eterna cartridges with spring checks, 4-arm lab handles with vandal resistant screws, swivel/rigid vacuum breaker nozzles, include lock washer to convert swivel gooseneck to rigid, serrated tip outlets with 0.5 GPM flow controls and 1/2" NPSM male inlets. Faucet shall meet ADA ANSI/ICC A117.1 requirements and be tested and certified to industries standards: ASME A112.18.1/CSA B125.1, and certified to NSF/ANSI 61, section 9 by CSA. T&S Brass model BL-5707-03 or approved equal. Thermostatic Mixing Valve: In-line Mini bronze Thermostatic Mixing valve, meeting ASSE 1070 for “Point of Use” individual temperature control application.

206 LABORATORY SINK LES-4,HC (BY CASEWORK SUPPLPIER)

A. Single Compartment Epoxy Resin Bowl by others, Faucet by others: Refer to Architectural drawings and Architectural specifications
   1. Drain: 1-1/2-inch by 1-1/2" chrome plated with cast brass P-trap.
   2. Drain Location: Off-Centered rear.
   3. Faucet Holes: Single hole
   4. Supplies: Chrome plated copper with stops as specified under lavatory supplies and stops.

B. Faucet Manufacturers:
   1. T&S Brass Model BL-5707-01 or approved equal
   2. Chicago Faucet
   3. Zurn

C. Faucet:
   1. Single hole, single temperature deck mount vandal resistant laboratory faucet, quarter-tern Eterna cartridge with spring check, 4-arm lab handle with vandal resistant screw, swivel/rigid vacuum breaker nozzle, include lock washer to convert swivel gooseneck to rigid, serrated tip outlet with 0.5 GPM flow control and 1/2" NPSM male inlet. Faucet shall meet ADA ANSI/ICC A117.1 requirements and be tested and certified to industries standards: ASME A112.18.1/CSA B125.1, and certified to NSF/ANSI 61, section 9 by CSA. T&S Brass model BL-5707-01 or approved equal. Thermostatic Mixing Valve: In-line Mini bronze Thermostatic Mixing valve, meeting ASSE 1070 for “Point of Use” individual temperature control application

207 HYDRATION STATION WITH BOTTLE FILLER - EWC-1

A. Electric Water Cooler Manufacturers:
   1. Elkay Manufacturing Company; LZS8WSLK or approved equal

B. Water Cooler: Electric, mechanically refrigerated; surface mounted,; stainless steel top, vinyl on steel body, elevated anti-squirt bubbler with stream guard, automatic stream regulator, push button, mounting bracket; integral air cooled condenser and stainless steel grille.
   1. ELKAY ezH20 Model LZS8WSLK or approved equal with single cooler, filtered 8.0 GPH, light gray, chilling capacity of 8.0 GPH of 50 degree drinking water. Features shall include mechanically activated, hands free, visual monitor, filtered green ticker, laminar flow, anti-microbrial, real drain, furnished with flex-guard safety bubbler, pushbar activation. Product shall be wall mount for indoor applications, serving one station, unit shall be certified to UL 399 and CAN/CSA C22.2 No. 120. Unit shall be lead free which is certified to NSF/ANSI 61 & 372 (lead free) and meets federal, state and local low lead requirements. Provide one replacement filter. Provide bracing where required.

C. Bottle Filler: ezH20, Materials to match fountain.

208 HYDRATION STATION - EWC-2

A. Same as EWC-1 minus the bottle filler (Model LZS8L or equal). Mounting height to match existing.

209 HYDRATION STATION, BI-LEVEL WITH BOTTLE FILLER - EWC-3

A. Bi-level, Electric Water Cooler Manufacturers:
   1. Elkay Manufacturing Company; LZSTL8WSLP or approved equal

B. Water Cooler: Bi-level, electric, mechanically refrigerated; surface mounted, ADA compliant; stainless steel top, vinyl on steel body, elevated anti-squirt bubbler with stream guard, automatic stream regulator, push button, mounting bracket; integral air cooled condenser and

stainless steel grille.

1. ELKAY ezH20 Model LZSTL8WSLP or approved equal with bi-level ADA cooler, filtered 8.0 GPH, light gray, chilling capacity of 8.0 GPH of 50 degree drinking water. Features shall include mechanically activated, hands free, visual monitor, filtered green ticker, laminar flow, anti-microbrial, real drain, furnished with flex-guard safety bubbler, pushbar activation. Product shall be wall mount for indoor applications, serving one station, unit shall be certified to UL 399 and CAN/CSA C22.2 No. 120. Unit shall be lead free which is certified to NSF/ANSI 61 & 372 (lead free) and meets federal, state and local low lead requirements. Install per ADA/ANSI 117.1 requirements. Provide one replacement filter. Provide bracing where required.

C. Bottle Filler: EZh20 or equal, Materials to match fountain.

210 EMERGENCY SHOWERS

A. Emergency Shower: ANSI Z358.1; wall-mounted, self- cleaning, non-clogging 8 inch diameter stainless steel deluge shower head with elbow, one inch full flow valve with pull chain and 8 inch diameter ring, one inch interconnecting fittings.

B. Thermostatic Mixing Valve: Thermostatic mixing valve, ASSE 1070 listed, with combination stop, strainer, and check valves, and flexible stainless steel connectors.

211 WALL HUNG FLUSH VALVE WATER CLOSETS (W-1)

A. Water closets; vitreous china, ASME A112.19.2, wall hung, siphon jet action, 1.6 gallons per flush, china bolt caps.
   1. Bowl: 15" high with elongated rim
   2. Flush valve: Exposed (top spud)
   3. Valve operation: Manual, oscillating handle.
   4. Color: White.
   5. Manufacturers:
      a. American Standard Inc. or equal
      b. Kohler Company
      c. Zurn industries

B. Flush valves; ASME A112.18.1 piston type complete with vacuum breaker stops and accessories. All flush valves shall have a five year manufacturer warrenty on all components.
   1. Exposed type, chrome plated, escutcheon, integral screwdriver stop, seat bumper, supply tube support ring, and antimicrobrial handle.
   2. Manufacturers:
      a. American Standard or equal
      b. Sloan valve company
      c. Zurn industries

C. Seats;
   1. Manufacturers:
      a. American Standard or equal
      b. Olsonite
      c. Bemis Manufacturing company

212 WALL HUNG FLUSH VALVE WATER CLOSETS - ADA (W-1,HC)

A. Water Clostes, vitreous china, ASME A112.19.2, wall hung, siphon jet flush action, same as specified for W-1 except mounted for ADA compliant installation.

213 FLOOR MOUNTED FLUSH VALVE WATER CLOSETS (W-2)

A. Water closets; vitreous china, ASME A112.19.2, floor mounted, siphon jet flush action, 1.6 gallons per flush,
   1. Bowl: 15" high with elongated rim
   2. Flush valve: Exposed (top spud)
   3. Valve operation: Manual, oscillating handle.
   4. Color: White.
   5. Manufacturers:
      a. American Standard Inc. or equal
      b. Kohler Company
      c. Zurn industries

B. Flush valves; ASME A112.18.1 piston type complete with vacuum breaker stops and accessories. All flush valves shall have a five year manufacturer warrenty on all components.
   1. Exposed type, chrome plated, escutcheon, integral screwdriver stop, seat bumper, supply tube support ring, and antimicrobrial handle.
   2. Manufacturers:
      a. American Standard or equal
      b. Sloan valve company
      c. Zurn industries

C. Seats;
   1. Manufacturers:
      a. American Standard or equal
      b. Olsonite
      c. Bemis Manufacturing company

214 FLOOR MOUNTED FLUSH VALVE WATER CLOSETS (W-2,HC)

A. Water closets, vitreous china, ASME A112.19.2, floor mounted, siphon jet flush action, same as specified for W-2 except bowl at 18" height for an ADA compliant installation.

215 WALL HUNG URINAL (U-1)

A. Urinal, vitreous china, ASME A112.19.2, wall hung urinal with side shields and concealed carrier.
   1. Flush volume: 0.5 gallon, maximum
   2. Flush valve: Exposed, (top spud)
   3. High efficiency washout action
   4. Trap: Integral
   5. Removable stainless steel strainer

B. Manufacturers:
   1. American standard or equal
   2. Kohler company
   3. Zurn Industries

C. Flush valves: ASME A112.18.1, piston type complete with vacuum breaker stops and accessories.
   1. Exposed type, chrome plated, escutcheon, integral screwdriver stop.
   2. Manufacturers:
      a. Sloan Valve Company or equal
      b. Zurn industries
      c. Moen

2.16 WALL HUNG URINAL - ADA (U-1,HC)

A. Urinal, vitreous china, ASME A112.19.2, wall hung with side shields and concealed carrier. same as specified for U-1, except mounted for an ADA complinat installation.

2.17 LAVATORIES (L-1)

A. Vitreous china, wall hung basin, ASME A112.19.2, 18"x20" with 4" high back, retangular basin with splash lip, front overflow and soap depression.
   1. Manufacturers:
      a. American Standard or equal
      b. Kohler Company
      c. Zurn industries

B. Supply faucet:
   1. Deck mounted, 8' fixed center, concealed hot and cold lavatory faucet. chrom plated solid brass construction.
   2. Manufacturers:
      a. American standard or equal
      b. moen commercial
      c. T&S Brass

2.18 LAVATORIES - ADA (L-1,HC)

A. same as specified for L-1 except mounted for an ADA compliant installation.

2.19 LAVATORY SYSTEMS

A. Lavatory system (LXS-2), Two station modular lavatory system, solid surface and automatic spray head module

B. Lavatory system (LXS-3), Three station modular lavatory system, solid surface and automatic sprat head module.

C. Bowl and Sprayhead: Cast polyester resin complying with ANSI Z124.3 and ANSI Z124.6. Centerlines of each station to be 30" centers.

D. Lavatory system shall include all waste and supply connections to wall, two flexible stainless steel supply connections with contractor supplied ball valves, thermostatic mixing valve, strainer, check valves, and liquid soap dispenser. ADA compliant trap cover.

E. Color: As selected by Architect.

F. Lavatory stations shall be secured to a rigid base concealing all supply and waste connections. Additional wall support shall be provided behind each fixture.

G. Provide ball type shut-off valves within fixture for provisions on flushing prior to final connection to unit.

H. Manufacturers:
   1. Acorn engineering company or equal
   2. Bradley Manufacturing

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that walls and floor finishes are prepared and ready for installation of fixtures.

3.02 INSTALLATION

A. Install each fixture with trap, easily removable for servicing and cleaning.

B. Provide chrome plated rigid or flexible supplies to fixtures with loose key stops, reducers, and escutcheons.

C. Install components level and plumb.

D. Install and secure fixtures in place with wall supports and bolts.

3.03 INTERFACE WITH WORK OF OTHER SECTIONS

A. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

3.04 ADJUSTING

A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

3.05 CLEANING

A. Clean plumbing fixtures and equipment.

3.06 PROTECTION

A. Protect installed products from damage due to subsequent construction operations.

B. Repair or replace damaged products before Date of Substantial Completion.

3.07 SCHEDULES

A. Fixture Heights: Install fixtures to heights above finished floor as indicated.
   1. Drinking Fountain:
      a. Child: 30 inches to top of basin rim.
      b. Standard Adult: 40 inches to top of basin rim.
      c. Accessible: 36 inches to top of spout.

END OF SECTION

SECTION 230513
COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General construction and requirements.

B. Applications.

C. Single phase electric motors.

D. Three phase electric motors.

E. Electronically Commutated Motors (ECM).

1.02 REFERENCE STANDARDS

A. ABMA STD 9 - Load Ratings and Fatigue Life for Ball Bearings.

B. IEEE 112 - IEEE Standard Test Procedure for Polyphase Induction Motors and Generators.

C. NEMA MG 1 - Motors and Generators.

D. NFPA 70 - National Electrical Code.

1.03 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide wiring diagrams with electrical characteristics and connection requirements.

C. Manufacturer's Installation Instructions: Indicate setting, mechanical connections, lubrication, and wiring instructions.

D. Operation Data: Include instructions for safe operating procedures.

E. Maintenance Data: Include assembly drawings, bearing data including replacement sizes, and lubrication instructions.

F. The motor manufacturer shall be a member in good standing with the National Electrical Manufacturers Association (NEMA).

1.04 QUALITY ASSURANCE

A. Comply with NFPA 70.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect motors stored on site from weather and moisture by maintaining factory covers and suitable weather-proof covering. For extended outdoor storage, remove motors from equipment and store separately.

1.06 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Provide three year manufacturer warranty for motors larger than 1 horsepower.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Baldor Electric Company/ABB Group; <>

B. Leeson Electric Corporation; <>

C. Regal-Beloit Corporation (Century); <>

D. Or equal.

202 GENERAL CONSTRUCTION AND REQUIREMENTS

A. Electrical Service:
   1. Motors 1/2 HP and Smaller: 115 volts, single phase, 60 Hz.
   2. Motors Larger than 1/2 Horsepower: 208 or 460 volts, three phase, 60 Hz.

B. Construction:
   1. Open drip-proof type except where specifically noted otherwise.
   2. Design for continuous operation in 104 degrees F environment.
   3. Design for temperature rise in accordance with NEMA MG 1 limits for insulation class, service factor, and motor enclosure type.

C. Visible Nameplate: Indicating motor horsepower, voltage, phase, cycles, RPM, full load amps, locked rotor amps, frame size, manufacturer's name and model number, service factor, power factor, efficiency.

D. Wiring Terminations:
   1. Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70, threaded for conduit.
   2. For fractional horsepower motors where connection is made directly, provide threaded conduit connection in end frame.

203 APPLICATIONS

A. Exception: Motors less than 250 watts, for intermittent service may be the equipment manufacturer's standard and need not comply with these specifications.

204 SINGLE PHASE POWER - SPLIT PHASE MOTORS

A. Starting Torque: Less than 150 percent of full load torque.

B. Starting Current: Up to seven times full load current.

C. Breakdown Torque: Approximately 200 percent of full load torque.

D. Drip-proof Enclosure: Class A (50 degrees C temperature rise) insulation, NEMA Service Factor, prelubricated sleeve or ball bearings.

E. Enclosed Motors: Class A (50 degrees C temperature rise) insulation, 1.0 Service Factor, prelubricated ball bearings.

205 SINGLE PHASE POWER - PERMANENT-SPLIT CAPACITOR MOTORS

A. Starting Torque: Exceeding one fourth of full load torque.

B. Starting Current: Up to six times full load current.

C. Multiple Speed: Through tapped windings.

D. Open Drip-proof or Enclosed Air Over Enclosure: Class A (50 degrees C temperature rise) insulation, minimum 1.0 Service Factor, prelubricated sleeve or ball bearings, automatic reset overload protector.

206 SINGLE PHASE POWER - CAPACITOR START MOTORS

A. Starting Torque: Three times full load torque.

B. Starting Current: Less than five times full load current.

C. Pull-up Torque: Up to 350 percent of full load torque.

D. Breakdown Torque: Approximately 250 percent of full load torque.

E. Motors: Capacitor in series with starting winding; provide capacitor-start/capacitor-run motors with two capacitors in parallel with run capacitor remaining in circuit at operating speeds.

F. Drip-proof Enclosure: Class A (50 degrees C temperature rise) insulation, NEMA Service Factor, prelubricated sleeve bearings.

G. Enclosed Motors: Class A (50 degrees C temperature rise) insulation, 1.0 Service Factor, prelubricated ball bearings.

207 THREE PHASE POWER - SQUIRREL CAGE MOTORS

A. Starting Torque: Between 1 and 1-1/2 times full load torque.

B. Starting Current: Six times full load current.

C. Power Output, Locked Rotor Torque, Breakdown or Pull Out Torque: NEMA Design B characteristics.

D. Design, Construction, Testing, and Performance: Comply with NEMA MG 1 for Design B motors.

E. Insulation System: NEMA Class B or better.

F. Testing Procedure: In accordance with IEEE 112. Load test motors to determine free from electrical or mechanical defects in compliance with performance data.

G. Motor Frames: NEMA Standard T-Frames of steel, aluminum, or cast iron with end brackets of cast iron or aluminum with steel inserts.

H. Thermistor System (Motor Frame Sizes 254T and Larger): Three PTC thermistors embedded in motor windings and epoxy encapsulated solid state control relay for wiring into motor starter; refer to Section 262913.

I. Bearings: Grease lubricated anti-friction ball bearings with housings equipped with plugged provision for relubrication, rated for minimum ABMA STD 9, L-10 life of 20,000 hours. Calculate bearing load with NEMA minimum V-belt pulley with belt center line at end of NEMA standard shaft extension. Stamp bearing sizes on nameplate.

J. Sound Power Levels: To NEMA MG 1.

K. Part Winding Start Where Indicated: Use part of winding to reduce locked rotor starting current to approximately 60 percent of full winding locked rotor current while providing approximately 50 percent of full winding locked rotor torque.

L. Weatherproof Epoxy Sealed Motors: Epoxy seal windings using vacuum and pressure with rotor and starter surfaces protected with epoxy enamel; bearings double shielded with waterproof non-washing grease.

M. Nominal Efficiency: As indicated at full load and rated voltage when tested in accordance with IEEE 112.

N. Nominal Power Factor: As indicated at full load and rated voltage when tested in accordance with IEEE 112.

208 ELECTRONICALLY COMMUTATED MOTORS (ECM)

A. Manufacturers:
   1. US Motors, a brand of NIDEC Motor Corporation; <>
   2. Or equal.

B. Applications:
   1. Commercial:
      a. Roof Top Unit:

1) Operating Mode: Constant speed.
2) Input: Motor manufacturer to coordinate control requirements with the control board of the roof top unit and/or specified sequence of operation.
3) Shaft Extension: Single.
4) RPM: 300 through 1200.

b. Packaged Indoor, Air-Cooled Heat Pump:
1) Operating Mode: Constant cfm.
2) Input: Motor manufacturer to coordinate control requirements with the control board of the DX fan coil unit and/or specified sequence of operation.
3) Shaft Extension: Single.
4) Options: Remote mount control/User-Interface.
5) RPM: 300 through 1250.

c. Package Terminal Air Conditioner (PTAC):
1) Operating Mode: Constant speed.
2) Input: Motor manufacturer to coordinate control requirements with the control board of the PTAC and/or specified sequence of operation.
3) Shaft Extension: Single.
4) Options: Resilient mounting.
5) RPM: 600 through 1800.

d. Power Roof Ventilator (PRV):
1) Operating Mode: Constant cfm.
2) Input: Motor manufacturer to coordinate control requirements with the control board of the PRV and/or specified sequence of operation.
3) Shaft Extension: Single.
4) Options: Resilient mounting.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install securely on firm foundation. Mount ball bearing motors with shaft in any position.

C. Check line voltage and phase and ensure agreement with nameplate.

END OF SECTION

SECTION 230517
SLEEVES AND SLEEVE SEALS FOR HVAC PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pipe sleeves.

B. Manufactured sleeve-seal systems.

1.02 RELATED REQUIREMENTS

A. Section 078400 - Firestopping.

1.03 REFERENCE STANDARDS

A. ASTM C592 - Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type).

B. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate pipe materials used, jointing methods, supports, floor and wall penetration seals. Indicate installation, layout, weights, mounting and support details, and piping connections.

C. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016000 - Product Requirements, for additional provisions.
   2. Extra Valve Stem Packings: Two for each type and size of valve.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified this section.
   1. Minimum three years experience.

C. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store sleeve and sleeve seals in shipping containers, with labeling in place.

B. Provide temporary protective coating on cast iron and steel sleeves if shipped loose.

1.07 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 PIPE SLEEVES

A. Manufacturers:
   1. Flexicraft Industries; <>
   2. Or equal.

B. Vertical Piping:
   1. Sleeve Length: 1 inch above finished floor.

2. Provide sealant for watertight joint.
3. Drilled Penetrations: Provide 1-1/2 inch angle ring or square set in silicone adhesive around penetration.

C. Plastic or Sheet Metal: Pipe passing through interior walls, partitions, and floors, unless steel or brass sleeves are specified below.

D. Clearances:
1. Provide allowance for insulated piping.
2. Wall, Floor, Floor, Partitions, and Beam Flanges: 1 inch greater than external; pipe diameter.
3. All Rated Openings: Caulked tight with fire stopping material in compliance with ASTM E814 in accordance with Section 078400 to prevent the spread of fire, smoke, and gases.

2.02 MANUFACTURED SLEEVE-SEAL SYSTEMS

A. Manufacturers:
1. Advance Products & Systems, LLC; <>
2. Flexicraft Industries; <>
3. Or equal.

B. Modular/Mechanical Seal:
1. Synthetic rubber interlocking links continuously fill annular space between pipe and wall/casing opening.
2. Provide watertight seal between pipe and wall/casing opening.
3. Elastomer element size and material in accordance with manufacturer's recommendations.
4. Glass reinforced plastic pressure end plates.

PART 3 EXECUTION

3.01 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and foreign material, from inside and outside, before assembly.

3.02 INSTALLATION

A. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.

B. Install piping to conserve building space, to not interfere with use of space and other work.

C. Install piping and pipe sleeves to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

D. Structural Considerations:
1. Do not penetrate building structural members unless indicated.

E. Provide sleeves when penetrating footings, floors, walls, and partitions. Seal pipe including sleeve penetrations to achieve fire resistance equivalent to fire separation required.
1. Aboveground Piping:
a. Pack solid using mineral fiber in compliance with ASTM C592.
b. Fill space with an elastomer caulk to a depth of 0.50 inch where penetrations occur between conditioned and unconditioned spaces.
2. All Rated Openings: Caulk tight with fire stopping material in compliance with ASTM E814 in accordance with Section 078400 to prevent the spread of fire, smoke, and gases.
3. Caulk exterior wall sleeves watertight with lead and oakum or mechanically expandable chloroprene inserts with mastic-sealed components.

F. Manufactured Sleeve-Seal Systems:

1. Install manufactured sleeve-seal systems in sleeves located in grade slabs and exterior concrete walls at piping entrances into building.
2. Provide sealing elements of the size, quantity, and type required for the piping and sleeve inner diameter or penetration diameter.
3. Locate piping in center of sleeve or penetration.
4. Install field assembled sleeve-seal system components in annular space between sleeve and piping.
5. Tighten bolting for a water-tight seal.
6. Install in accordance with manufacturer's recommendations.

G. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

3.03 CLEANING

A. Upon completion of work, clean all parts of the installation.

B. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

END OF SECTION

SECTION 230519
METERS AND GAUGES FOR HVAC PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pressure gauges and pressure gauge taps.

B. Thermometers and thermometer wells.

C. Static pressure gauges.

D. Filter gauges.

1.02 REFERENCE STANDARDS

A. ASME B40.100 - Pressure Gauges and Gauge Attachments.

B. ASTM E1 - Standard Specification for ASTM Liquid-in-Glass Thermometers.

C. ASTM E77 - Standard Test Method for Inspection and Verification of Thermometers.

D. UL 393 - Indicating Pressure Gauges for Fire-Protection Service.

1.03 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide list that indicates use, operating range, total range and location for manufactured components.

C. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016000 - Product Requirements, for additional provisions.

1.04 FIELD CONDITIONS

A. Do not install instrumentation when areas are under construction, except for required rough-in, taps, supports and test plugs.

PART 2 PRODUCTS

2.01 PRESSURE GAUGES

A. Manufacturers:
   1. Dwyer Instruments, Inc; <>
   2. Moeller Instrument Company, Inc; <>
   3. Omega Engineering, Inc; <>
   4. Or equal.

B. Pressure Gauges: ASME B40.100, UL 393 drawn steel case, phosphor bronze bourdon tube, rotary brass movement, brass socket, with front recalibration adjustment, black scale on white background.
   1. Case: Steel with brass bourdon tube.
   2. Size: 4-1/2 inch diameter.
   3. Mid-Scale Accuracy: One percent.
   4. Scale: Psi.

2.02 PRESSURE GAUGE TAPPINGS

A. Gauge Cock: Tee or lever handle, brass for maximum 150 psi.

B. Needle Valve: Brass, 1/4 inch NPT for minimum 150 psi.

C. Pulsation Damper: Pressure snubber, brass with 1/4 inch connections.

2.03 STEM TYPE THERMOMETERS

A. Manufacturers:
   1. Dwyer Instruments, Inc; <>
   2. Omega Engineering, Inc; <>
   3. Weksler Glass Thermometer Corp; <>
   4. Or equal.

B. Thermometers - Adjustable Angle: Red- or blue-appearing non-toxic liquid in glass; ASTM E1; lens front tube, cast aluminum case with enamel finish, cast aluminum adjustable joint with positive locking device; adjustable 360 degrees in horizontal plane, 180 degrees in vertical plane.
   1. Size: 9 inch scale.
   2. Window: Clear Lexan.
   3. Stem: 3/4 inch NPT brass.
   4. Accuracy: 2 percent, per ASTM E77.
   5. Calibration: Degrees F.

2.04 THERMOMETER SUPPORTS

A. Socket: Brass separable sockets for thermometer stems with or without extensions as required, and with cap and chain.

2.05 TEST PLUGS

A. Test Plug: 1/4 inch or 1/2 inch brass fitting and cap for receiving 1/8 inch outside diameter pressure or temperature probe with Viton core for temperatures up to 400 degrees F.

2.06 STATIC PRESSURE GAUGES

A. Manufacturers:
   1. Dwyer Instruments, Inc; <>
   2. Omega Engineering, Inc; <>
   3. Veris Industries; <>
   4. Weksler Glass Thermometer Corp; <>
   5. Or equal.

B. 3-1/2 inch diameter dial in metal case, diaphragm actuated, black figures on white background, front recalibration adjustment, 2 percent of full scale accuracy.

C. Inclined manometer, red liquid on white background with black figures, front recalibration adjustment, 3 percent of full scale accuracy.

D. Accessories: Static pressure tips with compression fittings for bulkhead mounting, 1/4 inch diameter tubing.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide one pressure gauge per pump, installing taps before strainers and on suction and discharge of pump. Pipe to gauge.

C. Install pressure gauges with pulsation dampers. Provide gauge cock to isolate each gauge. Extend nipples to allow clearance from insulation.

D. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2 inch for installation of thermometer sockets. Ensure sockets allow clearance from insulation.

E. Install thermometer sockets adjacent to controls system thermostat, transmitter, or sensor sockets. <>Where thermometers are provided on local panels, duct or pipe mounted thermometers are not required.

F. Coil and conceal excess capillary on remote element instruments.

G. Provide instruments with scale ranges selected according to service with largest appropriate scale.

H. Install gauges and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.

I. Adjust gauges and thermometers to final angle, clean windows and lenses, and calibrate to zero.

J. Locate test plugs adjacent to pressure gages and pressure gage taps.

END OF SECTION

SECTION 230523
GENERAL-DUTY VALVES FOR HVAC PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Applications.

B. General requirements.

C. Globe valves.

D. Ball valves.

E. Check valves.

1.02 ABBREVIATIONS AND ACRONYMS

A. CWP: Cold working pressure.

B. EPDM: Ethylene propylene copolymer rubber.

C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

D. NRS: Nonrising stem.

E. OS&Y: Outside screw and yoke.

F. PTFE: Polytetrafluoroethylene.

G. TFE: Tetrafluoroethylene.

1.03 REFERENCE STANDARDS

A. ASME B1.20.1 - Pipe Threads, General Purpose (Inch).

B. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.

C. ASME B16.5 - Pipe Flanges and Flanged Fittings NPS 1/2 Through NPS 24 Metric/Inch Standard.

D. ASME B16.10 - Face-to-Face and End-to-End Dimensions of Valves.

E. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.

F. ASME B16.34 - Valves - Flanged, Threaded and Welding End.

G. ASME B31.9 - Building Services Piping.

H. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings.

I. AWWA C606 - Grooved and Shouldered Joints.

J. MSS SP-80 - Bronze Gate, Globe, Angle and Check Valves.

K. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on valves including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.

C. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

D. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts listings.

E. Maintenance Materials: Furnish Owner with one wrench for every five plug valves, in each size of square plug valve head.
   1. See Section 016000 - Product Requirements, for additional provisions.

1.05 QUALITY ASSURANCE

A. Manufacturer:
   1. Obtain valves for each valve type from single manufacturer.
   2. Company must specialize in manufacturing products specified in this section, with not less than three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:
   1. Minimize exposure of operable surfaces by setting plug and ball valves to open position.
   2. Protect valve parts exposed to piped medium against rust and corrosion.
   3. Protect valve piping connections such as grooves, weld ends, threads, and flange faces.
   4. Adjust globe, gate, and angle valves to the closed position to avoid clattering.
   5. Secure check valves in either the closed position or open position.
   6. Adjust butterfly valves to closed or partially closed position.

B. Use the following precautions during storage:
   1. Maintain valve end protection and protect flanges and specialties from dirt.
      a. Provide temporary inlet and outlet caps.
      b. Maintain caps in place until installation.
   2. Store valves in shipping containers and maintain in place until installation.
      a. Store valves indoors in dry environment.
      b. Store valves off the ground in watertight enclosures when indoor storage is not an option.

C. Exercise the following precautions for handling:
   1. Handle large valves with sling, modified to avoid damage to exposed parts.
   2. Avoid the use of operating handles or stems as rigging or lifting points.

PART 2 PRODUCTS

2.01 APPLICATIONS

A. Provide the following valves for the applications if not indicated on drawings:
   1. Throttling (Hydronic): Ball, Globe, and Plug.
   2. Isolation (Shutoff): Butterfly, Gate, and Ball.
   3. Swing Check (Pump Outlet):
      a. 2 NPS and Smaller: Bronze with bronze disc.
   4. Dead-End: Butterfly, single-flange (lug) type.

B. Substitutions of valves with higher CWP classes or SWP ratings for same valve types are permitted when specified CWP ratings or SWP classes are not available.

C. Required Valve End Connections for Non-Wafer Types:
   1. Steel Pipe:
      a. 2 NPS and Smaller: Threaded ends.
   2. Copper Tube:
      a. 2 NPS and Smaller: Threaded ends (Exception: Solder-joint valve-ends).

D. Heating Hot Water Valves:
   1. 2 NPS and Smaller, Brass and Bronze Valves:
      a. Ball: Full port, two piece, bronze trim.

b. Swing Check: Bronze disc, Class 125.
c. Globe: Bronze disc, Class 125.

202 GENERAL REQUIREMENTS

A. Valve Pressure and Temperature Ratings: No less than rating indicated; as required for system pressures and temperatures.

B. Valve Sizes: Match upstream piping unless otherwise indicated.

C. Valve Actuator Types:
1. Handwheel: Valves other than quarter-turn types.
2. Wrench: Plug valves with square heads.
3. Chainwheel: Device for attachment to valve handwheel, stem, or other actuator, of size and with chain for mounting height, as indicated in the "Valve Installation" Article.

D. Valves in Insulated Piping: Provide 2 NPS stem extensions and the following features:
1. Gate Valves: Rising stem.
2. Ball Valves: Extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.

E. Memory Stops: Fully adjustable after insulation is installed.

F. Valve-End Connections:
1. Threaded End Valves: ASME B1.20.1.
2. Flanges on Iron Valves: ASME B16.1 for flanges on iron valves.
3. Pipe Flanges and Flanged Fittings 1/2 NPS through 24 NPS: ASME B16.5.
4. Solder Joint Connections: ASME B16.18.
5. Grooved End Connections: AWWA C606.

G. General ASME Compliance:
1. Ferrous Valve Dimensions and Design Criteria: ASME B16.10 and ASME B16.34.
2. Building Services Piping Valves: ASME B31.9.

H. Bronze Valves:
1. Fabricate from dezincification resistant material.
2. Copper alloys containing more than 15 percent zinc are not permitted.

I. Source Limitations: Obtain each valve type from a single manufacturer.

203 BRONZE GLOBE VALVES

A. Class 125: CWP Rating: 200 psig:.
1. Comply with MSS SP-80, Type 1.
2. Body: Bronze; ASTM B62, with integral seat and screw in bonnet.
3. Ends: Threaded or solder joint.
4. Stem and Disc: Bronze or PTFE.
5. Packing: Asbestos free.
a. Handwheel: Malleable iron.
b. Manufacturers:
1) Apollo Valves; <>
2) Or equal.

204 BRASS BALL VALVES

A. Two Piece, Full Port with Stainless Steel Trim:
1. Comply with MSS SP-110.
2. SWP Rating: 150 psig.

3. CWP Rating: 600 psig.
4. Body: Forged brass.
5. Ends: Threaded.
6. Seats: PTFE or TFE.
7. Ball: Chrome-plated brass.
8. Manufacturers:
    a. Apollo Valves; <>
    b. Ferguson Enterprises Inc; <>
    c. Or equal.

2.05 BRONZE BALL VALVES

A. Two Piece, Full Port with Bronze or Brass Trim:
1. Comply with MSS SP-110.
2. SWP Rating: 150 psig.
3. CWP Rating: 600 psig.
4. Body: Bronze.
5. Ends: Threaded.
6. Seats: PTFE .
7. Stem: Bronze or brass.
8. Ball: Chrome plated brass.
9. Manufacturers:
    a. Apollo Valves; <>
    b. Viega LLC; <>
    c. Or equal.

2.06 BRONZE SWING CHECK VALVES

A. Class 125: CWP Rating: 200 psig (1380 kPa).
1. Comply with MSS SP-80, Type 3.
2. Body Design: Horizontal flow.
3. Body Material: Bronze, ASTM B62.
4. Ends: Threaded.
5. Disc: Bronze.
6. Manufacturers:
    a. Apollo Valves; <>
    b. Or equal.

PART 3 EXECUTION

3.01 EXAMINATION

A. Discard all packing materials and verify that valve interior, including threads and flanges are completely clean without signs of damage or degradation that could result in leakage.

B. Verify valve parts to be fully operational in all positions from closed to fully open.

C. Confirm gasket material to be suitable for the service, to be of correct size, and without defects that could compromise effectiveness.

D. Should valve is determined to be defective, replace with new valve.

3.02 INSTALLATION

A. Provide unions or flanges with valves to facilitate equipment removal and maintenance while maintaining system operation and full accessibility for servicing.

B. Provide separate valve support as required and locate valve with stem at or above center of piping, maintaining unimpeded stem movement.

C. Where valve support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welds.

D. Install check valves where necessary to maintain direction of flow as follows:
   1. Lift Check: Install with stem plumb and vertical.
   2. Swing Check: Install horizontal maintaining hinge pin level.

END OF SECTION

SECTION 230529
HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Support and attachment components for equipment, piping, and other HVAC/hydronic work.

1.02 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

C. ASTM A181/A181M - Standard Specification for Carbon Steel Forgings, for General - Purpose Piping.

D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.

E. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings.

F. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel.

G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

H. MFMA-4 - Metal Framing Standards Publication.

I. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation.

J. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components to be installed.
   2. Coordinate the work with other trades to provide additional framing and materials required for installation.
   3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
   4. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
   5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.04 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for channel (strut) framing systems, non-penetrating rooftop supports, post-installed concrete and masonry anchors, and thermal insulated pipe supports.

B. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.05 QUALITY ASSURANCE

A. Comply with applicable building code.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Installer Qualifications for Powder-Actuated Fasteners (when specified): Certified by fastener system manufacturer with current operator's license.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 SUPPORT AND ATTACHMENT COMPONENTS

A. General Requirements:
   1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of plumbing work.
   2. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.
   3. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supportedwith a minimum safety factor of 2.0. Include consideration for vibration, equipment operation, and shock loads where applicable.
   4. Do not use wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.
   5. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
      a. Indoor Dry Locations: Use zinc-plated steel or approved equivalent unless otherwise indicated.
      b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel, stainless steel, or approved equivalent unless otherwise indicated.
      c. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
      d. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.

B. Metal Channel (Strut) Framing Systems: Factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.
   1. Manufacturers:
      a. Cooper B-Line, a division of Eaton Corporation; <>
      b. Ferguson Enterprises Inc; <>
      c. Thomas & Betts Corporation; <>
      d. Unistrut, a brand of Atkore International Inc; <>
      e. Or equal.
      f. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.
   2. Provide factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.
   3. Comply with MFMA-4.
   4. Channel Material:
      a. Indoor Dry Locations: Use painted steel, zinc-plated steel, or galvanized steel.
      b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel.
   5. Minimum Channel Thickness: Steel sheet, 12 gage, 0.1046 inch.
   6. Minimum Channel Dimensions: 1-5/8 inch width by 13/16 inch height.

C. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.
   1. Minimum Size, Unless Otherwise Indicated or Required:

a. Equipment Supports: 1/2 inch diameter.
b. Piping up to 1 inch (27 mm) nominal: 1/4 inch diameter.
c. Piping larger than 1 inch (27 mm) nominal: 3/8 inch diameter.
d. Trapeze Support for Multiple Pipes: 3/8 inch diameter.

D. Steel Cable:
1. Manufacturers:
a. Ductmate Industries, Inc, a DMI Company
b. Or equal.
c. Substitutions: See Section 016000 - Product Requirements.
d. Source Limitations: Furnish associated fittings, accessories, and hardware produced by a single manufacturer.

E. Thermal Insulated Pipe Supports:
1. Manufacturers:
a. Aeroflex USA, Inc; <>
b. Buckaroos, Inc; <>
c. KB Enterprises; <>
d. Substitutions: See Section 016000 - Product Requirements.
2. General Construction and Requirements:
a. Insulated pipe supports to be provided at hanger, support, and guide locations on pipe requiring insulation or additional support.
b. Pipe supports to be provided for nominally sized, 1/2 inch to 30 inch iron pipes.
c. Insulation inserts to consist of rigid phenolic foam insulation surrounded by a 360 degree, PVC jacketing.
3. Products:
a. Aeroflex USA, Inc
b. Buckaroos, Inc; <>
c. Or equal.

F. Pipe Supports:
1. Operating Temperatures from 122 to 446 degrees F:
a. Overhead Support: MSS SP-58 Type 1 or 3 through 12, with appropriate saddle of MSS SP-58 Type 40 for insulated pipe.
b. Roller Support: MSS SP-58 Types 41 or 43 through 46, with appropriate saddle of MSS SP-58 Type 39 for insulated pipe.
c. Sliding Support: MSS SP-58 Types 35 through 38.

G. Beam Clamps: MSS SP-58 Types 19 through 23, 25 or 27 through 30 based on required load.
1. Manufacturers:
a. Ferguson Enterprises Inc; <>
b. Or equal.
c. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.
2. Material: ASTM A36/A36M carbon steel or ASTM A181/A181M forged steel.
3. Provide clamps with hardened steel cup-point set screws and lock-nuts for anchoring in place.

H. Strut Clamps: Two-piece pipe clamp.
1. Manufacturers:
a. Ferguson Enterprises Inc; <>
b. Or equal.

c. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.

I. Insulation Clamps: Two bolt-type clamps designed for installation under insulation.
   1. Manufacturers:
      a. Ferguson Enterprises Inc; <>

J. Pipe Hangers: For a given pipe run use hangers of the same type and material.
   1. Manufacturers:
      a. Ferguson Enterprises Inc; <>
      b. Or equal.
   2. Material: Malleable iron, ASTM A47/A47M; or carbon steel, ASTM A36/A36M.
   3. Provide coated or plated hangers to isolate steel hangers from dissimilar metal tube or pipe.

K. Intermediate Pipe Guides: Use pipe clamps with oversize pipe sleeve that provides clearance around pipe.
   1. Pipe Diameter 6 inches and Smaller: Provide minimum clearance of 0.16 inch.
   2. Pipe Diameter 8 inches: 0.625 inch U-bolt.

L. Pipe Alignment Guides: Galvanized steel.
   1. Pipe Diameter 8 inches and Smaller: Spider or sleeve type.

M. Dielectric Barriers: Provide between metallic supports and metallic piping and associated items of dissimilar type; acceptable dielectric barriers include rubber or plastic sheets or coatings attached securely to pipe or item.

N. Non-Penetrating Rooftop Supports for Low-Slope Roofs:
   1. Manufacturers:
      a. Cooper B-Line, a division of Eaton Corporation; <>
      b. Erico International Corporation, a brand of Pentair; <>
      c. Ferguson Enterprises Inc; <>
      d. PHP Systems/Design; <>
      e. Unistrut, a brand of Atkore International Inc; <>
      f. Or equal.
   2. Provide steel pedestals with thermoplastic or rubber base that rest on top of roofing membrane, not requiring any attachment to the roof structure and not penetrating the roofing assembly, with support fixtures as specified.
   3. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
   4. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports.
   5. Mounting Height: Provide minimum clearance of 6 inches under supported component to top of roofing.

O. Anchors and Fasteners:
   1. Manufacturers - Mechanical Anchors:
      a. Hilti, Inc; <>
      b. ITW Red Head, a division of Illinois Tool Works, Inc; <>
      c. Powers Fasteners, Inc; <>
      d. Simpson Strong-Tie Company Inc; <>
      e. Or equal.
   2. Manufacturers - Powder-Actuated Fastening Systems:
      a. Hilti, Inc; <>

b. ITW Ramset, a division of Illinois Tool Works, Inc; <>
c. Powers Fasteners, Inc; <>:
d. Simpson Strong-Tie Company Inc; <>
e. Or equal.

3. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.
4. Concrete: Use expansion anchors or screw anchors.
5. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.
6. Hollow Masonry: Use toggle bolts.
7. Hollow Stud Walls: Use toggle bolts.
8. Steel: Use beam clamps, machine bolts, or welded threaded studs.
9. Sheet Metal: Use sheet metal screws.
10. Wood: Use wood screws.
11. Plastic and lead anchors are not permitted.

P. Pipe Installation Accessories:
1. Copper Pipe Supports:
a. Manufacturers:
1) HoldRite, a brand of Reliance Worldwide Corporation; <>
2) Or equal.
3) Source Limitations: Furnish supports, associated fittings, accessories, and hardware produced by a single manufacturer.
2. Thermal Insulated Pipe Supports:
a. Manufacturers:
1) HoldRite, a brand of Reliance Worldwide Corporation; <>
2) Or equal.
3) Source Limitations: Furnish supports, associated fittings, accessories, and hardware produced by a single manufacturer.
3. Overhead Pipe Supports:
a. Manufacturers:
1) HoldRite, a brand of Reliance Worldwide Corporation; <>
2) Or equal.
3) Source Limitations: Furnish supports, associated fittings, accessories, and hardware produced by a single manufacturer.
4. Plenum Pipe Supports:
a. Manufacturers:
1) HoldRite, a brand of Reliance Worldwide Corporation; <>
2) Or equal.
3) Source Limitations: Furnish supports, associated fittings, accessories, and hardware produced by a single manufacturer.
5. Inserts and Clamps:
a. Manufacturers:
1) HoldRite, a brand of Reliance Worldwide Corporation; <>:
2) Or equal.
3) Source Limitations: Furnish supports, associated fittings, accessories, and hardware produced by a single manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive support and attachment components.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Provide independent support from building structure. Do not provide support from piping, ductwork, conduit, or other systems.

C. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.

D. Unless specifically indicated or approved by Architect, do not provide support from roof deck.

E. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

F. Provide thermal insulated pipe supports complete with hangers and accessories. Install thermal insulated pipe supports during the installation of the piping system.

G. Equipment Support and Attachment:
   1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
   2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
   3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
   4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

H. Secure fasteners according to manufacturer's recommended torque settings.

I. Remove temporary supports.

3.03 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Inspect support and attachment components for damage and defects.

C. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

D. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION

SECTION 230548
VIBRATION AND SEISMIC CONTROLS FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Vibration isolation requirements.

B. Vibration-isolated equipment support bases.

C. Vibration isolators.

1.02 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete.

B. Section 055000 - Metal Fabrications: Materials and requirements for fabricated metal supports.

1.03 REFERENCE STANDARDS

A. ASHRAE (HVACA) - ASHRAE Handbook - HVAC Applications.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate selection and arrangement of vibration isolation and/or seismic control components with the actual equipment to be installed.
   2. Coordinate the work with other trades to provide additional framing and materials required for installation.
   3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
   4. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 033000.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for products, including materials, fabrication details, dimensions, and finishes.
   1. Vibration Isolators: Include rated load capacities and deflections; include information on color coding or other identification method for spring element load capacities.

1.06 QUALITY ASSURANCE

A. Comply with applicable building code.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

201 VIBRATION ISOLATION REQUIREMENTS

A. Design and provide vibration isolation systems to reduce vibration transmission to supporting structure from vibration-producing HVAC equipment and/or HVAC connections to vibration-isolated equipment.

B. Comply with applicable general recommendations of ASHRAE (HVACA), where not in conflict with other specified requirements:

C. General Requirements:
   1. Select vibration isolators to provide required static deflection.
   2. Select vibration isolators for uniform deflection based on distributed operating weight of actual installed equipment.
   3. Select vibration isolators for outdoor equipment to comply with wind design requirements.
   4. Select vibration-isolated equipment support bases and associated vibration isolators to provide minimum 2 inch operating clearance beneath base unless otherwise indicated.

D. Equipment Isolation:
   1. Equipment <>: <>.
      a. Location: Outdoor.
      b. Mounting: Vibration-isolated curb rails.
      c. Base Depth: 4 inches.
      d. Isolator Type (Non-Seismic Application): Housed spring isolators.
      e. Isolator Static Deflection: 2 inches.

202 VIBRATION ISOLATORS

A. Manufacturers:
   1. Vibration Isolators:
      a. Kinetics Noise Control, Inc; <>
      b. Mason Industries; <>
      c. Vibration Eliminator Company, Inc; <>
      d. Or equal.
   2. Source Limitations: Furnish vibration-isolators and associated accessories produced by a single manufacturer and obtained from a single supplier.

B. General Requirements:
   1. Resilient Materials for Vibration Isolators: Oil, ozone, and oxidant resistant.
   2. Spring Elements for Spring Isolators:
      a. Color code or otherwise identify springs to indicate load capacity.
      b. Lateral Stability: Minimum lateral stiffness to vertical stiffness ratio of 0.8.
      c. Designed to operate in the linear portion of their load versus deflection curve over deflection range of not less than 50 percent above specified deflection.
      d. Designed to provide additional travel to solid of not less than 50 percent of rated deflection at rated load.
      e. Selected to provide designed deflection of not less than 75 percent of specified deflection.
      f. Selected to function without undue stress or overloading.

C. Vibration Isolators for Non-Seismic Applications:
   1. Housed Spring Isolators:
      a. Description: Isolator assembly consisting of single or multiple free-standing, laterally stable steel spring(s) within a metal housing.

b. Furnished with integral elastomeric snubbing elements, non-adjustable type, for limiting equipment movement and preventing metal-to-metal contact between housing elements.
c. Bottom Load Plate: Steel with non-skid elastomeric isolator pad with provisions for bolting to supporting structure as required.
d. Furnished with integral leveling device for positioning and securing supported equipment.

2. Spring Isolator Hangers, Non-Seismic:
a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing single or multiple free-standing, laterally stable steel spring(s) in series with an elastomeric element for the lower hanger rod connection.
b. Designed to accommodate misalignment of bottom hanger rod up to 30 degrees (plus/minus 15 degrees) without short circuiting of isolation.

2.03 ACOUSTICAL AND VIBRATION ISOLATORS

A. General Requirements:
1. Acoustical Isolation System: Through-stud isolators, pipe clamps, riser clamp pads, neoprene and felt lining material and associated support brackets.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that mounting surfaces are ready to receive vibration isolation and/or seismic control components and associated attachments.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.

C. Secure fasteners according to manufacturer's recommended torque settings.

D. Field-Welding (where approved by Architect): Comply with Section 055000.

E. Install flexible piping connections to provide sufficient slack for vibration isolation and/or seismic relative displacements as indicated or as required.

F. Vibration Isolation Systems:
1. Spring Isolators:
a. Position equipment at operating height; provide temporary blocking as required.
b. Lift equipment free of isolators prior to lateral repositioning to avoid damage to isolators.
c. Level equipment by adjusting isolators gradually in sequence to raise equipment uniformly such that excessive weight or stress is not placed on any single isolator.
2. Isolator Hangers:
a. Use precompressed isolator hangers where required to facilitate installation and prevent damage to equipment utility connection provisions.
b. Locate isolator hangers at top of hanger rods in accordance with manufacturer's instructions.
3. Clean debris from beneath vibration-isolated equipment that could cause short circuiting of isolation.

4. Use elastomeric grommets for attachments where required to prevent short circuiting of isolation.
5. Adjust isolators to be free of isolation short circuits during normal operation.
6. Do not overtighten fasteners such that resilient material isolator pads are compressed beyond manufacturer's maximum recommended deflection.

3.03 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Inspect vibration isolation and/or seismic control components for damage and defects.

C. Vibration Isolation Systems:
1. Verify isolator static deflections.
2. Verify required clearance beneath vibration-isolated equipment support bases.
3. Verify vibration isolation performance during normal operation; investigate sources of isolation short circuits.

D. Correct deficiencies and replace damaged or defective vibration isolation and/or seismic control components.

END OF SECTION

SECTION 230553
IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nameplates.

B. Pipe markers.

1.02 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems.

B. ASTM D709 - Standard Specification for Laminated Thermosetting Materials.

1.03 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.

C. Product Data: Provide manufacturers catalog literature for each product required.

D. Manufacturer's Installation Instructions: Indicate special procedures, and installation.

PART 2 PRODUCTS

2.01 IDENTIFICATION APPLICATIONS

A. Heat Pumps, Rooftop Units, Heating and Ventiliation Units: Nameplates

B. Control Panels: Nameplates.

C. Pumps: Nameplates.

2.02 NAMEPLATES

A. Manufacturers:
   1. Advanced Graphic Engraving, LLC; <>
   2. Brimar Industries, Inc; <>
   3. Craftmark Pipe Markers; <>
   4. Kolbi Pipe Marker Co; <>
   5. Seton Identification Products, a Tricor Direct Company; <>:
   6. Or equal.

B. Letter Color: White.

C. Letter Height: 1/2 inch.

D. Background Color: Black.

E. Plastic: Comply with ASTM D709.

2.03 PIPE MARKERS

A. Manufacturers:
   1. Brady Corporation; <>
   2. Brimar Industries, Inc; <>
   3. Craftmark Pipe Markers; <>
   4. Kolbi Pipe Marker Co; <>
   5. MIFAB, Inc; <>: www.mifab.com/#sle.
   6. Seton Identification Products, a Tricor Company; <>

B. Color: Comply with ASME A13.1.

C. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

D. Color code as follows:
   1. Heating, Cooling, and Boiler Feedwater: Green with white letters.

PART 3 EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.02 INSTALLATION

A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.

END OF SECTION

SECTION 230593
TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Testing, adjustment, and balancing of air systems.

B. Testing, adjustment, and balancing of hydronic and refrigerating systems.

C. Measurement of final operating condition of HVAC systems.

1.02 REFERENCE STANDARDS

A. AABC (NSTSB) - AABC National Standards for Total System Balance, 7th Edition.

B. ASHRAE Std 111 - Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems.

C. SMACNA (TAB) - HVAC Systems Testing, Adjusting and Balancing.

1.03 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. TAB Plan: Submit a written plan indicating the testing, adjusting, and balancing standard to be followed and the specific approach for each system and component.
   1. Include at least the following in the plan:
      a. List of all air flow, water flow, sound level, system capacity and efficiency measurements to be performed and a description of specific test procedures, parameters, formulas to be used.
      b. Copy of field checkout sheets and logs to be used, listing each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.
      c. Discussion of what notations and markings will be made on the duct and piping drawings during the process.
      d. Final test report forms to be used.
      e. Procedures for formal deficiency reports, including scope, frequency and distribution.

C. Control System Coordination Reports: Communicate in writing to the controls installer all setpoint and parameter changes made or problems and discrepancies identified during TAB that affect, or could affect, the control system setup and operation.

D. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
   1. Revise TAB plan to reflect actual procedures and submit as part of final report.
   2. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Architect and for inclusion in operating and maintenance manuals.
   3. Include actual instrument list, with manufacturer name, serial number, and date of calibration.
   4. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.
   5. Units of Measure: Report data in both I-P (inch-pound) and SI (metric) units.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

A. Perform total system balance in accordance with one of the following:
   1. AABC (NSTSB), AABC National Standards for Total System Balance.

2. ASHRAE Std 111, Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems.
3. SMACNA (TAB).

B. Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.

C. Where HVAC systems and/or components interface with life safety systems, including fire and smoke detection, alarm, and control, coordinate scheduling and testing and inspection procedures with the authorities having jurisdiction.

D. TAB Agency Qualifications:
1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.
2. Having minimum of three years documented experience.
3. Certified by one of the following:
a. AABC, Associated Air Balance Council; upon completion submit AABC National Performance Guaranty.
b. NEBB, National Environmental Balancing Bureau:
c. TABB, The Testing, Adjusting, and Balancing Bureau of National Energy Management Institute:

E. TAB Supervisor and Technician Qualifications: Certified by same organization as TAB agency.

3.02 EXAMINATION

A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
1. Systems are started and operating in a safe and normal condition.
2. Temperature control systems are installed complete and operable.
3. Proper thermal overload protection is in place for electrical equipment.
4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
5. Duct systems are clean of debris.
6. Fans are rotating correctly.
7. Fire and volume dampers are in place and open.
8. Air coil fins are cleaned and combed.
9. Access doors are closed and duct end caps are in place.
10. Air outlets are installed and connected.
11. Duct system leakage is minimized.
12. Hydronic systems are flushed, filled, and vented.
13. Pumps are rotating correctly.
14. Proper strainer baskets are clean and in place.
15. Service and balance valves are open.

B. Submit field reports. Report defects and deficiencies that will or could prevent proper system balance.

C. Beginning of work means acceptance of existing conditions.

3.03 PREPARATION

A. Hold a pre-balancing meeting at least one week prior to starting TAB work.
1. Require attendance by all installers whose work will be tested, adjusted, or balanced.

3.04 ADJUSTMENT TOLERANCES

A. Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.

B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.

C. Hydronic Systems: Adjust to within plus or minus 10 percent of design.

3.05 RECORDING AND ADJUSTING

A. Ensure recorded data represents actual measured or observed conditions.

B. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

C. Mark on drawings the locations where traverse and other critical measurements were taken and cross reference the location in the final report.

D. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

E. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

3.06 AIR SYSTEM PROCEDURE

A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities at site altitude.

B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.

C. Measure air quantities at air inlets and outlets.

D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.

E. Use volume control devices to regulate air quantities only to extend that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.

F. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.

G. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.

H. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.

I. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.

J. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.

K. Where modulating dampers are provided, take measurements and balance at extreme conditions. Balance variable volume systems at maximum air flow rate, full cooling, and at minimum air flow rate, full heating.

L. Measure building static pressure and adjust supply, return, and exhaust air systems to provide required relationship between each to maintain approximately 0.05 inches positive static pressure near the building entries.

3.07 WATER SYSTEM PROCEDURE

A. Adjust water systems to provide required or design quantities.

B. Use calibrated Venturi tubes, orifices, or other metered fittings and pressure gages to determine flow rates for system balance. Where flow metering devices are not installed, base flow balance on temperature difference across various heat transfer elements in the system.

C. Adjust systems to provide specified pressure drops and flows through heat transfer elements prior to thermal testing. Perform balancing by measurement of temperature differential in conjunction with air balancing.

D. Effect system balance with automatic control valves fully open to heat transfer elements.

E. Effect adjustment of water distribution systems by means of balancing cocks, valves, and fittings. Do not use service or shut-off valves for balancing unless indexed for balance point.

3.08 SCOPE

A. Test, adjust, and balance the following:
   1. HVAC Pumps.
   2. Packaged Roof Top Heating/Cooling Units.
   3. Packaged Terminal Air Conditioning Units.
   4. Packaged Indoor, Air-Cooled Heat Pump Units.
   5. Air Coils.
   6. Air Handling Units.
   7. Fans.
   8. Air Inlets and Outlets.

3.09 MINIMUM DATA TO BE REPORTED

A. Electric Motors:
   1. Manufacturer.
   2. Model/Frame.
   3. HP/BHP.
   4. Phase, voltage, amperage; nameplate, actual, no load.
   5. RPM.
   6. Service factor.
   7. Starter size, rating, heater elements.
   8. Sheave Make/Size/Bore.

B. Pumps:
   1. Identification/number.
   2. Manufacturer.
   3. Size/model.
   4. Impeller.
   5. Service.
   6. Design flow rate, pressure drop, BHP.
   7. Actual flow rate, pressure drop, BHP.
   8. Discharge pressure.
   9. Suction pressure.
   10. Total operating head pressure.
   11. Shut off, discharge and suction pressures.
   12. Shut off, total head pressure.

C. Heating Coils:

1. Identification/number.
2. Location.
3. Service.
4. Manufacturer.
5. Air flow, design and actual.
6. Water flow, design and actual.
7. Water pressure drop, design and actual.
8. Entering water temperature, design and actual.
9. Leaving water temperature, design and actual.
10. Entering air temperature, design and actual.
11. Leaving air temperature, design and actual.
12. Air pressure drop, design and actual.

D. Air Moving Equipment:
1. Inlet pressure.
2. Discharge pressure.
3. Sheave Make/Size/Bore.
4. Number of Belts/Make/Size.
5. Fan RPM.

E. Return Air/Outside Air:
1. Identification/location.
2. Design air flow.
3. Actual air flow.
4. Design return air flow.
5. Actual return air flow.
6. Design outside air flow.
7. Actual outside air flow.
8. Return air temperature.
9. Outside air temperature.
10. Required mixed air temperature.
11. Actual mixed air temperature.
12. Design outside/return air ratio.
13. Actual outside/return air ratio.

F. Exhaust Fans:
1. Location.
2. Manufacturer.
3. Model number.
4. Serial number.
5. Air flow, specified and actual.
6. Total static pressure (total external), specified and actual.
7. Inlet pressure.
8. Discharge pressure.
9. Sheave Make/Size/Bore.
10. Number of Belts/Make/Size.
11. Fan RPM.

G. Duct Traverses:
1. System zone/branch.
2. Duct size.
3. Area.

4. Design velocity.
5. Design air flow.
6. Test velocity.
7. Test air flow.
8. Duct static pressure.
9. Air temperature.
10. Air correction factor.

END OF SECTION

SECTION 230713
DUCT INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Duct insulation.

B. Duct liner.

C. Insulation jackets.

1.02 REFERENCE STANDARDS

A. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

B. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric).

C. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.

D. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.

E. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.

F. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation.

G. ASTM C916 - Standard Specification for Adhesives for Duct Thermal Insulation.

H. ASTM C1071 - Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material).

I. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

J. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials.

K. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

L. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials.

1.03 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

C. Manufacturer's Instructions: Indicate installation procedures necessary to ensure acceptable workmanship and that installation standards will be achieved.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section with not less than three years of documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified in this section, with minimum three years of experienceand approved by manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labelled with manufacturer's identification, including product density and thickness.

B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.06 FIELD CONDITIONS

A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.

B. Maintain temperature during and after installation for minimum period of 24 hours.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 GLASS FIBER, FLEXIBLE

A. Manufacturer:
   1. Johns Manville; <>
   2. JP Lamborn Co
   3. Knauf Insulation
   4. Owens Corning Corporation; <>
   5. CertainTeed Corporation; <>
   6. Or equal.

B. Insulation: ASTM C553; flexible, noncombustible blanket.
   1. 'K' value: 0.25 at 75 degrees F, when tested in accordance with ASTM C518.
   2. Maximum Service Temperature: 250 degrees F.
   3. Maximum Water Vapor Absorption: 5.0 percent by weight.

C. Vapor Barrier Jacket:
   1. Kraft paper with glass fiber yarn and bonded to aluminized film.
   2. Secure with pressure sensitive tape.

D. Vapor Barrier Tape:
   1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

E. Outdoor Vapor Barrier Mastic:
   1. Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.

F. Tie Wire: Annealed steel, 16 gage, 0.0508 inch diameter.

2.03 GLASS FIBER, RIGID

A. Manufacturer:
   1. Johns Manville; <>
   2. Knauf Insulation; <>
   3. Owens Corning Corporation
   4. CertainTeed Corporation; <>

B. Insulation: ASTM C612; rigid, noncombustible blanket.
   1. 'K' Value: 0.24 at 75 degrees F, when tested in accordance with ASTM C518.
   2. Maximum Service Temperature: 450 degrees F.
   3. Maximum Water Vapor Absorption: 5.0 percent.
   4. Minimum Density: 6.0 lb/cu ft.

C. Vapor Barrier Jacket:
   1. Kraft paper with glass fiber yarn and bonded to aluminized film.

2. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.
3. Secure with pressure sensitive tape.

D. Vapor Barrier Tape:
1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

E. Indoor Vapor Barrier Finish:
1. Cloth: Untreated; 9 oz/sq yd weight, glass fabric.
2. Vinyl emulsion type acrylic, compatible with insulation, black color.

204 JACKETS

A. Canvas Jacket: UL listed 6 oz/sq yd plain weave cotton fabric treated with dilute fire retardant lagging adhesive.
1. Lagging Adhesive:
a. Compatible with insulation.

B. Mineral Fiber (Outdoor) Jacket: Asphalt impregnated and coated sheet, 50 lb/square.

C. Aluminum Jacket: ASTM B209 (ASTM B209M).
1. Thickness: 0.016 inch sheet.
2. Finish: Embossed.
3. Joining: Longitudinal slip joints and 2 inch laps.
4. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.
5. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.

205 DUCT LINER

A. Manufacturers:
1. Armacell LLC
2. Ductmate Industries, Inc, a DMI Company; <>
3. Johns Manville; <>
4. Knauf Insulation; <>
5. Owens Corning Corporation
6. CertainTeed Corporation; <>
7. Or equal.

B.

C. Elastomeric Foam Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1, in sheet form.
1. Minimum Service Temperature: Minus 40 degrees F.
2. Maximum Service Temperature: 180 degrees F.
3. Fungal Resistance: No growth when tested according to ASTM G21.
4. Apparent Thermal Conductivity: Maximum of 0.28 at 75 degrees F.
5. Minimum Noise Reduction Coefficients:
a. 1 inch Thickness: 0.40.
6. Erosion Resistance: Does not show evidence of breaking away, flaking off, or delamination at velocities of 10,000 fpm per ASTM C1071.
7. Connection: Waterproof vapor barrier adhesive.

D. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation. Comply with ASTM C916.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that ducts have been tested before applying insulation materials.

B. Verify that surfaces are clean, foreign material removed, and dry.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Insulated ducts conveying air below ambient temperature:
   1. Provide insulation with vapor barrier jackets.
   2. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
   3. Insulate entire system including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.

C. Insulated ducts conveying air above ambient temperature:
   1. Provide with or without standard vapor barrier jacket.
   2. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.

D. Ducts Exposed in Mechanical Equipment Rooms or Finished Spaces (below 10 feet above finished floor): Finish with canvas jacket sized for finish painting.

3.03 SCHEDULES

A. Exhaust Ducts Within 10 ft of Exterior Openings:
   1. 2" Thick, Flexible or Rigid Glass Fiber Insulation

B. Outside Air Intake Ducts:
   1. 2" Thick, Flexible or Rigid Glass Fiber Insulation

C. Plenums:
   1. 2" Thick, Flexible or Rigid Glass Fiber Insulation

D. Plenums (Cooling System):
   1. 2" Thick, Flexible or Rigid Glass Fiber Insulation

E. Supply and Return Ducts:
   1. 2" Thick, Flexible or Rigid Glass Fiber Insulation
   2. 1" Duct Liner within 15 feet of fan discharge

END OF SECTION

SECTION 230719
HVAC PIPING INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Piping insulation.

B. Jackets and accessories.

1.02 RELATED REQUIREMENTS

A. Section 078400 - Firestopping.

B. Section 232300 - Refrigerant Piping: Placement of inserts.

1.03 REFERENCE STANDARDS

A. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

B. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric).

C. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.

D. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement.

E. ASTM C449 - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement.

F. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.

G. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation.

H. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.

I. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

J. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials.

K. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

C. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years of documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum three years of experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

1.07 FIELD CONDITIONS

A. Maintain ambient conditions required by manufacturers of each product.

B. Maintain temperature before, during, and after installation for minimum of 24 hours.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 GLASS FIBER, RIGID

A. Manufacturers:
   1. CertainTeed Corporation; <>
   2. Johns Manville Corporation; <>
   3. Knauf Insulation
   4. Owens Corning Corporation
   5. Or equal.

B. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible, with wicking material to transport condensed water to the outside of the system for evaporation to the atmosphere.
   1. K Value: ASTM C177, 0.23 at 75 degrees F.
   2. Maximum Service Temperature: 220 degrees F.
   3. Maximum Moisture Absorption: 0.2 percent by volume.

C. Vapor Barrier Jacket: White kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm-inches.

D. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.

E. Vapor Barrier Lap Adhesive: Compatible with insulation.

F. Insulating Cement/Mastic: ASTM C195; hydraulic setting on mineral wool.

G. Fibrous Glass Fabric:
   1. Cloth: Untreated; 9 oz/sq yd weight.
   2. Blanket: 1.0 lb/cu ft density.
   3. Weave: 5 by 5.

H. Indoor Vapor Barrier Finish:
   1. Cloth: Untreated; 9 oz/sq yd weight.
   2. Vinyl emulsion type acrylic, compatible with insulation, black color.

I. Outdoor Vapor Barrier Mastic: Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.

J. Insulating Cement: ASTM C449.

2.03 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Manufacturer:
   1. Aeroflex USA, Inc
   2. Armacell LLC
   3. K-Flex USA LLC
   4. Or equal.

B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1; use molded tubular material wherever possible.

1. Minimum Service Temperature: Minus 40 degrees F.
2. Maximum Service Temperature: 180 degrees F.
3. Connection: Waterproof vapor barrier adhesive.

C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.
1. Manufacturers:
a. Aeroflex USA, Inc
b. Or equal.
c. Substitutions: See Section 016000 - Product Requirements.

2.04 JACKETS

A. Aluminum Jacket: ASTM B209 (ASTM B209M) formed aluminum sheet.
1. Thickness: 0.016 inch sheet.
2. Finish: Embossed.
3. Joining: Longitudinal slip joints and 2 inch laps.
4. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.
5. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that piping has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Exposed Piping: Locate insulation and cover seams in least visible locations.

C. Insulated pipes conveying fluids below ambient temperature; insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.

D. Glass fiber insulated pipes conveying fluids below ambient temperature:
1. Provide vapor barrier jackets, factory-applied or field-applied; secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.

E. For hot piping conveying fluids over 140 degrees F, insulate flanges and unions at equipment.

F. Glass fiber insulated pipes conveying fluids above ambient temperature.
1. Provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples.
2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.

G. Inserts and Shields:
1. Application: Piping 1-1/2 inches diameter or larger.
2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
3. Insert location: Between support shield and piping and under the finish jacket.
4. Insert Configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.

5. Insert Material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.

H. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, refer to Section 078400.

I. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet above finished floor): Finish with canvas jacket sized for finish painting.

J. Exterior Applications: Provide vapor barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor barrier cement. Cover with aluminum jacket with seams located on bottom side of horizontal piping. Provide two coats of UV resistant finish for flexible elastomeric cellular insulation without jacketing.

3.03 SCHEDULE

A. Heating Systems:
   1. Heating Water Supply and Return:
      a. Piping less than 1-1/2": Rigid Glass Fiber Insulation, 1.5" Thick
      b. Piping 1-1/2" and greater: Rigid Glass Fiber Insulation, 2.0" Thick

B. Cooling Systems:
   1. Condensate Drains from Cooling Coils:
      a. All piping: Rigid Glass Fiber Insulation, 1.0" Thick
   2. Refrigerant Hot Gas and Suction:
      a. All piping: Flexible Elastomeric Insulation, 1.0' Thick

END OF SECTION

SECTION 230923
DIRECT DIGITAL CONTROL SYSTEM FOR HVAC

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 RELATED SECTIONS

A. This Section includes the Building Management System (BMS) control equipment for HVAC systems and components, including open protocol control components for terminal heating and cooling units. Depending on the scope of the project, the complete specification may have numerous sections that interface to this section, including several from Division 25, 26, & 28.

1.03 STANDARD TERMS

A. Standard
   1. ASHRAE: American Society Heating, Refrigeration, Air Conditioning Engineers
   2. AHU: Air Handling Unit
   3. BACnet: Building Automation Controls Network
   4. BMS: Building Management System
   5. DDC: Direct Digital Control
   6. EIA: Electronic Industries Alliance
   7. GUI: Graphical User Interface
   8. HVAC: Heating, Ventilation, and Air Conditioning
   9. IEEE: Institute Electrical Electronic Engineers
   10. MER: Mechanical Equipment Room
   11. PID: Proportional, Integral, Derivative
   12. VAV: Variable Air Volume Box

B. Communications and protocols
   1. ARP: Address Resolution Protocol
   2. BACnet: Building Automation and Control Networks
   3. CORBA: Common Object Request Broker Architecture
   4. CSMA/CD: Carrier Sense Multiple Access/Collision Detect
   5. DDE: Dynamic Data Exchange
   6. FTP: File Transfer Protocol
   7. FTT: Free Topology Transceivers
   8. HTTP: Hyper Text Transfer Protocol
   9. IIOP: Internet Inter-ORB Protocol
   10. IP: Internet Protocol
   11. LAN: Local Area Network
   12. LON: Echelon Communication - Local Operating Network
   13. MS/TP: Master Slave Token Passing
   14. OBIX: Open Building Information Exchange
   15. ODBC: Open Database Connectivity
   16. ORB: Object Request Broker
   17. SNVT: Standard Network Variables Types
   18. SQL: Structured Query Language
   19. UDP: User Datagram Protocol
   20. XML: eXtensible Markup Language

C. Controllers
   1. ASD: Application Specific Device
   2. AAC: Advanced Application Controller
   3. ASC: Application Specific Controller.
   4. CAC: Custom Application Controller.
   5. DCU: Distributed Control Unit
   6. LCM: Local Control Module
   7. MC: MicroControllers
   8. MP: Multi-purpose
   9. MPC: Multi-purpose Controller
   10. MPV: Multi-purpose VAV controller
   11. NSC: Network Server Controller
   12. PEM: Package Equipment Module
   13. PPC: Programmable Process Controller
   14. RC: Room controller
   15. SDCU: Standalone Digital Control Units
   16. SLC: Supervisory Logic Controller
   17. UEC: Unitary Equipment Controller
   18. VAVDDC: Variable Air Volume Direct Digital Controller

D. Tools and Software
   1. AFDD: Automated Fault Detection and Diagnostic
   2. APEO: Automated Predictive Energy Optimization
   3. DR: Demand Response
   4. CCDT: Configuration, Commissioning and Diagnostic Tool
   5. BPES: BACnet Portable Engineering Station
   6. LPES: LON Portable Engineering Station
   7. POT: Portable Operator's Terminal
   8. PEMS: Power and Energy Management Software

1.04 QUALIFICATIONS OF BIDDER

A. All bidders must be building automation contractors in the business of installing direct digital control building automation systems for a minimum of 3 years.
   1. The Building Management System contractor shall have a full service facility within 50 miles of the project that is staffed with engineers trained and certified by the manufacturer in the configuration, programming and service of the automation system. The contractor's technicians shall be fully capable of providing instructions and routine emergency maintenance service on all system components.

1.05 SCOPE OF WORK

A. The Contractor shall furnish and install a complete building automation system including all necessary hardware and all operating and applications software necessary to perform the control sequences of operation as called for in this specification. Network level components of the system - workstations, servers, etc. shall communicate using the BACnet protocol, as defined by ASHRAE Standard 135-2004. No gateways shall be used for communication to controllers furnished under this section.
   1. At a minimum, provide controls for the following:
      a. Air Handling Units
      b. Cabinet unit heater controls
      c. Exhaust and Supply Fans
      d. Finned tube radiation control

e. Hot Water Loop Pumps
f. Power wiring to DDC devices, smoke control dampers and BAS panels except as otherwise specified
g. Rooftop Units
h. Unit Ventilators
i. Variable Frequency Drives

B. Except as otherwise noted, the control system shall consist of all necessary Ethernet Network Controllers, Standalone Digital Control Units, Room Controllers, workstations, software, sensors, transducers, relays, valves, dampers, damper operators, control panels, and other accessory equipment, along with a complete system of electrical interlocking wiring to fill the intent of the specification and provide for a complete and operable system. Except as otherwise specified, provide operators for equipment such as dampers if the equipment manufacturer does not provide these. Coordinate requirements with the various Contractors.

C. The BAS contractor shall review and study all HVAC drawings and the entire specification to familiarize themselves with the equipment and system operation and to verify the quantities and types of dampers, operators, alarms, etc. to be provided.

D. All interlocking wiring, wiring and installation of control devices associated with the equipment listed below shall be provided under this Contract. When the BAS system is fully installed and operational, the BAS Contractor and representatives of the Owner will review and check out the system - see System Acceptance and Testing section of this document. At that time, the BAS contractor shall demonstrate the operation of the system and prove that it complies with the intent of the drawings and specifications.

E. Provide services and manpower necessary for commissioning of the system in coordination with the HVAC Contractor, Balancing Contractor and Owner's representative.

F. All work performed under this section of the specifications will comply with all governing codes, laws and governing bodies. If the drawings and/or specifications are in conflict with governing codes, the Contractor, with guidance from the engineer, shall submit a proposal with appropriate modifications to the project to meet code restrictions. If this specification and associated drawings exceed governing code requirements, the specification will govern. The Contractor shall obtain and pay for all necessary construction permits and licenses.

1.06 SYSTEM DESCRIPTION

A. In accordance to the scope of work, the system shall also provide a graphical, web-based, operator interface that allows for instant access to any system through a standard browser. The contractor must provide PC-based programming workstations, operator workstations and microcomputer controllers of modular design providing distributed processing capability, and allowing future expansion of both input/output points and processing/control functions.

For this project, the system shall consist of the following components:

1. Web-Based Operator Workstations: The BAS Contractor shall furnish licenses for web connection to the BAS system. Web-based users shall have access to all system points and graphics, shall be able to receive and acknowledge alarms, and shall be able to control setpoints and other parameters. All engineering work, such as trends, reports, graphics, etc. that are accomplished from the WorkStation shall be available for viewing through the web browser interface without additional changes. The web-based interface must conform to the B-OWS BACnet device profile. There will be no need for any additional computer based hardware to support the web-based user interface.
2. Ethernet-based Network Router and/or Network Server Controller(s): The BAS Contractor shall furnish needed quantity of Ethernet-based Network Server Controllers as described in Part 2 of the specification. These controllers will connect directly to the Operator

Workstation over Ethernet at a minimum of 100mbps, and provide communication to the Standalone Digital Control Units and/or other Input/Output Modules. Network Server Controllers shall conform to BACnet device profile B-BC. Network controllers that utilize RS232 serial communications or ARCNET to communicate with the workstations will not be accepted. Network Controllers shall be tested and certified by the BACnet Testing Laboratory (BTL) as BACnet Building Controllers (B-BC).

3. Standalone Digital Control Units (SDCUs): Provide the necessary quantity and types of SDCUs to meet the requirements of the project for mechanical equipment control including air handlers, central plant control, and terminal unit control. Each SDCU will operate completely standalone, containing all of the I/O and programs to control its associated equipment. Each BACnet protocol SDCU shall conform to the BACnet device profile B-AAC. BACnet SDCUs shall be tested and certified by the BACnet Testing Laboratory (BTL) as BACnet Advanced Application Controllers (B-AAC).

B. The Local Area Network (LAN) shall be either a 10 or 100 Mpbs Ethernet network supporting BACnet, Modbus, XML and HTTP for maximum flexibility for integration of building data with enterprise information systems and providing support for multiple Network Server Controllers (NSCs), user workstations and a local host computer system.

C. The Enterprise Ethernet (IEEE 802.3) LAN shall utilize Carrier Sense Multiple/Access/Collision Detect (CSMA/CD), Address Resolution Protocol (ARP) and User Datagram Protocol (UDP) operating at 10 or 100 Mbps.

D. The system shall enable an open architecture that utilizes EIA standard 709.1, the LonTalk™ protocol and/or ANSI / ASHRAE™ Standard 135-2004, BACnet functionality to assure interoperability between all system components. Native support for the LonTalk™ protocol and the ANSI / ASHRAE™ Standard 135-2004, BACnet protocol are required to assure that the project is fully supported by the HVAC open protocols to reduce future building maintenance, upgrade, and expansion costs.

E. The system shall enable an architecture that utilizes a MS/TP selectable 9.6-76.8 KBaud protocol, as a common communication protocol between controllers and integral ANSI / ASHRAE™ Standard 135-2004, BACnet functionality to assure interoperability between all system components. The AAC shall be capable of communicating as a MS/TP device or as a BACnet IP device communicating at 10/100 Mbps on a TCP/IP trunk. The ANSI / ASHRAE™ Standard 135-2004, BACnet protocol is required to assure that the project is fully supported by the leading HVAC open protocol to reduce future building maintenance, upgrade, and expansion costs.

F. LonTalk™ packets may be encapsulated into TCP/IP messages to take advantage of existing infrastructure or to increase network bandwidth where necessary or desired.

1. Any such encapsulation of the LonTalk™ protocol into IP datagrams shall conform to existing LonMark™ guide functionality lines for such encapsulation and shall be based on industry standard protocols.
2. The products used in constructing the BMS shall be LonMark™ compliant.
3. In those instances in which Lon-Mark™ devices are not available, the BMS contractor shall provide device resource files and external interface definitions for LonMark devices.

G. The software tools required for network management of the LonTalk™ protocol and the ANSI / ASHRAE™ Standard 135-2004, BACnet protocol must be provided with the system. Drawings are diagrammatic only. Equipment and labor not specifically referred to herein or on the plans and are required to meet the functional intent, shall be provided without additional cost to the Owner. BACnet clients shall comply with the BACnet Operator Workstation (B-OWS) device profile; with the ability to support data read and write functionality. Physical connection of BACnet devices shall be via Ethernet IP or MS/TP. Physical connection of LonWorks devices

shall be via Ethernet IP or FTT-10A.

H. The system shall provide support for Modbus TCP and RTU protocols natively, and not require the use of gateways.

I. Complete temperature control system to be DDC with electronic sensors and electronic/electric actuation of Mechanical Equipment Room (MER) valves and dampers and electronic actuation of terminal equipment valves and actuators as specified herein. The BMS is intended to seamlessly connect devices throughout the building regardless of subsystem type, i.e. variable frequency drives, low voltage lighting systems, electrical circuit breakers, power metering and card access should easily coexist on the same network channel.
   1. The supplied system must incorporate the ability to access all data using HTML5 enabled browsers without requiring proprietary operator interface and configuration programs. The system shall not require JAVA to be enabled in the browser.
   2. Data shall reside on a supplier-installed server for all database access.
   3. A hierarchical topology is required to assure reasonable system response times and to manage the flow and sharing of data without unduly burdening the customer’s internal Intranet network.

J. All work described in this section shall be installed, wired, circuit tested and calibrated by factory certified technicians qualified for this work and in the regular employment of the approved manufacturer's local field office. The approved manufacturer's local field office shall have a minimum of 3 years of installation experience with the manufacturer and shall provide documentation in the bid and submittal package verifying longevity of the installing company's relationship with the manufacturer when requested. Supervision, hardware and software engineering, calibration and checkout of the system shall be by the employees of the approved manufacturer's local field office and shall not be subcontracted. The control contractor shall have an in place support facility within 50 miles of the site with factory certified technicians and engineers, spare parts inventory and all necessary test and diagnostic equipment for the installed system, and the control contractor shall have 24 hours/day, 7 days/week emergency service available.

K. Provide the Commissioning, configuration and diagnostic tool (CCDT), color display personnel computer, software, and interfaces to provide uploading/downloading of High Point Count Controllers (AAC), Unitary Equipment Controllers (UEC) and VAV controllers (VAVDDC), monitoring all BACnet objects, monitoring overrides of all controller physical input/output points, and editing of controller resident time schedules.

L. The system shall have the capability to provide a web-enabled PEMS (power and energy management system) monitoring system intended to monitor an entire electrical distribution infrastructure, from incoming utility feeds down to low voltage distribution points. It shall be designed to monitor and manage energy consumption throughout an enterprise, whether within a single facility or across a network of facilities, to improve energy availability and reliability, and to measure and manage energy efficiency. It shall be a standard product offering with no custom programming required. It shall provide a seamless user experience (““Single pane of glass””) for managing the mechanical systems (HVAC and lighting) and monitoring the power distribution system (transformers, breakers, relays, switches, capacitors, UPS, invertors, etc.) Pricing is to be a separate line item from the BAS proposal. See specification 26 09 13 for exact requirements.

M. The system shall provide an app running on a fixed or mobile device (iOS (iPad), Android (tablet), Windows) offering a consistent, aesthetic, customized graphical interface, that allows to aggregate in a graphical manner various types of services such as room temperature control, lighting control, curtain control, remote TV, etc. System shall communicate via web services and have the ability to be designed once and deployed to multiple devices at the same time.

Pricing is to be a separate line item from the BAS proposal. Provide costs for develop and deploy and tiered costs for multiple levels of device purchases.

1.07 WORK BY OTHERS

A. The BAS Contractor shall cooperate with other contractors performing work on this project necessary to achieve a complete and neat installation. To that end, each contractor shall consult the drawings and specifications for all trades to determine the nature and extent of others' work.

B. The BAS Contractor shall furnish all Airflow Stations, Control Dampers, Control Valves, Flow Meters, Flow Switches, Refrigerant Pressure/Transducers, Sensor Wells and other similar equipment for installation by the Mechanical Contractor and/or others.

C. The BAS Contractor shall provide field supervision to the designated contractor for the installation of the following:
   1. Automatic control dampers
   2. Blank-off plates for dampers that are smaller than duct size.
   3. Sheet metal baffles plates to eliminate stratification.
   4. The Electrical Contractor shall provide:
      a. All 120VAC power wiring to motors, heat trace, junction boxes for power to BAS panels.
      b. Auxiliary contact (pulse initiator) on the electric meter for central monitoring of kWh and KW. Electrical Contractor shall provide the pulse rate for remote readout to the BAS. BAS contractor to coordinate this with the electrical contractor.

1.08 CODE COMPLIANCE

A. Provide BAS components and ancillary equipment, which are UL-916 listed and labeled.

B. All equipment or piping used in conditioned air streams, spaces or return air plenums shall comply with NFPA 90A Flame/Smoke/Fuel contribution rating of 25/50/0 and all applicable building codes or requirements.

C. All wiring shall conform to the National Electrical Code.

D. All smoke dampers shall be rated in accordance with UL 555S.

E. Comply with FCC rules, Part 15 regarding Class A radiation for computing devices and low power communication equipment operating in commercial environments.

F. Comply with FCC, Part 68 rules for telephone modems and data sets.

1.09 SUBMITTALS

A. All shop drawings shall be prepared in Visio Professional or AutoCAD software. In addition to the drawings, the Contractor shall furnish a CD containing the identical information. Drawings shall be B size or larger.

B. Shop drawings shall include a riser diagram depicting locations of all controllers and workstations, with associated network wiring. Also included shall be individual schematics of each mechanical system showing all connected points with reference to their associated controller. Typicals will be allowed where appropriate.

C. Submittal data shall contain manufacturer's data on all hardware and software products required by the specification. Valve, damper and air flow station schedules shall indicate size, configuration, capacity and location of all equipment.

D. Software submittals shall contain narrative descriptions of sequences of operation, program listings, point lists, and a complete description of the graphics, reports, alarms and configuration to be furnished with the workstation software. Information shall be bound or in a three ring

binder with an index and tabs. Diagrams shall be on 11” by 17” foldouts. If color has been used to differentiate information, the printed copies shall be in color.

E. Submit five (5) copies of submittal data and shop drawings to the Engineer for review prior to ordering or fabrication of the equipment. The Contractor, prior to submitting, shall check all documents for accuracy.

F. The Engineer will make corrections, if required, and return to the Contractor. The Contractor will then resubmit with the corrected or additional data. This procedure shall be repeated until all corrections are made to the satisfaction of the Engineer and the submittals are fully approved.

G. The following is a list of post construction submittals that shall be updated to reflect any changes during construction and re-submitted as “As-Built”.
   1. System architecture drawing.
   2. Layout drawing for each control panel
   3. Wiring diagram for individual components
   4. System flow diagram for each controlled system
   5. Instrumentation list for each controlled system
   6. Sequence of control
   7. Binding map
   8. A matrix sheet detailing all system addresses and communication settings for the following:
      a. All IP network addresses & settings
      b. All BMS device addresses & communication settings
   9. Operation and Maintenance Manuals

H. Information common to the entire system shall be provided. This shall include but not be limited to the following.
   1. Product manuals for the key software tasks.
   2. Operating the system.
   3. Administrating the system.
   4. Engineering the operator workstation.
   5. Application programming.
   6. Engineering the network.
   7. Setting up the web server.
   8. Report creation.
   9. Graphics creation.
   10. All other engineering tasks.
   11. System Architecture Diagram.
   12. List of recommended maintenance tasks associated with the system servers, operator workstations, data servers, web servers and web clients.
   13. Define the task.
   14. Recommend a frequency for the task.
   15. Reference the product manual that includes instructions on executing the task.
   16. Names, addresses, and telephone numbers of installing contractors and service representatives for equipment and control systems.
   17. Licenses, guarantees, and warranty documents for equipment and systems.
   18. Submit one copy for each building, plus two extra copies.

I. Information common to the systems in a single building shall be provided.
   1. System architecture diagram for components within the building annotated with specific location information.

2. As-built drawing for each control panel.
3. As-built wiring design diagram for all components.
4. Installation design details for each I/O device.
5. As-built system flow diagram for each system.
6. Sequence of control for each system.
7. Binding map for the building.
8. Product data sheet for each component.
9. Installation data sheet for each component.
10. Submit two copies for each building and two extra copies.

J. Software shall be provided:
1. Submit a copy of all software installed on the servers and workstations.
2. Submit all licensing information for all software installed on the servers and workstations.
3. Submit a copy of all software used to execute the project even if the software was not installed on the servers and workstations.
4. Submit all licensing information for all of the software used to execute the project.
5. All software revisions shall be as installed at the time of the system acceptance.
6. Firmware Files
7. Submit a copy of all firmware files that were downloaded to or pre-installed on any devices installed as part of this project.
8. This does not apply to firmware that is permanently burned on a chip at the factory and can only be replaced by replacing the chip.
9. Submit a copy of all application files that were created during the execution of the project.
10. Submit a copy of all graphic page files created during the execution of the project.

1.10 COORDINATION

A. Coordinate location of thermostats, humidistats, and other exposed control sensors with plans and room details before installation.

B. Coordinate equipment from other divisions including "Intrusion Detection," "Lighting Controls," "Motor Control Centers," "Panel boards," and "Fire Alarm" to achieve compatibility with equipment that interfaces with those systems.

C. Coordinate supply of conditioned electrical circuits for control units and operator workstation.

D. Coordinate location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3 Section "Cast-in-Place Concrete".

E. Coordinate with the Owner's IT department on locations for NSC's, Ethernet communication cabling and TCP/IP addresses.

1.11 OWNERSHIP

A. The Owner shall retain licenses to software for this project.

B. The Owner shall sign a copy of the manufacturer’s standard software and firmware licensing agreement as a condition off this contractor. Such license shall grant use of all programs and application software to the Owner as defined by the manufacturer’s license agreement, but shall protect the manufacturer’s rights to disclosure of Trade Secrets contained within such software.

C. The licensing agreement shall not preclude the use of the software by individuals under contract to the owner for commissioning, servicing or altering the system in the future. Use of the software by individuals under contract to the owner shall be restricted to use on the owner’s computers and only for the purpose of commissioning, servicing, or altering the installed

system.

D. All project developed software, files and documentation shall become the property of the Owner. These include but are not limited to:
   1. Server and workstation software
   2. Application programming tools
   3. Configuration tools
   4. Network diagnostic tools
   5. Addressing tools
   6. Application files
   7. Configuration files
   8. Graphic files
   9. Report files
   10. Graphic symbol libraries
   11. All documentation

1.12 QUALITY ASSURANCE - SYSTEM STARTUP AND COMMISSIONING

A. Each point in the system shall be tested for both hardware and software functionality. In addition, each mechanical and electrical system under control of the BAS will be tested against the appropriate sequence of operation specified herein. Successful completion of the system test shall constitute the beginning of the warranty period. A written report will be submitted to the owner indicating that the installed system functions in accordance with the plans and specifications.

B. The BAS contractor shall commission and set in operating condition all major equipment and systems, such as the chilled water, hot water and all air handling systems, in the presence of the equipment manufacturer's representatives, as applicable, and the Owner and Architect's representatives.

C. The BAS Contractor shall provide a technician for 40 days manpower and engineering services required to assist the HVAC Contractor and Balancing Contractor in testing, adjusting, and balancing all systems in the building. The BAS Contractor shall coordinate all requirements to provide a complete air balance with the Balancing Contractor and shall include all labor and materials in his contract.

D. Startup Testing shall be performed for each task on the startup test checklist, which shall be initialed by the technician and dated upon test was completion along with any recorded data such as voltages, offsets or tuning parameters. Any deviations from the submitted installation plan shall also be recorded.

E. Required elements of the startup testing include:
   1. Measurement of voltage sources, primary and secondary
   2. Verification of proper controller power wiring.
   3. Verification of component inventory when compared to the submittals.
   4. Verification of labeling on components and wiring.
   5. Verification of connection integrity and quality (loose strands and tight connections).
   6. Verification of bus topology, grounding of shields and installation of termination devices.
   7. Verification of point checkout.
   8. Each I/O device is landed per the submittals and functions per the sequence of control.
   9. Analog sensors are properly scaled and a value is reported
   10. Binary sensors have the correct normal position and the state is correctly reported.
   11. Analog outputs have the correct normal position and move full stroke when so commanded.

12. Binary outputs have the correct normal state and respond appropriately to energize/de-energize commands.
13. Documentation of analog sensor calibration (measured value, reported value and calculated offset).
14. Documentation of Loop tuning (sample rate, gain and integral time constant).

F. A performance verification test shall also be completed for the operator interaction with the system. Test elements shall be written to require the verification of all operator interaction tasks including, but not limited to the following.
1. Graphics navigation.
2. Trend data collection and presentation.
3. Alarm handling, acknowledgement and routing.
4. Time schedule editing.
5. Application parameter adjustment.
6. Manual control.
7. Report execution.
8. Automatic backups.
9. Web Client access.

G. A Startup Testing Report and a Performance Verification Testing Report
1. shall be provided upon test completion.

1.13 WARRANTY AND MAINTENANCE

A. All components, system software, and parts furnished and installed by the BMS contractor shall be guaranteed against defects in materials and workmanship for 2 years of substantial completion. Labor to repair, reprogram, or replace these components shall be furnished by the BMS contractor at no charge during normal working hours during the warranty period. Materials furnished but not installed by the BMS contractor shall be covered to the extent of the product only. Installation labor shall be the responsibility of the trade contractor performing the installation. All corrective software modifications made during warranty periods shall be updated on all user documentation and on user and manufacturer archived software disks. The Contractor shall respond to the owner's request for warranty service within 24 standard working hours.

1.14 TRAINING

A. On-site training shall consist of a minimum of (120) hours of hands-on instruction geared at the operation and maintenance of the systems. The curriculum shall include
1. System Overview
2. System Software and Operation
3. System access
4. Software features overview
5. Changing setpoints and other attributes
6. Scheduling
7. Editing programmed variables
8. Displaying color graphics
9. Running reports
10. Workstation maintenance
11. Viewing application programming
12. Operational sequences including start-up, shutdown, adjusting and balancing.
13. Equipment maintenance

B. Factory, classroom training will include a minimum of (2) training reservations for a 3 day course with material covering workstation operation tuition free with travel expense

responsibility of the owner. The option for 2-3 weeks of system engineering and controller programming shall be possible if necessary and desired.

PART 2 PRODUCTS

201 MANUFACTURERS

A. Subject to compliance with requirements, provide products by one of the following manufacturers:
   1. Electric Components
      a. Schneider-Electric Field Devices
      b. Or approved equal.
   2. Electronic Components
      a. Schneider-Electric Field Devices.
      b. Or approved equal.
   3. Direct Digital Control Systems Field Controller Devices:
      a. Schneider Electric EcoStruxure Building MP BACnet series, b3 BACnet series, MNB BACnet installed by approved manufacturer's local field office.
      b. Or approved equal.

202 SYSTEM ARCHITECTURE

A. General
   1. The Building Automation System (BAS) shall consist of Network Server/Controllers (NSCs), a family of Standalone Digital Control Units (SDCUs), Administration and Programming Workstations (APWs), and Web-based Operator Workstations (WOWs). The BAS shall provide control, alarm detection, scheduling, reporting and information management for the entire facility, and Wide Area Network (WAN) if applicable.
   2. An Enterprise Level BAS shall consist of an Enterprise Server, which enables multiple NSCs (including all graphics, alarms, schedules, trends, programming, and configuration) to be accessible from a single Workstation simultaneously for operations and engineering tasks.
   3. The Enterprise Level BAS shall be able to host up to 250 servers, or NSCs, beneath it.
   4. For Enterprise reporting capability and robust reporting capability outside of the trend chart and listing ability of the Workstation, a Reports Server shall be installed on a Microsoft Windows SQL based computer. The Reports Server can be installed on the same computer as the Enterprise Server.
   5. The system shall be designed with a top-level 10/100bT Ethernet network, using the BACnet/IP, LonWorks IP, and/or Modbus TCP protocol.

B. Modbus RTU/ASCII (and J-bus), Modbus TCP, BACnet MS/TP, BACnet IP, LonTalk FTT-10A, and WebServices shall be native to the NSCs. There shall not be a need to provide multiple NSCs to support all the network protocols, nor should there be a need to supply additional software to allow all three protocols to be natively supported.

C. A sub-network of SDCUs using the BACnet IP, BACnet MS/TP protocol shall connect the local, stand-alone controllers with Ethernet-level Network Server Controllers/IP Routers.

D. TCP/IP Level
   1. The TCP/IP layer connects all of the buildings on a single Wide Area Network (WAN) isolated behind the campus firewall. Fixed IP addresses for connections to the campus WAN shall be used for each device that connects to the WAN.

E. Fieldbus Level with Standalone Digital Control Units (SDCUs)
   1. The fieldbus layer shall support all of the following types of SDCUs:

a. BACnet IP SDCU requirements: The system shall consist of one or more BACnet/IP field buses managed by the Network Server Controller. The field bus layer shall consist of up to 50 IP SDCUs in daisy chain topology, or 39 if using RSTP, per layer, with a max of 5 sub networks in daisy chain for a total of 250 SDCUs or 6 sub networks in RSTP for a total of 234 SDCUs.
b. BACnet MS/TP SDCU requirements: The system shall consist of one or more BACnet MS/TP field buses managed by the Network Server Controller. Minimum speed shall be 76.8kbps. The field bus layer consists of an RS485, token passing bus that supports up to 127 Standalone Digital Control Units (SDCUs) for operation of HVAC and lighting equipment. These devices shall conform to BACnet standard 135-2004. The NSCs shall be capable of at least two BACnet MS/TP field buses for a total capability of 254 SDCUs per NSC.
c. The system shall provide support, at the SDCU level, for ZigBee Pro wireless devices. An internal antenna shall be part of the unit for ZigBee® communication or an external antenna RP-SMA connector shall be part of the unit allowing installation of an external RP-SMA antenna for ZigBee® communication

F. BAS LAN Segmentation
1. The BAS shall be capable of being segmented, through software, into multiple local area networks (LANs) distributed over a wide area network (WAN). Workstations can manage a single LAN (or building), and/or the entire system with all portions of that LAN maintaining its own, current database.

G. Standard Network Support
1. All NSCs, Workstation(s) and Servers shall be capable of residing directly on the owner's Ethernet TCP/IP LAN/WAN with no required gateways. Furthermore, the NSC's, Workstation(s), and Server(s) shall be capable of using standard, commercially available, off-the-shelf Ethernet infrastructure components such as routers, switches and hubs. With this design the owner may utilize the investment of an existing or new enterprise network or structured cabling system. This also allows the option of the maintenance of the LAN/WAN to be performed by the owner's Information Systems Department as all devices utilize standard TCP/IP components.

H. System Expansion
1. The BAS system shall be scalable and expandable at all levels of the system using the same software interface, and the same TCP/IP level and fieldbus level controllers. Systems that require replacement of either the workstation software or field controllers in order to expand the system shall not be acceptable.
2. Web-based operation shall be supported directly by the NSCs and require no additional software.
3. The system shall be capable of using graphical and/or line application programming language for the Network Server Controllers.

I. Support For Open Systems Protocols
1. All Network Server Controllers must natively support the BACnet IP, BACnet MS/TP, LonWorks FTT-10, Modbus TCP, Modbus RTU (RS-485 and RS-232), and Modbus ASCII protocols.

203 NETWORK SERVER CONTROLLERS (NSCS)

A. Network Router Controllers shall combine both network routing functions, control functions, and server functions into a single unit.

B. The BACnet NSC shall be classified as a "native" BACnet device, supporting the BACnet Network Server Controller (B-BC) profile. Controllers that support a lesser profile such as B-SA are not acceptable. NSCs shall be tested and certified by the BACnet Testing Laboratory (BTL)

as BACnet Network Server Controllers (B-BC).

C. The Network Server Controller shall provide the interface between the LAN or WAN and the field control devices, and provide global supervisory control functions over the control devices connected to the NRS.

D. The NSCs shall be capable of whitelisting IPs to restrict access to a pre-defined list of hosts or devices.

E. Whitelisting of file extensions for documents shall be capable.

F. Encrypted and authenticated communication shall be configurable for non-open protocol communications using TLS 1.2

G. The NSCs shall support Simple Network Management Protocol version 3 (SNMPv3) for monitoring of the NSCs using a Network Management Tool.

H. The NSCs shall support remote system logging for used by System Information and Event Monitoring (SIEM) software.

I. They shall also be responsible for monitoring and controlling their own HVAC equipment such as an AHU or boiler.

J. They shall also contain graphics, trends, trend charts, alarm views, and other similar presentation objects that can be served to workstations or web-based interfaces. A sufficient number of NSCs shall be supplied to fully meet the requirements of this specification and the attached point list.

K. It shall be capable of executing application control programs to provide:
   1. Calendar functions
   2. Scheduling
   3. Trending
   4. Alarm monitoring and routing
   5. Time synchronization by means of an Internet site including automatic synchronization
   6. Native integration of LonWorks controller data and Modbus controller data or BACnet controller data and Modbus controller data
   7. Network Management functions for all LonWorks based devices

L. Hardware Specifications
   1. Memory:
      a. The operating system of the controller, application programs, and all other portions of the configuration database, shall be stored in non-volatile, FLASH memory. Servers/Controllers shall contain enough memory for the current application, plus required history logging, plus a minimum of 20% additional free memory.
   2. Each NSC shall provide the following on-board hardware for communication:
      a. Two 10/100b Ethernet for communication to Workstations, other NRCs, IP field bus controllers, other SDCUs, and onto the internet.
         1) The two Ethernet ports shall support active switch and BACnet/IP communication protocols.
         2) Support IPv4 addressing
         3) Ethernet port 1 shall support static or DHCP client configuration for communication to Workstation or other NSCs
         4) Ethernet port 2 shall support switch mode or DHCP server to set addressing of DHCP client devices
         5) It shall be possible to disable Ethernet port 2
         6) In DHCP server mode, the Ethernet port 2 shall support 50 BACnet/IP field controllers in daisy chain configuration directly from the port

7) Each NSC shall be able to support a total of 250 IP SDCUs in daisy chain configuration (5 sub networks via switch)
8) If using RSTP (Rapid Spanning Tree Protocol) with a managed switch (with IEEE 802.1W or IEEE 802.1Q-2014 support), Ethernet port 2 shall support up to 39 devices
9) Each NSC shall be able to support a total of 234 IP SDCUs in RSTP configuration (6 sub networks via managed switch)
10) Where a switch is needed, use a Cisco 9000 Catalyst or IE switch, EtherWAN EX63402-01B, or other equal and approved equivalent.

b. Two RS-485 ports for communication to BACnet MSTP bus or serial Modbus (software configurable)
c. One TP/FT port for communication to LonWorks devices.
d. One device USB port
e. One host USB port

3. The NSC shall conform to a small footprint no larger than 100W x 125H x 75D mm (3.94W x 4.92H x 2.95D in).

M. Modular Expandability:
1. The system shall employ a modular I/O design to allow expansion. Input and output capacity is to be provided through plug-in modules of various types. It shall be possible to combine I/O modules as desired to meet the I/O requirements for individual control applications.
2. One shall be able to “hot-change” (hot-swap) the I/O modules preserving the system on-line without any intervention on the software; addressing and configuration shall be automatic.
3. If for any reason the backplane of the modular I/O system were to fail, I/O module addresses will be protected.

N. Hardware Override Switches:
1. All digital outputs shall, optionally, include three position manual override switches to allow selection of the ON, OFF, or AUTO output state. These switches shall be built into the unit and shall provide feedback to the controller so that the position of the override switch can be obtained through software. In addition each analog output shall be equipped with an override potentiometer to allow manual adjustment of the analog output signal over its full range, when the 3 position manual override switch is placed in the ON position.

O. Universal Input Temperatures
1. All universal inputs directly connected to the NSC via modular expansion shall be capable of using the following thermistors for use in the system without any external converters needed.
a. 10 kohm Type I (Continuum)
b. 10 kohm Type II (I/NET)
c. 10 kohm Type III (Satchwell)
d. 10 kohm Type IV (FD)
e. Linearized 10 kohm Type V (FD w/11k shunt)
f. Linearized 10 kohm (Satchwell)
g. 1.8 kohm (Xenta)
h. 1 kohm (Balco)
i. 20 kohm (Honeywell)
j. 2.2 kohm (Johnson)
2. In addition to the above, the system shall be capable of using the below RTD sensors, however it is not required that all universal inputs be compatible with them.

a. PT100 (Siemens)
b. PT1000 (Sauter)
c. Ni1000 (Danfoss)

P. Local Status Indicator Lamps:
1. The NSC shall provide as a minimum LED indication of CPU status, Ethernet LAN status, and field bus status. For each input or output, provide LED indication of the value of the point (On/Off). The LED indication shall support software configuration to set whether the illumination of the LED corresponds to On or Off or whether the color when illuminated is Red or Green.

Q. Real Time Clock (RTC):
1. Each NSC shall include a real time clock, accurate to 10 seconds per day. The RTC shall provide the following: time of day, day, month, year, and day of week. Each NSC will allow for its own UTC offset, depending upon the time zone. When the time zone is set, the NSC will also store the appropriate times for daylight savings time.
2. The RTC date and time shall also be accurate, up to 30 days, when the NSC is powerless.
3. No batteries may be used to for the backup of the RTC.

R. Power Supply:
1. The 24 VDC power supply for the NSCs shall provide 30 watts of available power for the NSC and associated IO modules. The system shall support the use of more than one power supply if heavily power consuming modules are required.
2. The power supply, NSC, and I/O modules shall connect power wise and communication wise via the separate terminal base allowing for ease of replacement and no separate or loose wiring.

S. Automatic Restart After Power Failure:
1. Upon restoration of power after an outage, the NSC shall automatically and without human intervention update all monitored functions, resume operation based on current, synchronize time and status, and implement special start-up strategies as required.

T. Data Retention:
1. During a power failure, the NSC shall retain all programs, configuration data, historical data, and all other data that is configured to be retained. There shall be no time restriction for this retention and it must not use batteries to achieve it.

U. Software Specifications
1. The operating system of the controller, application programs, and all other portions of the configuration database such as graphics, trends, alarms, views, etc., shall be stored in non-volatile, FLASH memory. There will be no restrictions placed on the type of application programs in the system. Each NSC shall be capable of parallel processing, executing all control programs simultaneously. Any program may affect the operation of any other program. Each program shall have the full access of all I/O facilities of the processor. This execution of control function shall not be interrupted due to normal user communications including interrogation, program entry, printout of the program for storage, etc.
2. Each NSC shall have an available capacity of 4 GB of memory. This shall represent 2 GB for application and historical data and 2 GB dedicated for backup storage.

V. User Programming Language:
1. The application software shall be user programmable. This includes all strategies, sequences of operation, control algorithms, parameters, and setpoints. The source program shall be either a script-based structured text or graphical function block based and fully programmable by the user. The language shall be structured to allow for the

configuration of control programs, schedules, alarms, reports, telecommunications, local displays, mathematical calculations, and histories. Users shall be able to place comments anywhere in the body of either script or function block programs.

2. Network Server Controllers that use a “canned” program method will not be accepted.

W. Control Software:
   1. The NSC shall have the ability to perform the following pre-tested control algorithms:
      a. Proportional, Integral plus Derivative Control (PID)
      b. Two Position Control
      c. Digital Filter
      d. Ratio Calculator
      e. Equipment Cycling Protection

X. Mathematical Functions:
   1. Each controller shall be capable of performing basic mathematical functions (+, -, *, /), squares, square roots, exponential, logarithms, Boolean logic statements, or combinations of both. The controllers shall be capable of performing complex logical statements including operators such as >, <, =, and, or, exclusive or, etc. These must be able to be used in the same equations with the mathematical operators and nested up to five parentheses deep.

Y. NSCs shall have the ability to perform any or all of the following energy management routines:
   1. Time of Day Scheduling
   2. Calendar Based Scheduling
   3. Holiday Scheduling
   4. Temporary Schedule Overrides
   5. Optimal Start
   6. Optimal Stop
   7. Night Setback Control
   8. Enthalpy Switchover (Economizer)
   9. Peak Demand Limiting
   10. Temperature Compensated Duty Cycling
   11. CFM Tracking
   12. Heating/Cooling Interlock
   13. Hot/Cold Deck Reset
   14. Hot Water Reset
   15. Chilled Water Reset

Z. History Logging:
   1. Each NSC controller shall be capable of LOCALLY logging any input, output, calculated value or other system variable either over user defined time intervals ranging from 1 second to 1440 minutes or based upon a user configurable change of value. A minimum of 1000 logs, with a minimum of 100,000 records, shall be stored. Each log can record either the instantaneous, average, minimum or maximum value of the point. Logged data shall be downloadable to a higher level NSC long term archiving based upon user-defined time intervals, or manual command.
   2. For extended trend logging a minimum of 1500 trends shall be capable, with a minimum number of 600,000 records within.
   3. Management of a power meter replacement to ensure meter log data is accurate shall be possible in the NSC.
   4. Every hardware input and output point, hosted within the NSC and attached I/O modules, shall be trended automatically without the requirement for manual creation, and each of these logs shall log values based upon a change of value and store at least 500 trend

samples before replacing the oldest sample with new data.

5. The presentation of logged data shall be built into the server capabilities of the NSC. Presentation can be in time stamped list formats or in a chart format with fully configurable pen colors, weights, scales and time spans.
6. Tooltips shall be present, magnetic, and visible based on users preference.
7. Comments shall be visible whenever viewing the trend log list.
8. System shall give indication of memory usage and be able to alert the user if too many logs are allocated.

AA. Alarm Management:

1. For each system point, alarms can be created based on high/low limits or in comparison to other point values. All alarms will be tested each scan of the NSC and can result in the display of one or more alarm messages or reports.
2. There is no limit to the number of alarms that can be created for any point
3. Alarms can be configured to be generated based upon a single system condition or multiple system conditions.
4. Alarms will be generated based on an evaluation of the alarm conditions and can be presented to the user in a fully configurable order, by priority, by time, by category, etc. These configurable alarm views will be presented to a user upon logging into the system regardless of whether the log in takes place at a WorkStation or a Webstation.
5. The alarm management system shall support the ability to create and select cause and action notes to be selected and associated with an alarm event. Checklists shall also be possible in order to present to an operator a suggested mode of troubleshooting. When acknowledging an alarm, it shall be possible to assign it to a user of the system such that the user is notified of the assignment and is made responsible for the alarm resolution.
6. Alarms must be capable of being routed to any BACnet workstation that conforms to the B-OWS device profile and uses the BACnet/IP protocol.

BB. Embedded Web Server

1. Each NSC must have the ability to serve out web pages containing the same information that is available from the WorkStation. The development of the screens to accomplish shall not require any additional engineering labor over that required to show them at the WorkStation itself.
2. The NSC shall be configurable to logging all Embedded Web Server access attempts
3. The NSC shall have the option to redirect HTTP based Embedded Web Server connections to secure, HTTPS connections.
4. The NSC shall authenticate and authorize all users connecting to the Embedded Web Server
5. The NSC shall provide to ability to configure an automatic logoff for Embedded Web Server users that have not had any activity for an adjustable time period.

204 BACNET IP FIELDBUS CONTROLLERS

A. Controllers - BACnet/IP Protocol

1. All BACnet/IP Fieldbus controllers shall be BACnet Testing Laboratory listed (v12 or later) as specified BACnet Advanced Application Controller (B-AAC)
2. All BACnet/IP Fieldbus controllers shall use the following communication specifications and achieve performance as specified herein:
   a. All controllers shall be able to communicate peer-to-peer without the need for a NSC
   b. Any BACnet/IP Fieldbus controllers on the Ethernet Data Link/Physical layer shall be able to act as a Master to allow for the exchange and sharing of data variables and messages with any other controller connected on the same communication cabling. Slave controllers are not acceptable.

B. The BACnet/IP Fieldbus controllers shall be equipped with 2x 10/100bT Ethernet communication ports with active switch and will support BACnet/IP communication protocols with the following configurations:
   1. Supporting IPv4 addressing
   2. Supporting Static IP setting, DHCP client and Auto-IP address acquision
   3. It shall be possible to disable Ethernet port 2

C. Topologies
   1. BACnet/IP Fieldbus controllers shall support daisy chain topology of up to 50 controllers. In case of any disruption to the communication, a system alarm shall notify the NSC/BMS of the point disruption has occurred.
   2. BACnet/IP Fieldbus Controllers shall support RSTP loop whereby up to 39 controllers are supported.
      a. In case of any disruption there shall be no communication interruption
      b. In case of any disruption there shall be system alarms that will inform the operator of the disruption

D. Performance
   1. Each BACnet/IP Fieldbus Controllers shall have a 32-bit microprocessor operating at 500 MHz and support a BACnet protocol stack in accordance with the ANSI/ASHRAE Standard 135-2008 and the BACnet Device Profile supported.
   2. They shall be multi-tasking, real-time digital control processors consisting of communication controllers, controls processing, power supplies with built-in inputs and outputs.

E. Programmability
   1. The BACnet/IP Fieldbus controllers shall support both script programming language and graphical that will be consistent with the NSC.
   2. The control program will reside within the same enclosure as the input/output circuitry, that reads inputs and controls outputs
   3. All control sequences programmed into the BACnet/IP Fieldbus Controllers shall be stored in non-volatile memory, which is not dependent upon the presence of a battery, to be retained.
   4. BACnet/IP Fieldbus controllers shall communicate with the Network Server Controller (NSC) via a BACnet/IP connection at a baud rate of not less than 100 Mbps
   5. BACnet/IP Fieldbus controllers shall support a dedicated communications port for connecting and supplying power to a matching room temperature and/or humidity sensor and/or CO2 and/or presence detector that does not utilize any of the I/O points of the controller.
   6. BACnet/IP Fieldbus controllers (Excluding VAV) shall support an add-on display to supply and provide access in real-time for monitoring inputs and overriding of outputs
   7. The override functionality must be supported by a dedicated processor to assure reliable operation (overriding of output)
   8. Each BACnet/IP Fieldbus controller shall have sufficient memory, to support its own operating system and databases, including:
      a. Control processes
      b. Energy management applications
      c. Alarm management
      d. Historical/trend data
      e. Maintenance support applications
      f. Custom processes
      g. Manal override monitoring

9. Each BACnet/IP Fieldbus controller shall support local trend data up to 2x the built-in I/O and at a minimum be capable of holding 5 days @ 15 min intervals locally.
10. The BACnet/IP Fieldbus controller analog or universal input shall use a 16 bit A/D converter.
11. The BACnet/IP Fieldbus controller analog or universal output shall use a 10 bit D/A converter.
12. Built-in I/O: each BACnet/IP Fieldbus controllers shall support:
    a. At minimum 8 and up to 20 configurable IO channels to monitor and to control the following types of inputs and outputs without the addition of equipment inside or outside the DDC Controller cabinet.
        1) Universal Inputs - the following thermistors for use in the system without any external converters needed.
            (a) 10 kohm Type I (Continuum)
            (b) 10 kohm Type II (I/NET)
            (c) 10 kohm Type III (Satchwell)
            (d) 10 kohm Type IV (FD)
            (e) Linearized 10 kohm Type V (FD w/11k shunt)
            (f) Linearized 10 kohm (Satchwell)
            (g) 1.8 kohm (Xenta)
            (h) 1 kohm (Balco)
            (i) 20 kohm (Honeywell)
            (j) 2.2 kohm (Johnson)
            (k) PT100 (Siemens)
            (l) PT1000 (Sauter)
            (m) Ni1000 (Danfoss)
        2) Analog inputs
            (a) Current Input - 0-20 mA
            (b) Voltage Input 0-10 Vdc
        3) Digital inputs from dry contact closure, pulse accumulators, voltage sensing.
        4) Digital outputs
        5) Analog outputs of 4-20 mA and/or 0-10 Vdc
13. Real Time Clock (RTC):
    a. Each BACnet/IP Fieldbus controller shall include a real time clock, accurate to +/-1 minute per month. The RTC shall provide the following: time of day, day, month, year, and day of week.
    b. The RTC date and time shall also be accurate, up to 7 days, when the BACnet/IP Fieldbus controller is powerless.
    c. No batteries may be used to for the backup of the RTC.
14. The BACnet/IP Fieldbus controller for Variable Air Volume (VAV) applications
    a. The BACnet/IP Fieldbus controller for VAV applications shall include a built-in ‘flow thru’ differential pressure transducer
    b. The VAV differential pressure transducer shall have a measurement range of 0 to 1 in. W.C. and measurement accuracy of ±5% at 0.001 to 1 in. W.C. and a minimum resolution of 0.001 in. W.C., insuring primary air flow conditions shall be controlled and maintained to within ±5% of setpoint at the specified minimum and maximum air flow parameters
    c. The BACnet/IP FieldBus controller for VAV applications shall support a dedicated commissioning tool for air flow balancing
    d. The BACnet/IP Fieldbus controller for VAV applications shall require no programing for air balancing algorithm

e. All balancing parameters shall be synchronized in NSC

15. Each BACnet/IP Fieldbus controller shall have a minimum of 10% spare capacity for each point type represented on the controller for future point connection
16. Power Requirements.: 24VDC (21 to 33 VDC) and 24 VAC +/-20% with local transformer power

F. Commissioning Tool - The BACnet/IP Fieldbus controller shall be supported via a dedicate mobile based commissioning tool for configuration, programming, air balancing and I/O checkout
   1. The Commissioning Tool shall be supported across: iOS, Android and Windows 10 platforms
   2. The Commissioning Tool shall be available for download on App Store, Google Store and Windows Store
   3. Commissioning Tool Interface to BACnet/IP Fieldbus controllers shall be via a Bluetooth adapter interface through the Intelligent Space Sensor or via a Wi-Fi access point on the LAN
   4. Functionality
      a. Device Configuration - the Commissioning Tool shall be able to set or edit all Network configurations associated with the BACnet/IP Fieldbus controller
      b. Programming - The Commissioning Tool shall be able to load offline engineered applications directly in to the controller directly
      c. Air Balancing
         1) The Commissioning Tool shall allow the air balancer to manually control the action of the actuator including the following function: open VAV damper, close VAV damper, open all VAV dampers, and close all VAV dampers.
         2) The Commissioning Tool shall be able to generate Air Balancing report
      d. IO Checkout
         1) The Commissioning Tool shall be able to support overriding of the outputs and reading value of inputs live
         2) The Commissioning Tool shall be able to support generation of I/O checkout report
      e. There shall be no limit to the number of Commissioning Tools that can be used on a network segment, however, one connection per controller is recommended

G. Intelligent Space Sensors - The BACnet/IP Fieldbus controller shall support a dedicated RJ45 communication port to communicate and power up to 4 intelligent wall mount sensors without the use of on board inputs or outputs
   1. The Intelligent Space Sensor shall communicate with the BACnet/IP Fieldbus controller through the sensor port and via category 5 or category 6 cable
   2. The Intelligent Space Sensor shall provide 2 RJ45 communication ports that will allow communication with parent BACnet/IP Field controller upstream and additional Intelligent Space Sensors downstream
   3. The Intelligent Space Sensor shall provide ambient space condition sensing without the use of hardware I/O

H. Each Intelligent Space Sensor shall provide a color touch display with:
   1. Minimum 61 mm (2.4”) by 61 mm (2.4”) display
   2. Backlit

I. The Intelligent Space Sensor shall be capable of displaying measured space temperature from 0 to 50 °C (32 to 122 °F) with accuracy of ±0.2 °C (±0.4 °F) selectable for 0.1 or 1 degree display resolution of °F or °C
   1. Sensing Element: 10k Type 3 Thermistor

2. Accuracy of ±0.2 °C (±0.4 °F)
3. Resolution: 0.1 or 1 degree display resolution
4. Range: 0 to 50 °C (32 to 122 °F)

J. The Intelligent Space Sensor shall have the option for humidity sensor support sensing humidity from 0 % RH to 100 % RH Digital humidity indication (selectable for 0.1 or 1% RH with selectable display resolution of 0.1 or 1 % RH
1. Accuracy: ±2 % RH
2. Resolution: 0.1 or 1 % RH
3. Range: 0 % RH to 100 % RH

K. The Intelligent Space Sensor shall have the option for support of CO2 sensor with display resolution with 0 to 2000 ppm resolution
1. Accuracy: ±30 ppm ±2% of measured value
2. Range: 0 to 2,000 ppm
3. Operating elevation: 0 to 16,000 ft.
4. Temperature dependence: 0.11% FS per °F
5. Stability: <2% of FS over life of sensor (15 years)
6. Sensing method: Non-dispersive infrared (NDIR), diffusion sampling

L. The Intelligent Space Sensor shall have the option for motion sensor

M. Display options: The Intelligent Space Sensor shall be capable of displaying the following elements:
1. Space temperature
2. Cooling space temperature set point
3. Heating space temperature set point
4. Current heating or cooling mode
5. Current occupancy mode
6. Fan speed
7. Current time

205 BACNET FIELDBUS AND BACNET SDCUS

A. Networking
1. IP Network: All devices that connect to the WAN shall be capable of operating at 10 megabits per second or 100 megabits per second.
2. IP To Field Bus Routing Devices
   a. A Network Server Controller shall be used to provide this functionality.
   b. These devices shall be configurable locally with IP crossover cable and configurable via the IP network.
   c. The routing configuration shall be such that only data packets from the field bus devices that need to travel over the IP level of the architecture areforwarded.

B. Field Bus Wiring and Termination
1. The wiring of components shall use a bus or daisy chain concept with no tees, stubs, or free topology.
2. Each field bus shall have a termination resistor at both ends of each segment.
3. The field bus shall support the use of wireless communications.

C. Repeaters
1. Repeaters are required to connect two segments.
2. Repeaters shall be installed in an enclosure. The enclosure may be in an interstitial space.

D. Field Bus Devices

1. General Requirements
    a. Devices shall have a light indicating that they are powered.
    b. Devices shall be locally powered. Link powered devices (power is furnished from a central source over the field bus cable) are not acceptable.
    c. Application programs shall be stored in a manner such that a loss of power does not result in a loss of the application program or configuration parameter settings. (Battery backup, flash memory, etc.)

E. Advance Application Controllers (B-AAC)
1. The key characteristics of a B-AAC are:
    a. They have physical input and output circuits for the connection of analog input devices, binary input devices, pulse input devices, analog output devices, and binary output devices. The number and type of input and output devices supported will vary by model.
    b. They may or may not provide support for additional input and output devices beyond the number of circuits that are provided on the basic circuit board. Support for additional I/O shall be provided by additional circuit boards that physically connect to the basic controller.
    c. The application to be executed by a B-AAC is created by an application engineer using the vendor's application programming tool.
    d. If local time schedules are embedded, the B-AAC shall support the editing of time schedule entries from any BACnet OWS that supports the BACnet service for writing of time schedule parameters.
    e. If local trend logging is embedded, the B-AAC shall support the exporting of trend log data to any BACnet OWS that supports the read range BACnet service for trending.
    f. If local alarm message initiation is embedded, the B-AAC shall:
        1) Deliver alarm messages to any BACnet OWS that supports the BACnet service for receiving alarm messages and is configured to be a recipient off the alarm message.
        2) Support alarm acknowledgement from any BACnet OWS that supports the BACnet service for executing alarm/event acknowledgement,
        3) Shall support the reading of analog and binary data from any BACnet OWS or Building Controller that supports the BACnet service for the reading of data.
    g. Shall support the control of the out of service property and assignment of value or state to analog and binary objects from any BACnet OWS that supports writing to the out of service property and the value property of analog and binary objects.
    h. Shall support the receipt and response to Time Synchronization commands from a BACnet Building Controller.
    i. Shall support the "Who is" and "I am." BACnet services.
    j. Shall support the "Who has" and "I have." BACnet services.
    k. Analog Input Circuits
        1) The resolution of the A/D chip shall not be greater than 0.01 Volts per increment. For an A/D converter that has a measurement range of 0 to 10 VDC and is 10 bit, the resolution is 10/1024 or 0.00976 Volts per increment.
        2) For non-flow sensors, the control logic shall provide support for the use of a calibration offset such that the raw measured value is added to the (+/-) offset to create a calibration value to be used by the control logic and reported to the Operator Workstation (OWS).
        3) For flow sensors, the control logic shall provide support for the use of an adjustable gain and an adjustable offset such that a two point calibration concept can be executed (both a low range value and a high range value are

adjusted to match values determined by a calibration instrument).

4) For non-linear sensors such as thermistors and flow sensors the B-AAC shall provide software support for the linearization of the input signal.

l. Binary Input Circuits

1) Dry contact sensors shall wire to the controller with two wires.
2) An external power supply in the sensor circuit shall not be required.
3) Pulse Input Circuits
4) Pulse input sensors shall wire to the controller with two wires.
5) An external power supply in the sensor circuit shall not be required.
6) The pulse input circuit shall be able to process up to 20 pulses per second.

m. True Analog Output Circuits

1) The logical commands shall be processed by a digital to analog (D/A) converter chip. The 0% to 100% control signal shall be scalable to the full output range which shall be either 0 to 10 VDC, 4 to 20 milliamps or 0 to 20 milliamps or to ranges within the full output range (Example: 0 to 100% creates 3 to 6 VDC where the full output range is 0 to 10 VDC).
2) The resolution of the D/A chip shall not be greater than 0.04 Volts per increment or 0.08 milliamps per increment.

n. Binary Output Circuits

1) Single pole, single throw or single pole, double throw relays with support for up to 230 VAC and a maximum current of 2 amps.
2) Voltage sourcing or externally powered triacs with support for up to 30 VAC and 0.5 amps at 24 VAC.

o. Program Execution

1) Process control loops shall operate in parallel and not in sequence unless specifically required to operate in sequence by the sequence of control.
2) The sample rate for a process control loop shall be adjustable and shall support a minimum sample rate of 1 second.
3) The sample rate for process variables shall be adjustable and shall support a minimum sample rate of 1 second.
4) The sample rate for algorithm updates shall be adjustable and shall support a minimum sample rate of 1 second.
5) The application shall have the ability to determine if a power cycle to the controller has occurred and the application programmer shall be able to use the indication of a power cycle to modify the sequence of controller immediately following a power cycle.

p. Local Interface

1) The controller shall support the connection of a portable interface device such as a laptop computer or vendor unique hand-held device. The ability to execute any tasks other than viewing data shall be password protected. Via this local interface, an operator shall be able to:
   (a) Adjust application parameters.
   (b) Execute manual control of input and output points.
   (c) View dynamic data.

F. Application Specific Devices

1. Application specific devices shall have fixed function configurable applications.
2. If the application can be altered by the vendor's application programmable tool, the device is an advanced application controller and not an application specific device.
3. Application specific devices shall be BTL certified.

206 DDC SENSORS AND POINT HARDWARE

A. Temperature Sensors
   1. Acceptable Manufacturers: Veris Industries, or equal.
   2. All temperature devices shall use precision thermistors accurate to +/- 1 degree F over a range of -30 to 230 degrees F. Space temperature sensors shall be accurate to +/- .5 degrees F over a range of 40 to 100 degrees F.
   3. Room Sensor: Standard space sensors shall be available in an off white enclosure made of high impact ABS plastic for mounting on a standard electrical box. Basis of Design: Veris TW Series, or equal
      a. Where manual overrides are required, the sensor housing shall feature both an optional sliding mechanism for adjusting the space temperature setpoint, as well as a push button for selecting after hours operation.
      b. Where a local display is specified, the sensor shall incorporate an LCD display for viewing the space temperature, setpoint and other operator selectable parameters. Using built in buttons, operators shall be able to adjust setpoints directly from the sensor.
   4. Duct Probe Sensor: Sensing element shall be fully encapsulated in potting material within a stainless steel probe. Useable in air handling applications where the coil or duct area is less than 14 square feet. Basis of Design: Veris TD Series, or equal
   5. Duct Averaging Sensor: Averaging sensors shall be employed in ducts which are larger than 14 square feet. The averaging sensor tube shall contain at least one thermistor for every 3 feet, with a minimum tube length of 6 feet. The averaging sensor shall be constructed of rigid or flexible copper tubing. Basis of Design: Veris TA Series, or equal
   6. Pipe Immersion Sensor: Immersion sensors shall be employed for measurement of temperature in all chilled and hot water applications as well as refrigerant applications. Provide sensor probe length suitable for application. Provide each sensor with a corresponding pipe-mounted sensor well, unless indicated otherwise. Sensor wells shall be stainless steel for non-corrosive fluids below 250 degrees F and 300 series stainless steel for all other applications. Basis of Design: Veris TI Series, or equal
   7. Outside Air Sensor: Provide the sensing element on the building's north side. Sensing element shall be fully encapsulated in potting material within a stainless steel probe. Probe shall be encased in PVC solar radiation shield and mounted in a weatherproof enclosure. Operating range -40 to 122 F, Basis of Design: Veris TO Series, or equal
   8. A pneumatic signal shall not be allowed for sensing temperature.

B. Liquid Differential Pressure Transmitters:
   1. Acceptable Manufacturer: Veris Industries, or equal
   2. Transmitter shall be microprocessor based
   3. Transmitter shall use two independent gauge pressure sensors to measure and calculate differential pressure
   4. Transmitter shall have 4 switch selectable ranges
   5. Transmitter shall have test mode to produce full-scale output automatically.
   6. Transmitter shall have provision for zeroing by pushbutton or digital input.
   7. Transmitter shall have field selectable outputs of 0-5V, 0-10V, and 4-20mA.
   8. Transmitter shall have field selectable electronic surge damping
   9. Transmitter shall have an electronic port swap feature
   10. Transmitter shall accept 12-30 VDC or 24 VAC supply power
   11. Sensor shall be 17-4 PH stainless steel where it contacts the working fluid.
   12. Performance:
      a. Accuracy shall be ±1% F.S. and ±2% F.S. for lowest selectable range

b. Long term stability shall be ±0.25%
c. Sensor temperature operating range shall be -4° to 185°F
d. Operating environment shall be 14° to 131°F; 10-90% RH noncondensing
e. Proof pressure shall be 2x max. F.S. range
f. Burst pressure shall be 5x max. F.S. range

13. Transmitter shall be encased in a NEMA 4 enclosure
14. Enclosure shall be white powder-coated aluminum
15. Transmitter shall be available with a certification of NIST calibration
16. Transmitter shall be preinstalled on a bypass valve manifold
17. Basis of Design: Veris PW, or equal

C. Current Sensors
1. Current status switches shall be used to monitor fans, pumps, motors and electrical loads. Current switches shall be available in split core models, and offer either a digital or an analog signal to the automation system. Acceptable manufacturer is Veris Industries, or equal

D. Current Status Switches for Constant Load Devices
1. Acceptable Manufacturer: Veris Industries, or eeual
2. General: Factory programmed current sensor to detect motor undercurrent situations such as belt or coupling loss on constant loads. Sensor shall store motor current as operating parameter in non-volatile memory. Push-button to clear memory.
3. Visual LED indicator for status.
4. Split core sensor, induced powered from monitored load and isolated to 600 VAC rms. Sensor shall indicate status from 0.5 A to 175 A.
5. Normally open current sensor output. 0.1A at 30 VAC/DC.
6. Basis of Design: Veris Model H608, or equal

E. Current Status Switches for Constant Load Devices (Auto Calibration)
1. Acceptable Manufacturer: Veris Industries or equal.
2. General: Microprocessor based, self-learning, self-calibrating current switch. Calibration-free status for both under and overcurrent, LCD display, and slide-switch selectable trip point limits. At initial power-up automatically learns average current on the line with no action required by the installer
3. Split core sensor, induced powered from monitored load and isolated to 600 VAC rms. Sensor shall indicate status from 2.5 A to 200 A.
4. Display: Backlit LCD; illuminates when monitored current exceeds 4.5A
5. Nominal Trip Point: ±40%, ±60%, or on/off (user selectable)
6. Normally open current sensor output. 0.1A at 30 VAC/DC.
7. Basis of Design: Veris Model H11D, or equal

F. Current Status Switches for Variable Frequency Drive Application
1. Acceptable Manufacturer: Veris Industries or equal
2. General: Microprocessor controlled, self-learning, self-calibrating current sensor to detect motor undercurrent and overcurrent situations such as belt loss, coupling shear, and mechanical failure on variable loads. Sensor shall store motor current as operating parameter in non-volatile memory. Push-button to clear memory and relearn.
3. Visual LED indicator for status.
4. Alarm Limits: ±20% of learned current in every 5 Hz freq. band
5. Split core sensor, induced powered from monitored load and isolated to 600 VAC rms. Sensor shall indicate status from 1.5 A to 150 A and from 12 to 115 Hz.
6. Normally open current sensor output. 0.1A at 30 VAC/DC.

7. Basis of Design: Veris Model H614, or equal

G. Liquid Flow, Insertion Type Turbine Flowmeter:
   1. Acceptable Manufacturer: Veris Industries, or equal
   2. General: Turbine-type insertion flow meter designed for use in pipe sizes 1 1/2” and greater. Available in hot tap configuration with isolation valves and mounting hardware to install or remove the sensor from pipeline that is difficult to shut down or drain
   3. Performance:
      a. Accuracy ±1% of rate over optimum flow range; =10 upstream and =5 downstream straight pipe diameters, uninterrupted flow
      b. Repeatability ±0.5%
      c. Velocity Range: 0.3 to 20 FPS
      d. Pressure Drop 0.5 psi or less @ 10 ft/sec for all pipe sizes 1.5” dia and up
      e. Pressure Rating: 1000 psi @ 70°F
   4. Maximum Temperature Rating: 300°F
   5. Materials: Stainless Steel or Brass body; Stainless steel impeller
   6. Transmitter:
      a. Power Supply: 12 - 30VAC or 8 - 35VDC.
         1) Output: [Frequency] [4-20 mA] [Scaled Pulse]
      b. Temperature Range: 14° to 150°F
      c. Display: 8 character 3/8" LCD (Optional)
      d. Enclosure: NEMA 4, Polypropylene with Viton® sealed acrylic cover
   7. Basis of Design: Veris SDI series, or eual

H. Liquid Flow/Energy Transmitter, Non-invasive Ultrasonic (Clamp-on):
   1. Acceptable Manufacturer: Veris Industries, or equal
   2. General: Clamp-on digital correlation transit-time ultrasonic flow meter designed for clean liquids or liquids containing small amounts of suspended solids or aeration. Optional temperature sensors for BTU calculations.
   3. Liquid: water, brine, raw sewage, ethylene, glycol, glycerin, others. Contact manufacturer for other fluid compatibility
   4. Pipe Surface Temperature: Pipe dia 1/2” to 2”:-40-185°F; Pipe dia > 2”: -40-250°F
   5. Performance:
      a. Flow Accuracy:
         1) Pipe dia 1/2” to 3/4” 1% of full scale
         2) Pipe dia 1” to 2” 1% of reading from 4-40 FPS
         3) Pipe dia 2” to 100” 1% of reading from 1-40 FPS
      b. Flow Repeatability ±0.01% of reading
      c. Velocity Range: (Bidirectional flow)
         1) Pipe dia 1/2” to 2” 2 to 40 FPS
         2) Pipe dia 2” to 100” 1 to 40 FPS
      d. Flow Sensitivity 0.001 FPS
      e. Temperature Accuracy (energy): 32-212°F; Absolute 0.45°F; Difference 0.18°F
      f. Temperature Sensitivity: 0.05°F
      g. Temperature Repeatability: ±0.05% of reading
   6. Transmitter:
      a. Power Supply: 95 to 264 VAC, 47 to 63 Hz or 10 to 28 VDC.
      b. Temperature Range: -40 to +185°F
      c. Display: 2 line backlit LCD with keypad
      d. Enclosure: NEMA 4, (IP65), Powder-coated aluminum, polycarbonate
   7. Agency Rating: UL 1604, EN 60079-0/15, CSA C22.2, CSA Class 1 (Pipe >2”)

8. Basis of Design: Veris FST & FSR series, or equal

I. Analog Electric/Pneumatic Transducer:
   1. Acceptable Manufacturer: Veris Industries, or equal
   2. General: Micro-controlled poppet valve for high accuracy and with no air loss in the system. Field configurable for pressure sensing in multiple applications.
   3. Power Supply: 22-30VDC, 20-30VAC
   4. Control Input: 4-20mA, 0-10V, 0-5V; jumper selectable
   5. Performance:
      a. Accuracy: 1% full scale; combined linearity, hysteresis, repeatability
      b. Compensated Temperature Range: 25° to 140°F
      c. Temp Coefficient: ±0.05%°C
      d. Operating Environment: 10-90% RH, non-condensing; 25° to 140°F
   6. Supply Pressure: 45 psig max.
   7. Manual Override: Jumper selectable mode, digital pushbutton adjust
   8. Alarm Contact: 100mA@30VAC/DC (Optional)
   9. Control Range 0-20 psig or 3-15 psig; jumper selectable
   10. Pressure Differential 0.1 psig (supply to branch)
   11. Pressure Indication Electronic, 3-1/2 digit LCD
   12. Housing: Mounted on standard SnapTrack; Optional clear dust cover
   13. Basis of Design: Veris EP Series, or equal

J. Control Valves
   1. Ball Valves
      a. ½" to ¾" Ball Valve
         1) Forged brass body rated at no less than 600 psi, chrome plated brass ball with blowout proof stem or optional stainless steel ball with blowout proof stem,
         2) Valves are to be in two-way and three-way configurations.
         3) Connection: Female NPT end fittings, Teflon® PTFE seat, characterizing disc glass filled PEEK providing equal percentage flow curve on two-way valve.
         4) Operating Temperature 20…250°F chilled or hot water with up to 60% glycol solution.
         5) Two-way and Bypass port should be ANSI Class IV (0.01% of Cv) seat leakage.
         6) Rangeability must be at least 300:1.
         7) Tool-less actuator connection.
         8) System Static Pressure Limit should be 600 psig (4137 Pa)
         9) Basis of Design: Schneider Electric VBB/VBS Ball Valves, or approved equal.
      b. ½" to 3" 2-way and ½" to 2" 3-way Ball Valves
         1) Valves must be for control of hot or chilled water, or solutions of up to 50% glycol.
         2) Ball valves must have close-offs of 40…130 psi depending on size.
         3) Valves will provide CVs from 0.33…266 depending on size.
         4) Valve characterizing insert, is to made of glass-filled Noryl™ and provide equal percentage flow.
         5) Valve body is to made of forged brass ASTM B283-06 and rated for static pressure of 360 psi at fluid temperatures of 20…250°F (-7…121°C).
         6) All valves are to have balls made of nickel/chromium plated brass with two-way valves having stainless steel balls as an option. All valve stems are to be stainless steel with reinforce Teflon® EPDM O-ring seals.
         7) 2-way valves are to be ANSI Class IV (0.01% of Cv) shutoff. 3-way valves are to be ANSI Class IV (0.01% of Cv piped coil-side outlet to the port A only.

8) Fluid (water) temperature are a minimum 20°F (-7°C) and a maximum of 250°F (121°C).
9) Basis of Design: Schneider Electric VB-2000, or approved equal.

2. Globe Valves (Bronze ½" to 2")
   a. Control Valves: Factory fabricated, with body material, and pressure class based on maximum pressure and temperature rating of piping system with a body rating of not less than 400 psig at 150°F, 321 psig at 281°F per ANSI B16.15.
   b. Valves two way NPS 2" and Smaller: Operator, stem and plug assembly, and spring-loaded PTFE/EPDM valve stem packing cartridge must be removable for future replacement to restore the valves back to their original condition. Material grade properties must meet the fluid temperature and pressure requirements:
      1) Standard duty bronze body, 316 stainless steel vertical stem, brass plug, soft seal, and bronze seat, renewable packing cartridge, and screwed/sweat/flared ends. Valves shall have allowable media temperature of 20°F …281°F to assure reliability with dual temperature applications.
      2) Heavy duty bronze body, 316 stainless steel vertical stem, 316 stainless steel plug, soft seal, and 316 stainless steel seat, renewable packing cartridge, and screwed ends. Valves shall have allowable media temperature of 20°F …340°F to assure to assure reliability with dual temperature applications.
      3) High temperature bronze body, 316 stainless steel vertical stem, 316 stainless steel plug, and 316 stainless steel seat, renewable packing cartridge, and screwed ends. Valves shall have allowable media temperature of 20°F …400°F.
   c. Two-way fluid system globe valves shall have the following characteristics:
      1) Rangeability: Greater than 100:1 for all valves with flow coefficients of 0.4 and higher to provide stable control under light load conditions.
      2) Maximum Allowable Seat Leakage: Standard and heavy duty valves must be designed to meet ANSI Class V (0.0005 ml per minute per "of orifice diameter per psi differential) up to 35 psi close off differential pressure and ANSI Class IV seat leakage (maximum 0.01% of full open valve capacity) above 35 psi with appropriate actuator. High temperature valves must meet ANSI Class III seat leakage (maximum 0.1% of full open valve capacity).
      3) The valve must be able to operate with a full-open operating differential of no less than 87 psi.
      4) Flow Characteristics: Modified equal percentage characteristics for standard duty water applications and modified linear for heavy duty and high temperature steam applications with gradual opening for light loads.
      5) Sizing:
         (a) Two Position Water: Water: Line size or size using a differential pressure of 1 psi.
         (b) Modulating Water: 5 PSI or twice the load pressure drop.
         (c) Pressure drop across steam valve at a maximum flow of 80 percent of inlet pressure up to 15 psig and 42% of absolute (gage pressure + 14.7) inlet pressure above 15 psig inlet.
         (d) 100 psi saturated steam maximum inlet pressure for heavy duty bronze body globe valves ½"…2".
         (e) 150 psi saturated steam maximum inlet pressure for high temperature bronze body globe valves ½"…2".
      6) 35 psi saturated steam maximum inlet pressure for standard duty bronze body globe valves ½"…2".
      7) Valves 3-Way mixing (two inlets and one outlet) NPS 2" and Smaller:

8) Operator, stem and plug assembly, and spring-loaded PTFE/EPDM valve stem packing cartridge must be removable for future replacement to restore the valves back to their original condition. Material grade properties must meet the fluid temperature and pressure requirements:
   (a) Standard duty bronze body, 316 stainless steel vertical stem, brass plug, and bronze seat, renewable packing cartridge, and screwed or sweat ends. Valves shall have allowable media temperature of 20°F…281°F to assure reliability with dual temperature applications.
   (b) Heavy duty bronze body, 316 stainless steel vertical stem, 316 stainless steel plug, and 316 stainless steel seat, renewable disc and packing cartridge, and screwed ends. Valves shall have allowable media temperature of 20°F …340°F to assure reliability with dual temperature applications.

d. 3-Way mixing hydronic system globe valves shall have the following characteristics:
   1) Rangeability: Greater than 100:1 for all valves to provide stable
   2) Maximum Allowable Seat Leakage: A port must be designed to meet ANSI Class V (0.0005 ml per minute per “of orifice diameter per psi differential) up to 35 psi close off differential pressure and ANSI IV seat leakage (maximum 0.01% of full open valve capacity) above 35 psi with appropriate actuator. B port must meet ANSI Class III seat leakage (maximum 0.1% of full open valve capacity).
   3) The valve must be able to operate with a full-open operating differential of 87 psi.
   4) Flow Characteristics: Modified linear characteristics with gradual opening for light loads.
   5) Sizing: Modulating Water: Minimum 5 psi or at least equal to the load pressure drop.

e. Valves 3-Way diverting (one inlet and two outlets) NPS 2” and Smaller:
   1) Operator, stem and plug assembly, and spring-loaded PTFE/EPDM valve stem packing cartridge must be removable for future replacement to restore the valves back to their original condition. Valves must be designed specifically for diverting service, and mixing valves designed for mixing service must not be used for diverting applications. Material grade properties must meet the fluid temperature and pressure requirements:
      (a) Standard duty bronze body, 316 stainless steel vertical stem, brass plug, and bronze seat, renewable disc and packing cartridge, and screwed ends. Valves shall have allowable media temperature of 20°F …281°F to assure reliability with dual temperature applications.

f. 3-Way diverting hydronic system globe valves shall have the following characteristics:
   1) Rangeability: Greater than 100:1 for all valves to provide stable control under light load conditions.
   2) Maximum Allowable Seat Leakage: ANSI Class III seat leakage (maximum 0.1% of full open valve capacity).
   3) Maximum Allowable Pressure Differential: 35 psi in.an open position.
   4) Flow Characteristics: Modified linear characteristics with gradual opening for light loads.
   5) Sizing:
      (a) Modulating Water: Minimum 5 psi or at least equal to the load pressure drop.

g. Required Certifications: Pressure Equipment Directive (PED 97/23/EC), RoHS (Restriction of Hazardous Substances) and REACH (Regulation, Evaluation, Authorization, and Restriction of Chemicals), Canadian Registration Number.

h. Valve and Operator: To assure maximum performance and operation of the valve assembly both the valve and the actuator must be tested and approved by the valve manufacturer to assure compatibility of all components and performance to the specifications.
i. Basis of Design: Schneider Electric Venta VB-7000, or approved equal.

3. Butterfly Valves
   a. Valve body are to be polyester coated iron ASTM A126 lug mating with ANSI class 125/150 flanges.
   b. Disc Type: Ductile iron nylon 11 coated.
   c. Valve Stem:
      1) 2…8" 416 stainless steel double D stem.
      2) 10…12" 316 stainless steel double D stem.
      3) 14" and larger: stainless steel round shaft woodruff key slot.
   d. Valve seat: EPDM tongue and groove seat and molded O-ring flange seat
   e. Flow Characteristics: Modified equal percentage.
   f. Close-Off Pressure Rating: Bubble-tight shutoff (no leakage).
   g. Valve fluid temperature rating: -40…250°F (-40…121°C)
   h. Valve will have two (2) inch extended neck (because of heat).
   i. Valve must accept pneumatic or electric/electronic actuators
   j. Valves must have a minimum of a two (2) year warranty.
4. Flanged Valves
   a. Bodies: Shall be American Factory fabricated with ASTM A 126 Class B cast iron body material with the pressure class within the maximum pressure and temperature rating of the piping system. (125 body rating with not less than 200 psig at 150°F, decreasing to 169 psig at 281F per ANSA B16.1)
   b. Serviceability: 2-Way valve operators, stem and plug assemblies and spring-loaded PTFE/EPDM valve stem packing cartridges must be removable for future replacement to restore the valves back to their original condition.
   c. Construction: Material grades must meet the fluid temperature and pressure requirement temperatures of 20°F …281°F to assure reliability throughout all application temperature ranges.
   d. Packings: Shall be cartridges suitable for replacement as units withstanding the full operating temperature ranges, including daily and seasonal fluctuations of water, 60% glycol and steam fluids.
   e. Characteristics
      1) Rangeability: Two way,100:1 and greater for stable control under light load.
      2) Shutoff, 2-Way: Leakage allowed: ANSI Class IV (0.01% of max flow)
      3) 3-Way: Leakage allowed: ANSI Class III (0.1% of max flow)
      4) Flow curves: 2-Way modified equal percentage characteristic.
      5) Mixing and Diverting: Linear, modified with gradual opening for light loads.
   f. Piping
      1) Diverting valves, with the common port at the bottom can be used for mixing.
      2) Mixing valves with the common port at the end must not be used for diverting applications.
   g. Sizing
      1) Two Position Water: Line size or size using a differential pressure of 1 psi.
      2) Modulating Water: 5 PSI or twice the load pressure drop
      3) Steam, 2-Way: maximum pressure drop across the valve at a maximum flow of 80 percent of inlet pressure up to 15 psig. Above 15 psig inlet, 42% of absolute (gage pressure + 14.7) inlet pressure.

h. Certifications for All Models: Pressure Equipment Directive (PED 97/23/EC), RoHS (Restriction of Hazardous Substances) and REACH (Regulation, Evaluation, Authorization, and Restriction of Chemicals
i. Basis of Design: Schneider Electric VB-8000 and VB-9000 valves, or approved equal.

K. Control Valve Actuators
1. ½" to ¾" Ball Valve Actuators
a. Size for torque required for valve close-off pressure for system design.
b. Coupling: Direct coupled to valve body without use of external devices/tools
c. Auxiliary End Switch (optional) to be SPST 24 Vac/Vdc,101 mA to 5 mA maximum on selected two-position models.
d. Controller Signal Two-position, Floating or Proportional (0…5 Vdc, 0…10 Vdc, 5…10 Vdc, or 4…20 mA dc). Design allows for change via DIP switches without removal of cover.
e. Manual operating lever and position indicator must be standard.
f. Power Requirements: 24 Vac for floating, proportional, and 110…230 Vac for two position multi-voltage types
g. Actuators must be available with either Spring Return (SR) or Non-Spring Return (NSR) models.
h. Wiring (depending on model) Removable Terminal Block, 10 ft. (3.05 m) Plenum Cable, 18 in. (45 cm) Appliance Wire
i. Locations must be rated NEMA 2, IEC IP31. (Indoor Use Only.) Actuators with terminal block or plenum cable leads are plenum rated per UL file number E9429.
j. Agency Listings: ISO 9001, cULus, and CE.
k. Basis of Design: Schneider Electric VBB/VBS, or approved equal.
2. ½" to 3" 2-way and ½" to 2" 3-way Ball Valves Actuators
a. Size for torque required for valve close-off pressure for system design.
b. Actuators are to be available in spring return (SR) and non-spring return (NSR) models. Spring Return (SR) actuators are to provide a choice to return direction.
c. Actuators are to be available in models for two-position, floating and proportional control.
d. All actuator models are to be equipped with pigtail leads, manual override, and auxiliary switch(es)
e. Operating temperatures' Floating Non-Spring Return (NSR) with 33 lb.-in. of torque must be -25 to 130 °F (-32 to 55°C). All other actuators are to -22 to 140 °F (-30 to 60 °C)
f. Actuators must be NEMA 2 rated.
g. Agency Listings: ISO 9001, cULus, and CE.
h. Basis of Design: Schneider Electric VB-2000, or approved equal.
3. ½" to 2" Bronze, Linear Globe Valve Actuators/67 or 78 lbs. force
a. Actuator must have bi-color LED status indication for motion indication, auto calibration and alarm notification.
b. When the actuator is properly mounted must have a minimum of a NEMA 2 (IP53) rating.
c. Actuators are to be non-spring return.
d. Actuators are to be floating (used for two-position) or proportional models.
e. Proportional models will have optional models with a position output signal with field selectable 2…10 Vdc and 0…10 Vdc input signals and selectable input signal direct or reverse acting.
f. Actuator must have auto calibration which provides precise control by scaling the input signal to match the exact travel of the valve stem

g. Actuators must come in models with Pulse Width Modulated (PWM) with field selectable 0.59 to 2.93 sec and 0.1 to 25.5 sec input signal ranges with a position output signal
h. Actuators must have manual override with automatic release.
i. Models with position feedback output signal include field selectable 2…10 Vdc or 0…5 Vdc output signal
j. Removable wiring screw terminal with ½" conduit opening.
k. Actuator agency Listings: cUL-us LISTED mark, NEMA 2, NEC class 2 FCC part-15 class B, Canadian ICES-003, ESA registered, Plenum rated per UL 20430
l. Basis of Design: Schneider Electric MG350V, or approved equal.

4. ½" to 2" Bronze, Linear Globe Valve Actuators/105 lbs. force
   a. Actuators must have Two- Position, Floating, and Proportional models.
   b. Proportional models will a controller input signal of either a 0…10 Vdc, 2…10 Vdc, 4…20 mAdc, 0…3 Vdc, or 6…9 Vdc. Control function direct/reverse action is switch selectable on most models.
   c. Actuator force is to be 105 lb. (467 newton) with ½" (13 mm) nominal linear stroke
   d. Power requirements 24 Vac, 120 Vac or 230 Vac depending on model.
   e. Actuator housings rated for up to NEMA 2/ IP54.
   f. Actuator is to have overload protection throughout stroke.
   g. Actuator must automatically set input span to match valve travel.
   h. Actuator must have manual override to allow positioning of valve and preload.
   i. Actuator is to be spring return.
   j. Actuator is to mount directly to valves without separate linkage.
   k. Actuator agency Listings: UL 873, CUL: UL
   l. Basis of Design: Schneider Electric SmartX Mx51-7103, or approved equal
5. ½" to 2" Bronze, Linear Globe Valve Actuators/220 lbs. force
   a. Actuators must have Two- Position for a SPST controller, Floating for a SPST controller, and Proportional models will a controller input signal of either a 0…10 Vdc, 2…10 Vdc, 4…20 mAdc, or 6…9 Vdc. Control function direct/reverse action is jumper selectable
   b. Actuator is to be spring return.
   c. Actuator will have 220 lb. force (979 newton) with ½" (13 mm) or 1" (25 mm) nominal linear stroke
   d. Feedback on proportional model with 2…10 Vdc (max. 0.5 mA) output signal or to operate up to four like additional slave actuators.
   e. Actuator must automatically set input span to match valve travel
   f. Actuator is to have a 24 Vac power supply on Two-position and Proportional models and 120 Vac on Two-position models.
   g. Actuator housings rated for up to NEMA 2/ IP54
   h. Actuator must have manual override to allow positioning of valve and preload
   i. Actuator is to mount directly to vales without separate linkage.
   j. Actuator agency Listings: UL 873, CUL: UL
   k. Basis of Design: Schneider Electric SmartX Mx51-720x, or approved equal.
6. ½" to 2" Bronze, Linear Globe Valve Actuators with linkage SR
   a. Actuators with 35, 60, 133, or 150 lb.-in of force depending on model.
   b. Actuator housings rated for up to NEMA 2/ IP54 with a 150 lb.-in. rated a NEMA 4.
   c. Actuators are to be spring return.
   d. Actuators are to have Two-position, Floating and Proportional models.
   e. Actuators must have overload protection throughout rotation.

f. Actuator have an optional built-in auxiliary switch to provide for interfacing or signaling on selected models.
g. Actuator agency listings: UL-873, C22-2 No.24-83, CUL0
h. Basis of Design: Schneider Electric SmartX, or approved equal.

7. ½" to 2" Bronze Body, Linear Globe Valve Actuators with linkage SR & NSR
   a. Actuators are to be either floating SPDT control or proportional control 0…10, 2…10 Vdc or 4…20 mA with a 500-ohm resistor included.
   b. Actuators are to be direct/reverse with selectable DIP switches.
   c. Actuators are to have 90 lb. (400N), 180 lb. (800N), or 337 lb. (1500N) of force on Non-Spring Return (NSR) 157 lb. of force on the Spring Return model. Note: Not every actuator is for every valve.
   d. Actuators are to be powered with 24 Vac or 24 Vdc.
   e. All Non-Spring Return (NSR) actuators are to be NEMA 2, vertical mount only. Spring Return (SR) actuators are to have NEMA 4 models.
   f. Actuators must have manual override to allow positioning of the valve.
   g. Actuators must have selectable valve sequencing and flow curves of either equal percentage or linear.
   h. Actuators must have feedback.
   i. Actuators must have internal torque protection throughout stroke.
   j. 90°F (32°C) ambient at 366°F (186°C) fluid temperature
   k. Actuator agency listings (North America) UL873, cULus, RCM, CE
   l. Basis of Design: Schneider Electric Forta M400A-VB, M800A-VB, M900A, or approved equal and M1500x-VB screw mounted on Venta VB7000s, or approved equal.
8. 2 ½" to 6" Cast Iron Flanged Globe Valve Linear Actuators with linkage
   a. Actuators are to be either floating SPDT control or proportional control 0…10, 2…10 Vdc or 4…20 mA with a 500-ohm resistor included.
   b. Actuators are to direct/reverse acting with selectable DIP switch.
   c. Actuators are to have 180 lb. (800N) or 337 lb. (1500N) of force.
   d. Actuators will need a 24 Vac or Vdc power supply.
   e. Actuators are to be rated NEMA 2, vertical mount only.
   f. Actuators must have manual override to allow positioning of the valve.
   g. Actuators must have selectable valve sequencing and flow curves of either equal percentage to linear. A 2…10 Vac feedback.
   h. Actuators must have Internal torque protection throughout stroke.
   i. 90°F (32°C) ambient at 366°F (186°C) fluid temperature
   j. Actuator agency listings (North America) UL873, cULus, RCM, CE
   k. Basis of Design: Schneider Electric Forta M800A and M1500A, or approved equal.
9. 2" to 18" 2-Way and 2" to 16" 3-Way Linear Butterfly Valve Actuator with linkage NSR
   a. The butterfly valve actuators are to be Non-Spring Return (NSR) two-position and proportional taking 0…10 Vdc or 4…20 mA models. All Actuators are to be NEMA 4, manual override (hand wheel) two auxiliary switches, and built-in heater.
   b. Actuator close-offs and CVs must be appropriate for the valve size in a typical HVAC application.
   c. Actuators must be available in 24 Vac and 120 Vac models.
   d. Actuators must have Internal wiring isolation for parallel wiring multiple units that eliminates the risk of feedback from one actuator to another.
   e. Proportional models must have feedback of 0…10 Vdc or 4…20 mA.
   f. Actuator operating temperature shall be -40…150°F (-40…60°C).
   g. Actuator agency listings (North America) UL, CSA and CE

h. Basis of Design: Schneider Electric S70, or approved equal.

10. 2” to 4” 2-Way and 3-Way Butterfly Valve Actuators SR
    a. The butterfly valve actuators are to be Spring Return (SR) two-position and proportional taking 2…10 Vdc or 4…20 mA models. All Actuators are to be NEMA 2.
    b. Actuator close-offs and CVs must be appropriate for the valve size in a typical HVAC application.
    c. Actuators must be available in 24 Vac models.
    d. Actuators shall have two SPDT auxiliary switch models.
    e. Actuators must have [Internal wiring isolation for parallel wiring multiple units that eliminates the risk of feedback from one actuator to another.
    f. Proportional models must have feedback of 2…10 Vdc or 4…20 mA.
    g. Actuator agency listings (North America) UL, CSA and CE
    h. Basis of Design: Schneider Electric SmartX Mx-41-7153, or approved equal.
11. 2” to 6” 2-Way and 3-Way Butterfly Valve Actuators NSR
    a. The butterfly valve actuators are to be Non-Spring Return (NSR) two-position and proportional taking 0…10 Vdc or 4…20 mA models. All Actuators are to be NEMA 2.
    b. Actuator close-offs and CVs must be appropriate for the valve size in a typical HVAC application.
    c. Actuators must be available in 24 Vac models.
    d. Actuators shall have two SPDT auxiliary switch models.
    e. Actuators must have [Internal wiring isolation for parallel wiring multiple units that eliminates the risk of feedback from one actuator to another.
    f. Proportional models must have feedback of 2…10 Vdc or 4…20 mA.
    g. Actuator agency listings (North America) UL, CSA and CE
    h. Basis of Design: Schneider Electric SmartX NR-22xx-5xx, or approved equal.

L. Dampers
1. Automatic dampers, furnished by the Building Automation Contractor shall be single or multiple blade as required. Dampers are to be installed by the HVAC Contractor under the supervision of the BAS Contractor. All blank-off plates and conversions necessary to install smaller than duct size dampers are the responsibility of the Sheet Metal Contractor.
2. Damper frames are to be constructed of 13 gauge galvanized sheet steel mechanically joined with linkage concealed in the side channel to eliminate noise as friction. Compressible spring stainless steel side seals and acetyl or bronze bearings shall also be provided.
3. Damper blade width shall not exceed eight inches. Seals and 3/8 inch square steel zinc plated pins are required. Blade rotation is to be parallel or opposed as shown on the schedules.
4. For high performance applications, control dampers will meet or exceed the UL Class I leakage rating.
5. Control and smoke dampers shall be Ruskin, or approved equal.
6. Provide opposed blade dampers for modulating applications and parallel blade for two position control.

M. Damper Actuators
1. Direct-coupled type non-hydraulic designed for minimum 100,000 full-stroke cycles at rated torque.
2. Direct-coupled damper actuators must have a five-year warrantee.
3. Size for torque required for damper seal at maximum design conditions and valve close-off pressure for system design.

4. Overload protected electronically throughout rotation except for selected Floating actuators the have a mechanical clutch.
5. Spring Return Actuators: Mechanical fail safe shall incorporate a spring-return mechanism.
6. Non-Spring Return Actuators shall stay in the position last commended by the controller with an external manual gear release to allow positioning when not powered.
7. Power Requirements: 24Vac/dc [120Vac] [230Vac]
8. Proportional Actuators controller input range from 0…10 Vdc, 2…10 Vdc or 4…20 mA models.
9. Housing: Minimum requirement NEMA type 2
10. Actuators with a microprocessor should not be able to be modified by an outside source (cracked or hacked).
11. Actuators of 133 and 270 lb.-in. of torque or more should be able to be tandem mount or "gang" mount.
12. Agency Listings: ISO 9001, cULus, CE and CSA
13. Basis of Design: Schneider Electric SmartX Actuators, or approved equal.

207 ELECTRICAL POWER MEASUREMENT

A. Electrical Power Monitors, Single Point (Easy Install):
   1. Acceptable Manufacturer: Veris Industries., or approved equal.
   2. General: Consist of three split-core CTs, factory calibrated as a system, hinged at both axes with the electronics embedded inside the master CT. The transducer shall measure true (rms.RMS) power demand real power (kW) consumption (kWh). Conform to ANSI C12.1 metering accuracy standards.
   3. Voltage Input: Load capacity as shown on drawings. 208-480 VAC, 60 Hz
   4. Maximum Current Input: Up to 2400A
   5. Performance:
      a. Accuracy: +/- 1% system from 10% to 100% of the rated current of the CT's
      b. Operating Temperature Range: 32-140°F, 122°F for 2400A.
      c. Output: 4 to 20 mA, Pulse. or Modbus RTU
      d. Ratings:
         1) Agency: UL508 or equivalent
         2) Transducer internally isolated to 2000 VAC.
         3) Case isolation shall be 600 VAC.
      e. Basis of Design: Similar to Hawkeye Veris H80xx40 series, or approved equal
      f. Accessories: BACnet communications gateway

B. Electrical Power Monitors, Single Point (High Accuracy):
   1. Acceptable Manufacturer: Veris Industries, or equal.
   2. General: Revenue grade meter. Measures voltage, amperage, real power (kW), consumption (kWh), and reactive power (kVARar), and power factor (PF) per phase and total load for a single load. Factory calibrated as a system using split core CT's. Neutral voltage connection is required.
   3. Voltage Input: 208-480 VAC, 60 Hz
   4. Current Input: Up to 2400A
   5. Performance:
      a. Accuracy: +/- 1% system from 2% to 100% of the rated current of the CT's
      b. Operating Temperature Range: 32-122°F
   6. Output: Pulse, BACnet, Modbus RTU
   7. Display: Backlit LCD
   8. Enclosure: NEMA 1

9. Agency Rating: UL508 or equivalent
10. Basis of Design: Veris Industries H81xx00 series, or approved equal.

C. Electrical Power Monitors, Single Point (High Accuracy/Versatility):
1. Acceptable Manufacturer: Veris Industries, or equal.
2. General: Revenue grade meter. Measures voltage, amperage, real power (kW), consumption (kWh), reactive power (kVAR), apparent power (kVA) and power factor (PF) per phase and total load for a single load. Available with data logging , Bi-directional (4-quadrant) metering, and pulse contact accumulator inputs.
3. Voltage Input: 90-600 VAC, 50/60 Hz, 125-300 VDC
4. Current Input: 5A - 32,000A, selectable 1/3V or 1V CT inputs
5. Performance:
   a. Accuracy shall be +/- [0.2%] [0.5%] revenue grade
   b. Operating Temperature Range: -22-158°F
6. Output shall be [Pulse] [BACnet] [Modbus RTU] [LON]
7. Display: Backlit LCD
8. Enclosure: NEMA 4x optional
9. Agency Rating: UL508, ANSI C12.20
10. Basis of Design: Veris E5xxx series, or equal.

D. Electrical Power Monitors, Multiple Point (92 loads, High Accuracy):
1. Acceptable Manufacturer: Veris Industries, or equal.
2. General: Revenue grade meter. Measures volts, amps, power and energy for each circuit. 1/4 amp to 200 amp monitoring. 4 configurable alarm threshold registers
3. Voltage Input: 90-277 VAC, 60 Hz
4. Current Input: 5A - 32,000A, 1/3V CT inputs
5. Performance:
   a. Accuracy: +/- 0.5% meter (split core), +/- 1% system from 1/4-100A (solid core)
   b. Operating Temperature Range: 32-140°F
6. Output: Modbus RTU
7. Agency Rating: UL508, ANSI C12.10, IEC Class 1
8. Basis of Design: Veris E3xxx series, or equal.

PART 3 EXECUTION

3.01 CONTRACTOR RESPONSIBILITIES

A. General
1. Installation of the building automation system shall be performed by the Contractor or a subcontractor. However, all installation shall be under the personal supervision of the Contractor. The Contractor shall certify all work as proper and complete. Under no circumstances shall the design, scheduling, coordination, programming, training, and warranty requirements for the project be delegated to a subcontractor.

B. Demolition
1. Remove controls which do not remain as part of the building automation system, all associated abandoned wiring and conduit, and all associated pneumatic tubing. The Owner will inform the Contractor of any equipment which is to be removed that will remain the property of the Owner. All other equipment which is removed will be disposed of by the Contractor.

C. Access to Site
1. Unless notified otherwise, entrance to building is restricted. No one will be permitted to enter the building unless their names have been cleared with the Owner or the Owner's

Representative.

D. Code Compliance
   1. All wiring shall be installed in accordance with all applicable electrical codes and will comply with equipment manufacturer's recommendations. Should any discrepancy be found between wiring specifications in Division 17 and Division 16, wiring requirements of Division 17 will prevail for work specified in Division 17.

E. Cleanup
   1. At the completion of the work, all equipment pertinent to this contract shall be checked and thoroughly cleaned, and all other areas shall be cleaned around equipment provided under this contract.

3.02 WIRING, CONDUIT, AND CABLE

A. All wire will be copper and meet the minimum wire size and insulation class listed below:

Wire Class	Wire Size	Isolation Class
Power	12 Gauge	600 Volt
Class One	14 Gauge Std.	600 Volt
Class Two	18 Gauge Std.	300 Volt
Class Three	18 Gauge Std.	300 Volt
Communications	Per Mfr.	Per Mfr.

B. Power and Class One wiring may be run in the same conduit. Class Two and Three wiring and communications wiring may be run in the same conduit.

C. Where different wiring classes terminate within the same enclosure, maintain clearances and install barriers per the National Electric Code.

D. Where wiring is required to be installed in conduit, EMT shall be used. Conduit shall be minimum 1/2 inch galvanized EMT. Set screw fittings are acceptable for dry interior locations. Watertight compression fittings shall be used for exterior locations and interior locations subject to moisture. Provide conduit seal-off fitting where exterior conduits enter the building or between areas of high temperature/moisture differential.

E. Flexible metallic conduit (max. 3 feet) shall be used for connections to motors, actuators, controllers, and sensors mounted on vibration producing equipment. Liquid-tight flexible conduit shall be use in exterior locations and interior locations subject to moisture.

F. Junction boxes shall be provided at all cable splices, equipment termination, and transitions from EMT to flexible conduit. Interior dry location J-boxes shall be galvanized pressed steel, nominal four-inch square with blank cover. Exterior and damp location JH-boxes shall be cast alloy FS boxes with threaded hubs and gasketed covers.

G. Where the space above the ceiling is a supply or return air plenum, the wiring shall be plenum rated. Teflon wiring can be run without conduit above suspended ceilings. EXCEPTION: Any wire run in suspended ceilings that is used to control outside air dampers or to connect the system to the fire management system shall be in conduit.

H. Fiber optic cable shall include the following sizes; 50/125, 62.5/125 or 100/140.

I. Only glass fiber is acceptable, no plastic.

J. Fiber optic cable shall only be installed and terminated by an experienced contractor. The BAS contractor shall submit to the Engineer the name of the intended contractor of the fiber optic cable with his submittal documents.

3.03 HARDWARE INSTALLATION PRACTICES FOR WIRING

A. All controllers are to be mounted vertically and per the manufacturer's installation documentation.

B. The 120VAC power wiring to each Ethernet or Remote Site controller shall be a dedicated run, with a separate breaker. Each run will include a separate hot, neutral and ground wire. The ground wire will terminate at the breaker panel ground. This circuit will not feed any other circuit or device.

C. A true earth ground must be available in the building. Do not use a corroded or galvanized pipe, or structural steel.

D. Wires are to be attached to the building proper at regular intervals such that wiring does not droop. Wires are not to be affixed to or supported by pipes, conduit, etc.

E. Conduit in finished areas will be concealed in ceiling cavity spaces, plenums, furred spaces and wall construction. Exception; metallic surface raceway may be used in finished areas on masonry walls. All surface raceway in finished areas must be color matched to the existing finish within the limitations of standard manufactured colors.

F. Conduit, in non-finished areas where possible, will be concealed in ceiling cavity spaces, plenums, furred spaces, and wall construction. Exposed conduit will run parallel to or at right angles to the building structure.

G. Wires are to be kept a minimum of three (3) inches from hot water, steam, or condensate piping.

H. Where sensor wires leave the conduit system, they are to be protected by a plastic insert.

I. Wire will not be allowed to run across telephone equipment areas.

J. Provide fire caulking at all rated penetrations.

3.04 INSTALLATION PRACTICES FOR FIELD DEVICES

A. Well-mounted sensors will include thermal conducting compound within the well to insure good heat transfer to the sensor.

B. Actuators will be firmly mounted to give positive movement and linkage will be adjusted to give smooth continuous movement throughout 100 percent of the stroke.

C. Relay outputs will include transient suppression across all coils. Suppression devices shall limit transients to 150% of the rated coil voltage.

D. Water line mounted sensors shall be removable without shutting down the system in which they are installed.

E. For duct static pressure sensors, the high pressure port shall be connected to a metal static pressure probe inserted into the duct pointing upstream. The low pressure port shall be left open to the plenum area at the point that the high pressure port is tapped into the ductwork.

F. For building static pressure sensors, the high pressure port shall be inserted into the space via a metal tube. Pipe the low pressure port to the outside of the building.

3.05 ENCLOSURES

A. For all I/O requiring field interface devices, these devices where practical will be mounted in a field interface panel (FIP). The Contractor shall provide an enclosure which protects the device(s) from dust, moisture, conceals integral wiring and moving parts.

B. FIPs shall contain power supplies for sensors, interface relays and contactors, and safety circuits.

C. The FIP enclosure shall be of steel construction with baked enamel finish; NEMA 1 rated with a hinged door and keyed lock. The enclosure will be sized for twenty percent spare mounting space. All locks will be keyed identically.

D. All wiring to and from the FIP will be to screw type terminals. Analog or communications wiring may use the FIP as a raceway without terminating. The use of wire nuts within the FIP is prohibited.

E. All outside mounted enclosures shall meet the NEMA-4 rating.

F. The wiring within all enclosures shall be run in plastic track. Wiring within controllers shall be wrapped and secured.

3.06 IDENTIFICATION

A. Identify all control wires with labeling tape or sleeves using words, letters, or numbers that can be exactly cross-referenced with as-built drawings.

B. All field enclosures, other than controllers, shall be identified with a Bakelite nameplate. The lettering shall be in white against a black or blue background.

C. Junction box covers will be marked to indicate that they are a part of the BAS system.

D. All I/O field devices (except space sensors) that are not mounted within FIP's shall be identified with name plates.

E. All I/O field devices inside FIP's shall be labeled.

3.07 EXISTING CONTROLS.

A. Existing controls which are to be reused must each be tested and calibrated for proper operation. Existing controls which are to be reused and are found to be defective requiring replacement, will be noted to the Owner. The Owner will be responsible for all material and labor costs associated with their repair.

3.08 CONTROL SYSTEM SWITCH-OVER

A. Demolition of the existing control system will occur after the new temperature control system is in place including new sensors and new field interface devices.

B. Switch-over from the existing control system to the new system will be fully coordinated with the Owner. A representative of the Owner will be on site during switch-over.

C. The Contractor shall minimize control system downtime during switch-over. Sufficient installation mechanics will be on site so that the entire switch-over can be accomplished in a reasonable time frame.

3.09 LOCATION

A. The location of sensors is per mechanical and architectural drawings.

B. Space humidity or temperature sensors will be mounted away from machinery generating heat, direct light and diffuser air streams.

C. Outdoor air sensors will be mounted on the north building face directly in the outside air. Install these sensors such that the effects of heat radiated from the building or sunlight is minimized.

D. Field enclosures shall be located immediately adjacent to the controller panel(s) to which it is being interfaced.

3.10 SOFTWARE INSTALLATION

A. General.

1. The Contractor shall provide all labor necessary to install, initialize, start-up and debug all system software as described in this section. This includes any operating system

software or other third party software necessary for successful operation of the system.

3.11 DATABASE CONFIGURATION.

A. The Contractor will provide all labor to configure those portions of the database that are required by the points list and sequence of operation.

3.12 COLOR GRAPHIC DISPLAYS.

A. Unless otherwise directed by the owner, the Contractor will provide color graphic displays as depicted in the mechanical drawings for each system and floor plan. For each system or floor plan, the display shall contain the associated points identified in the point list and allow for setpoint changes as required by the owner.

3.13 REPORTS.

A. The Contractor will configure a minimum of 4 reports for the owner. These reports shall, at a minimum, be able to provide:
   1. Trend comparison data
   2. Alarm status and prevalence information
   3. Energy Consumption data
   4. System user data

3.14 DOCUMENTATION

A. As built software documentation will include the following:
   1. Descriptive point lists
   2. Application program listing
   3. Application programs with comments.
   4. Printouts of all reports.
   5. Alarm list.
   6. Printouts of all graphics
   7. Commissioning and System Startup
   8. An electronic copy of all databases, configuration files, or any type of files created specifically for each system.

3.15 POINT TO POINT CHECKOUT.

A. Each I/O device (both field mounted as well as those located in FIPs) shall be inspected and verified for proper installation and functionality. A checkout sheet itemizing each device shall be filled out, dated and approved by the Project Manager for submission to the owner or owner's representative.

B. In case of wireless devices, the signal strength recorded during checkout shall be reported.

3.16 CONTROLLER AND WORKSTATION CHECKOUT.

A. A field checkout of all controllers and front end equipment (computers, printers, modems, etc.) shall be conducted to verify proper operation of both hardware and software. A checkout sheet itemizing each device and a description of the associated tests shall be prepared and submitted to the owner or owner's representative by the completion of the project.

3.17 SYSTEM ACCEPTANCE TESTING

A. All application software will be verified and compared against the sequences of operation.

B. Control loops will be exercised by inducing a setpoint shift of at least 10% and observing whether the system successfully returns the process variable to setpoint. Record all test results and attach to the Test Results Sheet.

C. Test each alarm in the system and validate that the system generates the appropriate alarm message, that the message appears at all prescribed destinations (workstations or printers),

and that any other related actions occur as defined (i.e. graphic panels are invoked, reports are generated, etc.). Submit a Test Results Sheet to the owner.

D. Perform an operational test of each unique graphic display and report to verify that the item exists, that the appearance and content are correct, and that any special features work as intended. Submit a Test Results Sheet to the owner.

E. Perform an operational test of each third party interface that has been included as part of the automation system. Verify that all points are properly polled, that alarms have been configured, and that any associated graphics and reports have been completed. If the interface involves a file transfer over Ethernet, test any logic that controls the transmission of the file, and verify the content of the specified information.

END OF SECTION

SECTION 232113
HYDRONIC PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Hydronic system requirements.

B. Heating water and glycol piping, above grade.

C. Equipment drains and overflows.

D. Pipe hangers and supports.

E. Unions, flanges, mechanical couplings, and dielectric connections.

F. Valves:
   1. Ball valves.

1.02 REFERENCE STANDARDS

A. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300.

B. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.

C. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.

D. ASME B31.9 - Building Services Piping.

E. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

F. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.

G. ASTM A536 - Standard Specification for Ductile Iron Castings.

H. ASTM B32 - Standard Specification for Solder Metal.

I. ASTM B88 - Standard Specification for Seamless Copper Water Tube.

J. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric).

K. ASTM F1476 - Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications.

L. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding.

M. AWS D1.1/D1.1M - Structural Welding Code - Steel.

N. AWWA C606 - Grooved and Shouldered Joints.

O. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation.

PART 2 PRODUCTS

2.01 HYDRONIC SYSTEM REQUIREMENTS

A. Comply with ASME B31.9 and applicable federal, state, and local regulations.

B. Piping: Provide piping, fittings, hangers and supports as required, as indicated, and as follows:
   1. Where more than one piping system material is specified, provide joining fittings that are compatible with piping materials and ensure that the integrity of the system is not jeopardized.
   2. Use non-conducting dielectric connections whenever jointing dissimilar metals.
   3. Grooved mechanical joints may be used in accessible locations only.

a. Accessible locations include those exposed on interior of building, in pipe chases, and in mechanical rooms, aboveground outdoors, and as approved by Architect.
b. Grooved mechanical connections and joints comply with AWWA C606.
c. Use rigid joints unless otherwise indicated.

4. Provide pipe hangers and supports in accordance with ASME B31.9 or MSS SP-58 unless indicated otherwise.

C. Pipe-to-Valve and Pipe-to-Equipment Connections: Use flanges, unions, or grooved couplings to allow disconnection of components for servicing; do not use direct welded, soldered, or threaded connections.
1. Where grooved joints are used in piping, provide grooved valve/equipment connections if available; if not available, provide flanged ends and grooved flange adapters.

D. Valves: Provide valves where indicated:
1. Provide drain valves where indicated, and if not indicated provide at least at main shut-off, low points of piping, bases of vertical risers, and at equipment. Use 3/4 inch gate valves with cap; pipe to nearest floor drain.
2. For throttling, bypass, or manual flow control services, use globe, ball, or butterfly valves.
3. For shut-off and to isolate parts of systems or vertical risers, use gate, ball, or butterfly valves.

202 HEATING WATER AND GLYCOL PIPING, ABOVE GRADE

A. Steel Pipe: ASTM A53/A53M, Schedule 40, black, using one of the following joint types:
1. Welded Joints: ASTM A234/A234M, wrought steel welding type fittings; AWS D1.1/D1.1M welded.
2. Threaded Joints: ASME B16.3, malleable iron fittings.
3. Grooved Joints: AWWA C606 grooved pipe, fittings of same material, and mechanical couplings.

B. Copper Tube: ASTM B88 (ASTM B88M), Type K (A), drawn, using one of the following joint types:
1. Solder Joints: ASME B16.18 cast brass/bronze or ASME B16.22 solder wrought copper fittings.
a. Solder: ASTM B32 lead-free solder, HB alloy (95-5 tin-antimony) or tin and silver.
b. Braze: AWS A5.8M/A5.8 BCuP copper/silver alloy.
2. Tee Connections: Mechanically extracted collars with notched and dimpled branch tube.

203 EQUIPMENT DRAINS AND OVERFLOWS

A. Copper Tube: ASTM B88 (ASTM B88M), Type K (A), drawn; using one of the following joint types:
1. Solder Joints: ASME B16.18 cast brass/bronze or ASME B16.22 solder wrought copper fittings; ASTM B32 lead-free solder, HB alloy (95-5 tin-antimony) or tin and silver.

204 PIPE HANGERS AND SUPPORTS

A. Provide hangers and supports that comply with MSS SP-58.
1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
2. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch: Malleable iron, adjustable swivel, split ring.
3. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
4. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.

B. In grooved installations, use rigid couplings with offsetting angle-pattern bolt pads or with wedge shaped grooves in header piping to permit support and hanging in accordance with ASME B31.9.

2.05 UNIONS, FLANGES, MECHANICAL COUPLINGS, AND DIELECTRIC CONNECTIONS

A. Unions for Pipe 2 Inches and Less:
   1. Ferrous Piping: 150 psig malleable iron, threaded.
   2. Copper Pipe: Bronze, soldered joints.

B. Mechanical Couplings for Grooved and Shouldered Joints: Two or more curved housing segments with continuous key to engage pipe groove, circular C-profile gasket, and bolts to secure and compress gasket.
   1. Dimensions and Testing: In accordance with AWWA C606.
   2. Mechanical Couplings: Comply with ASTM F1476.
   3. Housing Material: Ductile iron, galvanized complying with ASTM A536.
   4. Gasket Material: EPDM suitable for operating temperature range from minus 30 degrees F to 230 degrees F.
   5. Bolts and Nuts: Hot dipped galvanized or zinc-electroplated steel.
   6. When pipe is field grooved, provide coupling manufacturer's grooving tools.
   7. Manufacturers:
      a. Victaulic Company; [_____]: www.victaulic.com/#sle.
      b. Or equal.
      c. Substitutions: See Section 016000 - Product Requirements.

C. Dielectric Connections:
   1. Waterways:
      a. Water impervious insulation barrier capable of limiting galvanic current to 1 percent of short circuit current in a corresponding bimetallic joint.
      b. Dry insulation barrier able to withstand 600 volt breakdown test.
      c. Construct of galvanized steel with threaded end connections to match connecting piping.
      d. Suitable for the required operating pressures and temperatures.

2.06 BALL VALVES

A. Manufacturers:
   1. Apollo Valves: www.apollovalves.com/#sle.
   2. Victaulic Company: www.victaulic.com/#sle.
   3. Or equal.

B. Up To and Including 2 Inches:
   1. Bronze one piece body, chrome plated brass ball, teflon seats and stuffing box ring, lever handle with balancing stops, solder ends with union.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Route piping in orderly manner, parallel to building structure, and maintain gradient.

C. Install piping to conserve building space and to avoid interfere with use of space.

D. Group piping whenever practical at common elevations.

E. Slope piping and arrange to drain at low points.

END OF SECTION

SECTION 232114
HYDRONIC SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Air vents.

B. Strainers.

C. Pressure-temperature test plugs.

D. Balancing valves.

1.02 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide product data for manufactured products and assemblies required for this project. Include component sizes, rough-in requirements, service sizes, and finishes. Include product description and model.

C. Manufacturer's Installation Instructions: Indicate hanging and support methods, joining procedures.

D. Maintenance Data: Include installation instructions, assembly views, lubrication instructions, and replacement parts list.

1.03 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary protective coating on cast iron and steel valves.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 PRODUCTS

2.01 AIR VENTS

A. Manufacturers:
   1. Armstrong International, Inc
   2. ITT Bell & Gossett
   3. Taco, Inc
   4. Or equal.

B. Manual Type: Short vertical sections of 2 inch diameter pipe to form air chamber, with 1/8 inch brass needle valve at top of chamber.

C. Float Type:
   1. Brass or semi-steel body, copper, polypropylene, or solid non-metallic float, stainless steel valve and valve seat; suitable for system operating temperature and pressure; with isolating valve.

2.02 STRAINERS

A. Manufacturers:
   1. Armstrong International, Inc
   2. Flexicraft Industries
   3. Grinnell Products

4. The Metraflex Company; LPD Y Strainer
5. Or equal.

B. Size 2 inch and Under:
1. Screwed brass or iron body for 175 psi working pressure, Y pattern with 1/32 inch stainless steel perforated screen.

2.03 PRESSURE-TEMPERATURE TEST PLUGS

A. Manufacturers:
1. Ferguson Enterprises Inc; [_____]: www.fnw.com/#sle.
2. Peterson Equipment Company Inc; [_____]: www.petesplug.com/#sle.
3. Sisco Manufacturing Company Inc; [_____]: www.siscomfg.com/#sle.
4. Or equal.

B. Construction: Brass body designed to receive temperature or pressure probe with removable protective cap, and Neoprene rated for minimum 200 degrees F.

C. Application: Use extended length plugs to clear insulated piping.

2.04 BALANCING VALVES

A. Manufacturers:
1. Armstrong International, Inc
2. Hays Fluid Controls
3. ITT Bell & Gossett
4. Taco, Inc
5. Tour & Anderson / Victaulic.
6. Or equal.

B. Size 2 inch and Smaller:
1. Provide ball, globe, or [_____] style with flow balancing, flow measurement, and shut-off capabilities, memory stops, minimum of two metering ports and NPT threaded, soldered, or [_____] connections.
2. Metal construction materials consist of bronze, brass, or [_____].
3. Non-metal construction materials consist of Teflon, EPDM, engineered resin, or [_____].

2.05 PRESSURE INDEPENDENT VALVES

A. Manufacturers:
1. Tour & Anderson / Victaulic.
2. Or equal.

B. Size 2 inch and Smaller:
1. Provide ball, globe, or [_____] style with flow balancing, flow measurement, and shut-off capabilities, memory stops, minimum of two metering ports and NPT threaded, soldered, or [_____] connections.
2. Metal construction materials consist of bronze, brass, or [_____].
3. Non-metal construction materials consist of Teflon, EPDM, engineered resin, or [_____].

PART 3 EXECUTION

3.01 INSTALLATION

A. Install specialties in accordance with manufacturer's instructions.

B. Provide manual air vents at system high points and as indicated.

END OF SECTION

SECTION 232300
REFRIGERANT PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Piping.

B. Refrigerant.

C. Moisture and liquid indicators.

D. Valves.

E. Strainers.

F. Filter-driers.

1.02 REFERENCE STANDARDS

A. ASHRAE Std 15 - Safety Standard for Refrigeration Systems and Designation and Classification of Refrigerants .

B. ASHRAE Std 34 - Designation and Safety Classification of Refrigerants.

C. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.

D. ASME B31.5 - Refrigeration Piping and Heat Transfer Components.

E. ASME B31.9 - Building Services Piping.

F. ASTM B280 - Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.

G. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding.

H. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation.

1.03 SYSTEM DESCRIPTION

A. Provide pipe hangers and supports in accordance with ASME B31.5 unless indicated otherwise.

B. Liquid Indicators:
   1. Use line size liquid indicators in main liquid line leaving condenser.
   2. If receiver is provided, install in liquid line leaving receiver.
   3. Use line size on leaving side of liquid solenoid valves.

C. Valves:
   1. Use service valves on suction and discharge of compressors.

D. Refrigerant Charging (Packed Angle) Valve: Use in liquid line between receiver shut-off valve and expansion valve.

E. Strainers:
   1. Use line size strainer upstream of each automatic valve.

F. Filter-Driers:
   1. Use a filter-drier immediately ahead of liquid-line controls, such as thermostatic expansion valves, solenoid valves, and moisture indicators.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide general assembly of specialties, including manufacturers catalogue information. Provide manufacturers catalog data including load capacity.

C. Shop Drawings: Indicate schematic layout of system, including equipment, critical dimensions, and sizes.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the type of work specified in this section, with minimum three years ofdocumented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store piping and specialties in shipping containers with labeling in place.

B. Protect piping and specialties from entry of contaminating material by leaving end caps and plugs in place until installation.

C. Dehydrate and charge components such as piping and receivers, seal prior to shipment, until connected into system.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Comply with ASME B31.9 for installation of piping system.

2.02 PIPING

A. Copper Tube: ASTM B280, H58 hard drawn.
   1. Fittings: ASME B16.22 wrought copper.
   2. Joints: Braze, AWS A5.8M/A5.8 BCuP silver/phosphorus/copper alloy.

B. Pipe Supports and Anchors:
   1. Provide hangers and supports that comply with MSS SP-58.
      a. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
   2. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch: Malleable iron adjustable swivel, split ring.
   3. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
   4. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
   5. Vertical Support: Steel riser clamp.
   6. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
   7. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.
   8. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.03 REFRIGERANT

A. Refrigerant: Use only refrigerants that have ozone depletion potential (ODP) of zero and global warming potential (GWP) of less than 50.

B. Refrigerant: R-134a, tetrafluoroethane as defined in ASHRAE Std 34.

2.04 MOISTURE AND LIQUID INDICATORS

A. Manufacturers:
   1. Henry Technologies; [_____]: www.henrytech.com/#sle.
   2. Parker Hannifin/Refrigeration and Air Conditioning; [_____]: www.parker.com/#sle.
   3. Sporlan, a Division of Parker Hannifin; [_____]: www.parker.com/#sle.
   4. Or equal.

B. Indicators: Single port type, UL listed, with copper or brass body, flared or solder ends, sight glass, color coded paper moisture indicator with removable element cartridge and plastic cap; for maximum temperature of 200 degrees F and maximum working pressure of 500 psi.

2.05 VALVES

A. Manufacturers:
   1. Hansen Technologies Corporation; <>
   2. Henry Technologies; <>
   3. Flomatic Valves; <>
   4. Or equal.

B. Service Valves:
   1. Forged brass body with copper stubs, brass caps, removable valve core, integral ball check valve, flared or solder ends, for maximum pressure of 500 psi.

2.06 STRAINERS

A. Manufacturers:
   1. Hansen Technologies Corporation; <>
   2. Parker Hannifin/Refrigeration and Air Conditioning; <>
   3. Sporlan, a Division of Parker Hannifin; <>
   4. Or equal.

B. Straight Line or Angle Line Type:
   1. Brass or steel shell, steel cap and flange, and replaceable cartridge, with screen of stainless steel wire or monel reinforced with brass; for maximum working pressure of 430 psi.

2.07 FILTER-DRIERS

A. Manufacturers:
   1. Flow Controls Division of Emerson Electric; <>
   2. Parker Hannifin/Refrigeration and Air Conditioning; <>
   3. Sporlan, a Division of Parker Hannifin; <>
   4. Or equal.

B. Performance:
   1. Pressure Drop: 2 psi, maximum, when operating at full connected evaporator capacity.
   2. Design Working Pressure: 350 psi, minimum.

C. Cores: Molded or loose-fill molecular sieve desiccant compatible with refrigerant, activated alumina, activated charcoal, and filtration to 40 microns, with secondary filtration to 20 microns; of construction that will not pass into refrigerant lines.

D. Construction: UL listed.
   1. Replaceable Core Type: Steel shell with removable cap.
   2. Connections: As specified for applicable pipe type.

PART 3 EXECUTION

3.01 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.02 INSTALLATION

A. Install refrigeration specialties in accordance with manufacturer's instructions.

B. Route piping in orderly manner, with plumbing parallel to building structure, and maintain gradient.

C. Install piping to conserve building space and avoid interference with use of space.

D. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

E. Pipe Hangers and Supports:
   1. Install in accordance with ASME B31.5.
   2. Support horizontal piping as indicated.
   3. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
   4. Place hangers within 12 inches of each horizontal elbow.
   5. Provide copper plated hangers and supports for copper piping.

F. Provide clearance for installation of insulation and access to valves and fittings.

G. Flood piping system with nitrogen when brazing.

H. Insulate piping; refer to Section 230719.

I. Follow ASHRAE Std 15 procedures for charging and purging of systems and for disposal of refrigerant.

J. Fully charge completed system with refrigerant after testing.

3.03 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Test refrigeration system in accordance with ASME B31.5.

C. Pressure test system with dry nitrogen to 200 psi. Perform final tests at 27 inches vacuum and 200 psi using halide torch. Test to no leakage.

END OF SE

SECTION 233100
HVAC DUCTS AND CASINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal ductwork.

B. Casing and plenums.

1.02 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

D. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems.

E. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible.

1.03 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data for duct materials.

C. Shop Drawings: Provide coordinated ductwork shop drawings prior to start of construction.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience, and approved by manufacturer.

B. Installer Qualifications: Company specializing in performing the type of work specified in this section, with minimum three years of documented experience.

1.05 FIELD CONDITIONS

A. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.

B. Maintain temperatures within acceptable range during and after installation of duct sealants.

PART 2 PRODUCTS

2.01 DUCT ASSEMBLIES

A. Regulatory Requirements: Construct ductwork to comply with NFPA 90A standards.

B. Ducts: Galvanized steel, unless otherwise indicated.

C. Low Pressure Supply (Heating Systems): 2 inch w.g. pressure class, galvanized steel.

D. Low Pressure Supply (System with Cooling Coils): 2 inch w.g. pressure class, galvanized steel.

E. Return and Relief: 2 inch w.g. pressure class, galvanized steel.

F. General Exhaust: 2 inch w.g. pressure class, galvanized steel.

G. Outside Air Intake: 2 inch w.g. pressure class, galvanized steel.

H. Transfer Air and Sound Boots: 2 inch w.g. pressure class.

202 MATERIALS

A. Galvanized Steel for Ducts: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G90/Z275 coating.

B. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.
   1. Type: Heavy mastic or liquid used alone or with tape, suitable for joint configuration and compatible with substrates, and recommended by manufacturer for pressure class of ducts.
   2. VOC Content: Not more than 250 g/L, excluding water.
   3. Surface Burning Characteristics: Flame spread index of zero and smoke developed index of zero, when tested in accordance with ASTM E84.
   4. Manufacturers:
      a. Carlisle HVAC Product
      b. Ductmate Industries, Inc, a DMI Company.
      c. Or equal.

C. Hanger Rod: ASTM A36/A36M; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.

D. Hanger Fasteners: Attach hangers to structure using appropriate fasteners, as follows:
   1. Manufacturers:
      a. Powers Fasteners, Inc.
      b. Or equal.

203 DUCTWORK FABRICATION

A. Fabricate and support in accordance with SMACNA (DCS) and as indicated.

B. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

C. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows must be used, provide air foil turning vanes of perforated metal with glass fiber insulation.

D. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

E. Fabricate continuously welded round and oval duct fittings in accordance with SMACNA (DCS).

F. Where ducts are connected to exterior wall louvers and duct outlet is smaller than louver frame, provide blank-out panels sealing louver area around duct. Use same material as duct, painted black on exterior side; seal to louver frame and duct.

204 MANUFACTURED DUCTWORK AND FITTINGS

A. Double Wall Insulated Round Ducts: Round spiral lockseam duct with galvanized steel outer wall, perforated galvanized steel inner wall; fitting with solid inner wall.
   1. Manufacture in accordance with SMACNA (DCS).
   2. Insulation:
      a. Thickness: 1 inch.
   3. Manufacturers:
      a. MKT Metal Manufacturing; Weatherguard: www.mktduct.com/#sle.
      b. United McGill.
      c. Or equal.

B. Round Ducts: Round lockseam duct with galvanized steel outer wall.
   1. Manufacture in accordance with SMACNA (DCS).

2. Manufacturers:
    a. EHG, a DMI Company
    b. Linx Industries, Inc, a DMI Company
    c. MKT Metal Manufacturing
    d. Or equal.

C. Flexible Ducts: Two ply vinyl film supported by helically wound spring steel wire.
1. Insulation: Fiberglass insulation with polyethylene vapor barrier film.
2. Pressure Rating: 10 inches WG positive and 1.0 inches WG negative.
3. Maximum Velocity: 4000 fpm.
4. Temperature Range: Minus 10 degrees F to 160 degrees F.
5. Manufacturers:
    a. Hart & Cooley, Inc.
    b. JP Lamborn Co.
    c. Or equal.

2.05 CASINGS

A. Fabricate casings in accordance with SMACNA (DCS) and construct for operating pressures indicated.

B. Mount floor mounted casings on 4 inch high concrete curbs. At floor, rivet panels on 8 inch centers to angles. Where floors are acoustically insulated, provide liner of galvanized 18 gage, 0.0478 inch expanded metal mesh supported at 12 inch centers, turned up 12 inches at sides with sheet metal shields.

C. Reinforce door frames with steel angles tied to horizontal and vertical plenum supporting angles. Install hinged access doors where indicated or required for access to equipment for cleaning and inspection.

D. Fabricate acoustic casings with reinforcing turned inward. Provide 16 gage, 0.0598 inch sheet steel back facing and 22 gage, 0.0299 inch perforated sheet steel front facing with 3/32 inch diameter holes on 5/32 inch centers. Construct panels 3 inches thick packed with 4.5 lb/cu ft minimum glass fiber insulation media, on inverted channels of 16 gage, 0.0598 inch sheet steel.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install, support, and seal ducts in accordance with SMACNA (DCS).

B. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

C. Flexible Ducts: Connect to metal ducts with draw bands.

D. Duct sizes indicated are inside clear dimensions. For lined ducts, maintain sizes inside lining.

E. Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pilot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.

F. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

G. Use double nuts and lock washers on threaded rod supports.

H. Connect diffusers or light troffer boots to low pressure ducts directly or with 5 feet maximum length of flexible duct held in place with strap or clamp.

I. Set plenum doors 6 to 12 inches above floor. Arrange door swings so that fan static pressure holds door in closed position.

J. At exterior wall louvers, seal duct to louver frame and install blank-out panels.

END OF SECTION

SECTION 233300
AIR DUCT ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Air turning devices/extractors.

B. Backdraft dampers - metal.

C. Duct access doors.

D. Duct test holes.

E. Fire dampers.

F. Flexible duct connectors.

G. Volume control dampers.

H. Miscellaneous products:
   1. Duct opening closure film.

1.02 RELATED REQUIREMENTS

A. Section 230548 - Vibration and Seismic Controls for HVAC.

B. Section 233100 - HVAC Ducts and Casings.

1.03 REFERENCE STANDARDS

A. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems.

B. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible.

C. UL 33 - Safety Heat Responsive Links for Fire-Protection Service.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide for shop fabricated assemblies including volume control dampers. Include electrical characteristics and connection requirements.

C. Manufacturer's Installation Instructions: Provide instructions for fire dampers.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect dampers from damage to operating linkages and blades.

PART 2 PRODUCTS

2.01 AIR TURNING DEVICES/EXTRACTORS

A. Manufacturers:
   1. Carlisle HVAC Products
   2. Elgen Manufacturing, Inc.
   3. Krueger-HVAC, Division of Air System Components
   4. Ruskin Company
   5. Titus HVAC, a brand of Johnson Controls
   6. Ward Industries, a brand of Hart and Cooley, Inc.
   7. Or equal.

B. Multi-blade device with blades aligned in short dimension; steel construction; with individually adjustable blades, mounting straps.

2.02 BACKDRAFT DAMPERS - METAL

A. Manufacturers:
   1. Louvers & Dampers, Inc, a brand of Mestek, Inc.
   2. Nailor Industries, Inc.
   3. Ruskin Company
   4. Or equal.

B. Gravity Backdraft Dampers, Size 18 by 18 inches or Smaller, Furnished with Air Moving Equipment: Air moving equipment manufacturer's standard construction.

C. Multi-Blade, Parallel Action Gravity Balanced Backdraft Dampers: Galvanized steel, with center pivoted blades of maximum 6 inch width, with felt or flexible vinyl sealed edges, linked together in rattle-free manner with 90 degree stop, steel ball bearings, and plated steel pivot pin; adjustment device to permit setting for varying differential static pressure.

2.03 DUCT ACCESS DOORS

A. Manufacturers:
   1. Ductmate Industries, Inc, a DMI Company
   2. Elgen Manufacturing, Inc.
   3. Ruskin Company
   4. SEMCO LLC
   5. Ward Industries, a brand of Hart and Cooley, Inc.
   6. Or equal.

B. Fabricate in accordance with SMACNA (DCS) and as indicated.

C. Fabrication: Rigid and close-fitting of galvanized steel with sealing gaskets and quick fastening locking devices. For insulated ducts, install minimum 1 inch thick insulation with sheet metal cover.
   1. Up to 18 inches Square: Provide two hinges and two sash locks.
   2. Up to 24 by 48 inches: Three hinges and two compression latches with outside and inside handles.

D. Access doors with sheet metal screw fasteners are not acceptable.

2.04 DUCT TEST HOLES

A. Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.

2.05 FIRE DAMPERS

A. Manufacturers:
   1. Louvers & Dampers, Inc, a brand of Mestek, Inc.
   2. Nailor Industries, Inc.
   3. Pottorff
   4. Ruskin Company
   5. Ward Industries, a brand of Hart and Cooley, Inc.
   6. Or equal.
   7. Substitutions: See Section 016000 - Product Requirements.

B. Curtain Type Dampers: Galvanized steel with interlocking blades. Provide stainless steel closure springs and latches for horizontal installations. Configure with blades out of air stream except for 1.0 inch pressure class ducts up to 12 inches in height.

C. Fusible Links: UL 33, separate at 160 degrees F with adjustable link straps for combination fire/balancing dampers.

206 FLEXIBLE DUCT CONNECTORS

A. Manufacturers:
   1. Carlisle HVAC Products
   2. Ductmate Industries, Inc, a DMI Company
   3. Elgen Manufacturing, Inc.
   4. Or equal.

B. Fabricate in accordance with SMACNA (DCS) and as indicated.

C. Flexible Duct Connections: Fabric crimped into metal edging strip.
   1. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A, minimum density 30 oz per sq yd.
      a. Net Fabric Width: Approximately 2 inches wide.
   2. Metal: 3 inches wide, 24 gage, 0.0239 inch thick galvanized steel.

D. Maximum Installed Length: 6 inch.

207 VOLUME CONTROL DAMPERS

A. Manufacturers:
   1. AireTechnologies, Inc, a DMI Company
   2. Louvers & Dampers, Inc, a brand of Mestek, Inc.
   3. Nailor Industries, Inc.
   4. Ruskin Company
   5. Or equal.

B. Fabricate in accordance with SMACNA (DCS) and as indicated.

C. Splitter Dampers:
   1. Material: Same gage as duct to 24 inches size in either direction, and two gages heavier for sizes over 24 inches.
   2. Blade: Fabricate of single thickness sheet metal to streamline shape, secured with continuous hinge or rod.
   3. Operator: Minimum 1/4 inch diameter rod in self aligning, universal joint action, flanged bushing with set screw .

D. Single Blade Dampers:
   1. Fabricate for duct sizes up to 6 by 30 inch.
   2. Blade: 24 gage, 0.0239 inch, minimum.

E. Multi-Blade Damper: Fabricate of opposed blade pattern with maximum blade sizes 8 by 72 inch. Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.
   1. Blade: 18 gage, 0.0478 inch, minimum.

F. End Bearings: Except in round ducts 12 inches and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon, thermoplastic elastomer, or sintered bronze bearings.

G. Quadrants:
   1. Provide locking, indicating quadrant regulators on single and multi-blade dampers.
   2. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.
   3. Where rod lengths exceed 30 inches provide regulator at both ends.

2.08 MISCELLANEOUS PRODUCTS

A. Duct Opening Closure Film: Mold-resistant, self-adhesive film to keep debris out of ducts during construction.
   1. Thickness: 2 mils.
   2. High tack water based adhesive.
   3. UV stable light blue color.
   4. Elongation Before Break: 325 percent, minimum.
   5. Manufacturers:
      a. Carlisle HVAC Products
      b. Or equal.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA (DCS). Refer to Section 233100 for duct construction and pressure class.

B. Provide backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.

C. Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, combination fire and smoke dampers, and elsewhere as indicated. Provide minimum 8 by 8 inch size for hand access, size for shoulder access, and as indicated. Provide 4 by 4 inch for balancing dampers only. Review locations prior to fabrication.

D. Provide duct test holes where indicated and required for testing and balancing purposes.

E. Provide fire dampers at locations indicated, where ducts and outlets pass through fire rated components, and where required by Authorities Having Jurisdiction. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.

F. Demonstrate re-setting of fire dampers to Owner's representative.

G. At fans and motorized equipment associated with ducts, provide flexible duct connections immediately adjacent to the equipment.

H. At equipment supported by vibration isolators, provide flexible duct connections immediately adjacent to the equipment.
   1. Refer to Section 230548.

I. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum 2 duct widths from duct take-off.

J. Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.

END OF SECTION

SECTION 233423
HVAC POWER VENTILATORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Roof exhausters.

B. Ceiling exhaust fans.

1.02 RELATED REQUIREMENTS

A. Section 230513 - Common Motor Requirements for HVAC Equipment.

B. Section 230548 - Vibration and Seismic Controls for HVAC.

C. Section 233300 - Air Duct Accessories: Backdraft dampers.

1.03 REFERENCE STANDARDS

A. AMCA (DIR) - (Directory of) Products Licensed Under AMCA International Certified Ratings Program.

B. AMCA 99 - Standards Handbook.

C. AMCA 204 - Balance Quality and Vibration Levels for Fans.

D. AMCA 210 - Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating.

E. AMCA 300 - Reverberant Room Method for Sound Testing of Fans.

F. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data.

G. UL 705 - Power Ventilators.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on fans and accessories including fan curves with specified operating point clearly plotted, power, RPM, sound power levels at rated capacity, and electrical characteristics and connection requirements.

PART 2 PRODUCTS

2.01 POWER VENTILATORS - GENERAL

A. Manufacturers:
   1. Carnes, a division of Carnes Company Inc.
   2. Greenheck Fan Corporation
   3. PennBarry, Division of Air System Components
   4. Twin City Fan & Blower.
   5. Substitutions: Or equal.

B. Static and Dynamically Balanced: AMCA 204 - Balance Quality and Vibration Levels for Fans.

C. Performance Ratings: Determined in accordance with AMCA 210 and bearing the AMCA Certified Rating Seal.

D. Sound Ratings: AMCA 301, tested to AMCA 300 and bearing AMCA Certified Sound Rating Seal.

E. Fabrication: Comply with AMCA 99.

F. UL Compliance: UL listed and labeled, designed, manufactured, and tested in accordance with UL 705.

G. Electrical Components: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

2.02 ROOF EXHAUSTERS

A. Fan Unit: V-belt or direct driven as indicated, with spun aluminum housing; resilient mounted motor; 1/2 inch mesh, 0.62 inch thick aluminum wire birdscreen; square base to suit roof curb with continuous curb gaskets.

B. Roof Curb: 16 inch high self-flashing of galvanized steel with continuously welded seams, hinged curb adapter and factory installed nailer strip.

C. Disconnect Switch: Factory wired, non-fusible, in housing for thermal overload protected motor.

D. Backdraft Damper: Gravity actuated, aluminum multiple blade construction, felt edged with offset hinge pin, nylon bearings, blades linked.

E. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheave selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.

2.03 CEILING EXHAUST FANS

A. Centrifugal Fan Unit: V-belt or direct driven with galvanized steel housing lined with acoustic insulation, resilient mounted motor, gravity backdraft damper in discharge.

B. Grille: Molded white plastic.

C. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheaves selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Secure roof exhausters with cadmium plated steel lag screws to roof curb.

C. Extend ducts to roof exhausters into roof curb. Counterflash duct to roof opening.

D. Install backdraft dampers on inlet to roof and wall exhausters.

E. Provide backdraft dampers on outlet from cabinet and ceiling exhauster fans and as indicated.

END OF SECTION

SECTION 233700
AIR OUTLETS AND INLETS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Diffusers:
   1. Rectangular ceiling diffusers.

B. Registers/grilles:
   1. Ceiling-mounted, exhaust and return register/grilles.
   2. Wall-mounted, supply register/grilles.
   3. Wall-mounted, exhaust and return register/grilles.

C. Gravity ventilators.

1.02 REFERENCE STANDARDS

A. AMCA 511 - Certified Ratings Program for Air Control Devices.

B. AMCA 550 - Test Method for High Velocity Wind Driven Rain Resistant Louvers.

C. ASHRAE Std 70 - Method of Testing the Performance of Air Outlets and Inlets.

D. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

E. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).

F. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems.

1.03 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.

1.04 QUALITY ASSURANCE

A. Test and rate air outlet and inlet performance in accordance with ASHRAE Std 70.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Krueger-HVAC

B. Metalaire, a brand of Metal Industries Inc.

C. Price Industries

D. Titus, a brand of Air Distribution Technologies

E. Or equal.

Substitutions: See Section 016000 - Product Requirements Or equal .

2.02 RECTANGULAR CEILING DIFFUSERS

A. Type: Provide square and rectangular, adjustable pattern diffuser to discharge air in 360 degree and four way pattern.

B. Connections: As indicated on drawings.

C. Frame: Provide surface mount, inverted T-bar, and spline type. In plaster ceilings, provide plaster frame and ceiling frame.

D. Fabrication: Aluminum with baked enamel finish.

E. Color: White.

F. Accessories: Provide butterfly volume control damper; anti-smudging device, gaskets for surface mounted diffusers, and [_____] with damper adjustable from diffuser face.

203 CEILING EXHAUST AND RETURN REGISTERS/GRILLES

A. Type: Streamlined blades, 3/4 inch minimum depth, 3/4 inch maximum spacing, with blades set at 45 degrees, horizontal face.

B. Frame: 1-1/4 inch margin with countersunk screw mounting.

C. Fabrication: Steel with 20 gage, 0.0359 inch minimum frames and 22 gage, 0.0299 inch minimum blades, steel and aluminum with 20 gage, 0.0359 inch minimum frame, or aluminum extrusions, with factory baked enamel finish.

D. Color: White.

E. Damper: Integral, gang-operated, opposed blade type with removable key operator, operable from face where not individually connected to exhaust fans.

204 WALL SUPPLY REGISTERS/GRILLES

A. Type: Streamlined and individually adjustable blades, 3/4 inch minimum depth, 3/4 inch maximum spacing with spring or other device to set blades, horizontal face, double deflection.

B. Fabrication: Steel with 20 gage, 0.0359 inch minimum frames and 22 gage, 0.0299 inch minimum blades, steel and aluminum with 20 gage, 0.0359 inch minimum frame, or aluminum extrusions, with factory baked enamel finish.

C. Color: White.

205 WALL EXHAUST AND RETURN REGISTERS/GRILLES

A. Type: Streamlined blades, 3/4 inch minimum depth, 3/4 inch maximum spacing, with spring or other device to set blades, horizontal face.

B. Frame: 1-1/4 inch margin with countersunk screw mounting.

C. Fabrication: Steel frames and blades, with factory baked enamel finish.

D. Color: White.

E. Damper: Integral, gang-operated, opposed blade type with removable key operator, operable from face.

206 GRAVITY VENTILATORS

A. Hood Intake and Relief Gravity Ventilator:
   1. General:
      a. Low silhouette for intake applications with natural gravity or negative pressure system(s).
      b. Performance ratings and factory testing to be in accordance with AMCA 511 and AMCA 550.
   2. Hood and Base:
      a. Material: Aluminum.
      b. Hood Construction: Precision formed, arched panels with interlocking seams.
   3. Birdscreen:
      a. Fabricate in accordance with ASTM B221 (ASTM B221M).

b. Construction: 1/2 inch Galvanized mesh.
c. Horizontally mounted across hood intake area.

4. Hood Support: Galvanized steel construction and fastened so hood can be removed completely from the base or hinged open.
5. Options/Accessories:
   a. Roof Curbs:
      1) Flat Roofs:
         (a) Welded, straight side curb with flashing flange and wood nailer.
      2) Pitched Roofs: Welded, straight side curb with flashing flange and wood nailer.
      3) Material: Aluminum.
      4) Insulation Thickness: 1 inch.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Check location of outlets and inlets and make necessary adjustments in position to comply with architectural features, symmetry, and lighting arrangement.

C. Install diffusers to ductwork with air tight connection.

END OF SECTION

SECTION 235100
BREECHINGS, CHIMNEYS, AND STACKS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Manufactured breechings.

B. Double wall metal stacks.

1.02 RELATED REQUIREMENTS

A. Section 078400 - Firestopping.

B. Section 220716 - Plumbing Equipment Insulation.

1.03 REFERENCE STANDARDS

A. NFPA 54 - National Fuel Gas Code; 2018.

B. NFPA 82 - Standard on Incinerators and Waste and Linen Handling Systems and Equipment; 2014.

C. NFPA 211 - Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances; 2016.

D. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005 (Revised 2009).

E. UL 103 - Factory-Built Chimneys for Residential Type and Building Heating Appliances; Current Edition, Including All Revisions.

1.04 DEFINITIONS

A. Breeching: Vent Connector.

B. Chimney: Primarily vertical shaft enclosing at least one vent for conducting flue gases outdoors.

C. Vent: That portion of a venting system designed to convey flue gases directly outdoors from a vent connector or from an appliance when a vent connector is not used.

D. Vent Connector: That part of a venting system that conducts the flue gases from the flue collar of an appliance to a chimney or vent, and may include a draft control device.

1.05 DESIGN REQUIREMENTS

A. Certified Sizing Calculations: Manufacturer shall certify venting system sizing calculations.

1.06 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

B. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.

1.07 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data indicating factory built chimneys, including dimensional details of components and flue caps, dimensions and weights, electrical characteristics and connection requirements.

C. Shop Drawings: Indicate general construction, dimensions, weights, support and layout of breechings. Submit layout drawings indicating plan view and elevations.

D. Manufacturer's Instructions: Include installation instructions, and indicate assembly, support details, and connection requirements.

E. Welding certificates.

1.08 QUALITY ASSURANCE

A. Source Limitations: Obtain listed system components through one source from a single manufacturer.

B. Welder's Qualifications: All welders shall be certified in accordance with AWS Standard D9.1, Specifications for Welding Sheet Metal.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. DuraVent; DuraStack Pro (DIS2): www.duravent.com/#sle.

B. Heatfab; CI Plus:www.heatfab.com.

C. Substitutions: See Section 016000 - Product Requirements.

2.02 BREECHINGS, CHIMNEYS, AND STACKS - GENERAL REQUIREMENTS

A. Regulatory Requirements:
   1. Conform to applicable code for installation of natural gas burning appliances and equipment.
   2. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

2.03 MANUFACTURED BREECHINGS

A. Provide factory-built, modular connector and manifold system, tested to UL 103 with positive pressure rating.

B. Assembly to be UL listed for use with building equipment in compliance with NFPA 211.

C. Fabricate with 1 inch (25 mm) minimum air space between walls and construct inner liner of 304 stainless steel and outer jacket of 304 stainless steel.
   1. Protect aluminized steel surfaces exposed to the elements with a minimum of one base coat of primer and one finish coat of corrosion resistant paint suitable for outer jacket skin temperatures of the application.

D. Design, fabricate, and install gas-tight preventing products of combustion leaking into the building.
   1. Securely connect inner joints and seal with factory supplied overlapping V-bands and appropriate sealant in accordance with manufacturer's instructions.
   2. System design to compensate for all flue gas induced thermal expansion.

2.04 DOUBLE WALL METAL STACKS

A. Provide double wall metal stacks, tested to UL 103 and UL listed with positive pressure rating, for use with building heating equipment, in compliance with NFPA 211.

B. Fabricate with 1 inch (25 mm) minimum air space between walls and construct inner liner of 304 stainless steel and outer jacket of 304 stainless steel.
   1. Protect aluminized steel surfaces exposed to the elements with a minimum of one base coat of primer and one finish coat of corrosion resistant paint suitable for outer jacket skin temperatures of the application.

C. Accessories, UL labeled:

1. Exit Cone: Consists of inner cone, and outer jacket, to increase stack exit velocity 1.5 times.

PART 3 EXECUTION

3.01 INSTALLATION

A. Coordinate installation of roof curbs, equipment supports and roof penetrations with existing conditions.

B. Install in accordance with manufacturer's instructions.

C. Install in accordance with NFPA 54.

D. Install breechings with minimum of joints. Align accurately at connections, with internal surfaces smooth.

E. Support breechings from building structure, rigidly with suitable ties, braces, hangers and anchors to hold to shape and prevent buckling. Support vertical breechings, chimneys, and stacks at 12 foot (4 m) spacing, to adjacent structural surfaces, or at floor penetrations. Refer to SMACNA (DCS) for equivalent duct support configuration and size.

F. Pitch breechings with positive slope up from fuel-fired equipment to chimney or stack.

G. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 078400.

H. Insulate breechings in accordance with Section 220716.

I. Assemble and install stack sections in accordance with NFPA 82, industry practices, and in compliance with UL listing. Join sections with acid-resistant joint cement. Connect base section to foundation using anchor lugs.

J. Level and plumb chimney and stacks.

K. Clean breechings, chimneys, and stacks during installation, removing dust and debris.

L. At appliances, provide slip joints permitting removal of appliances without removal or dismantling of breechings, breeching insulation, chimneys, or stacks.

M. Provide maximum 2 feet (maximum 600 mm) of breeching to connect appliance to chimney. Provide Type B chimney continuously from appliances.

END OF SECTION

SECTION 235216
CONDENSING BOILERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. High mass firetube stainless steel condensing boilers.

B. Boiler construction.

C. Boiler trim.

D. Fuel burning system.

E. Factory installed controls.

1.02 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete.

B. Section 230913 - Instruments and Control Elements.

C. Section 232114 - Hydronic Specialties.

D. Section 232500 - HVAC Water Treatment.

E. Section 235100 - Breechings, Chimneys, and Stacks.

F. Section 260583 - Wiring Connections: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

A. AHRI Directory of Certified Product Performance - Air-Conditioning, Heating, and Refrigeration Institute (AHRI); current edition at www.ahrinet.org.

B. ANSI Z21.13 - American National Standard for Gas-Fired Low-Pressure Steam and Hot Water Boilers; 2017.

C. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings; 2013, Including All Amendments and Errata.

D. ASME BPVC-IV - Boiler and Pressure Vessel Code, Section IV - Rules for Construction of Heating Boilers; 2017.

E. NBBI Manufacturer and Repair Directory - The National Board of Boiler and Pressure Vessel Inspectors (NBBI); Current Edition.

F. NFPA 31 - Standard for the Installation of Oil Burning Equipment; 2016.

G. NFPA 54 - National Fuel Gas Code; 2018.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct a preinstallation meeting at least one week prior to the start of the work of this section; require attendance by all affected installers.

B. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittals procedures.

B. Product Data: For each type of product.

1. Shop Drawings: For boilers, boiler trim, and accessories. Include product description, model number, dimensions, clearances, weights, components and options.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field

connection.

3. Include diagrams for power, signal, and control wiring.
    a. Schematic wiring diagram of boiler control system of the ladder-type showing all components, interlocks, etc. Schematic wiring diagram shall clearly identify factory wiring and field wiring by others.
    b. Detail wiring for power, signal, and control systems.

C. Manufacturer's Installation Instructions: Indicate assembly, support details, connection requirements, and include start up instructions.

D. Manufacturer’s Certification: The boiler manufacturer shall certify the following:
1. The products and systems furnished are in strict compliance with the specifications.
2. The boiler, burner, and other associated mechanical and electrical equipment have been properly coordinated and integrated to provide a complete and operable boiler package.
3. ASME Certification in the form of ASME Stamp on the product and completed and signed data sheet.
4. ASME CSD-1 Certification, in the form of completed data sheet.
5. cULus Certification in the form of an affixed label to the equipment.
6. The specified factory tests have been satisfactorily performed.
7. The specified field tests have been satisfactorily performed.

E. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect boilers from damage by leaving factory inspection openings and shipping packaging in place until final installation.

1.07 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Provide a five year warranty to include coverage for heat exchanger.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Natural Gas for Indoor Applications:
1. Cleaver-Brooks;
2. Bosch/Buderus;
3. Viessmann;
4. Substitutions: See Section 016000 - Product Requirements.

2.02 BOILER CONSTRUCTION

A. Conform to the minimum requirements of ASME BPVC-IV and ANSI Z21.13 for construction of boilers.

B. Assembly to bear the ASME "H" stamp and comply with the efficiency requirements of the latest edition of ASHRAE Std 90.1 I-P.

C. Required Directory Listings:
1. AHRI Directory of Certified Product Performance - Air-Conditioning, Heating, and Refrigeration Institute (AHRI); current edition at www.ahrinet.org.
2. NBBI Manufacturer and Repair Directory - The National Board of Boiler and Pressure Vessel Inspectors (NBBI); current edition at www.nationalboard.org.

D. Heat Exchanger: Duplex stainless steel tubes, tube sheets, and combustion chamber. The heat exchanger shall be a single-pass, counter-flow arrangement.

1. The firetubes shall be duplex stainless steel, fitted with aluminum internal heat transfer fins.

E. Provide adequate tappings, observation ports, removable panels, and access doors for entry, cleaning, and inspection.

F. Insulate casing with insulation material, protected and covered by heavy-gage metal jacket.

G. Factory apply boiler base and other components, that are subject to corrosion, with durable, powder coated finish.

H. "Near condensing" copper fin designs, watertube, cast iron, cast aluminum, or "add-on" secondary condensing exchangers will not be considered. Boilers with minimum flow requirements also will not be considered.

203 BOILER TRIM

A. ASME rated pressure relief valve.

B. Flow switch.

C. Solid State Low water cut-off probe control with manual reset and test switch.

D. Temperature and pressure gage mounted on the water outlet.

E. Outlet water supply sensing probe for operating water limit setpoint.

F. Return water-sensing probe for operating limit setpoint.

G. Auxiliary low water cutoff

H. Automatic air vent

I. Drain valve.

J. Stack temperature sensor - UL Recognized as a limit control.

K. Condensate neutralization tank.

L. Automatic isolation valve, including valve, actuator, and transformer to power isolation valve through the boiler. The valve, actuator, and transformer shall ship loose for field installation and wiring.
   1. The isolation valve shall be Bray 2-way resilient seated butterfly valve, model ABL or approved equal, with ANSI 150# flanges, lugged style.
   2. The electric actuator shall a Bray Commercial actuator, or approved equal, 24VAC, fail in position, with auxiliary end switch.

M. 2-Way automatic isolation valve.

N. Manual Reset High Limit Temperature sensor; range not to exceed 210 deg F and shall be an integral device of the Boiler Burner Control and UL Recognized as a limit control.

204 FUEL BURNING SYSTEM

A. Provide forced draft automatic burner, integral to boiler, designed to burn natural gas, and maintain fuel-air ratios automatically.
   1. Blower: Centrifugal fan to operate during each burner firing sequence and to prepurge and postpurge the combustion chamber.
      a. The blower motor shall have a variable speed ECM motor with integrated drive electronics. Constant speed motors and variable frequency AC drives are not acceptable.
   2. Burner: Natural gas, forced draft burner.
      a. The burner shall be a linkage-less, self-regulating, air-fuel ratio gas valve-venturi system. Burner regulation shall be accomplished without the use of fuel/air mixing

valves or actuators.
   b. The burner shall be achieve sub 20 ppm NOx when firing on natural gas at all firing rates.
   c. Burner shall be minimum 5:1 fully modulating turndown.
3. Combustion Air Filter: Protects fuel burning system from debris.

B. Gas Train: The gas train shall meet the requirements of CSA/UL and ASME CSD-1 and shall include:
1. Low Gas Pressure Interlock, manual reset.
2. High Gas Pressure Interlock, manual reset.
3. Upstream and downstream manual test cocks.
4. Ball Type manual shutoff valve upstream of the main gas valve.
5. Unibody double safety gas valve assembly.
6. Gas Pressure Regulator
7. Union connection to permit burner servicing.

C. Intakes: Combustion air intake capable of accepting free mechanical room air or direct outside air through a sealed intake pipe

D. Ignition: Spark ignition with 100 percent main-valve shutoff with UV scanner for flame supervision.

E. Combustion air proving switch shall be furnished to ensure sufficient combustion airflow is present for burner ignition firing.

F. To ensure that the flue is not blocked, the burner shall include a High Air Pressure Switch sensing the outlet pressure connection relative to stack backdraft.

205 FACTORY INSTALLED CONTROLS

A. The Boiler shall include a Falcon Computerized Boiler Burner control which shall be an integrated, solid state digital micro-processing modulating device, complete with sequence indication, fault reset, mode selection, and parameter set-point. It shall be mounted at the front of the boiler panel for easy access and viewing.
1. Controller shall provide for both flame safeguard and boiler control through separate power supplied CPU's (to meet NFPA) and shall perform the following functions:
2. Burner sequencing with safe start check, pre-purge, Electronic direct spark ignition and post purge. A UV scanner shall be used to prove combustion.
3. Flame Supervision. The control shall provide pre-purge and post-purge and shall maintain a running history of operating hours, number of cycles, and the most recent fifteen lockouts. The control shall be connected to a touchscreen display interface that will display this information in clear English text descriptions.
4. Safety Shutdown with display of lockout or hold condition.
5. PID modulating control of the variable speed fan for firing capacity relative to load requirements; i.e. to meet supply water temperature set point.
6. Gas pressure supervision, high and low.
7. Combustion Air Proving Supervision.
8. High Air Pressure [back draft too high] Supervision.
9. The supply temperature and set-point temperature shall be displayed at all times on the touch screen display.
10. Controller shall be equipped with a touch screen display for set up, trouble shooting, and operational display, and shall include ModBus communication capability of this information.
11. Include the programming of circulating pump or isolation valve control and support the control of 2 heating demand loops.

B. All parameter input control set-points shall be factory pre-configured. Parameter settings are to be established to suit jobsite conditions -- settings are to be configured at the time of initial jobsite operation.

C. All controls to be panel mounted and so located on the boiler as to provide ease of servicing the boiler without disturbing the controls and also located to prevent possible damage by water according to UL and CSA requirements.

D. Electrical power supply shall be 115 volts, 60 cycle single phase.

E. When multiple boilers are to be installed together, a system integration control shall be provided to stage up to 8 boilers. The control shall include automatic selection of needed boilers based on energy demand, an adjustable outdoor reset schedule, domestic hot water priority, and a system digital display. The control shall stage and modulate the boilers utilizing firing rate threshold staging and parallel modulation to optimize condensing potential while minimizing energy wasting short cycling. This strategy takes full advantage of the inverse efficiency characteristic (lower fire rate, higher efficiency) of condensing boilers. The control shall monitor supply water temperature, return water temperature and shall communicate between boilers via RS-485 network wiring.

F. Boilers shall communicate with [BACnet I/P] [BACnet MSTP] [LONWorks] [ModBus TCP/IP] [ModBus RTU] [Johnson Metasys N2] building management system utilizing a protocol translator for requirements other than the native ModBus RTU.
   1. The Protocol Translator solution can either come factory mounted in a NEMA 1 enclosure, or ship loose for installation in a boiler control panel. Select the option below that applies.
   2. Protocol translator mounted in a NEMA 1 panel with power supply and terminals.
   3. Protocol translator shipped loose for installation in boiler control panel with required power supply.

G. The boiler controls shall include provisions for [outside air reset] [night setback].

H. The boiler controls shall include provisions for sending signal to [start/stop primary boiler pump] [start/stop primary boiler pump and vary pump speed based on boiler firing rate] [open/close automatic isolation valve].

2.06 SOURCE QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Burner and Hydrostatic Test: Factory pressure test gas train, test fire burner and gas train assembly, and perform a functional controls test for all safety devices; perform hydrostatic test.

C. Test and inspect factory-assembled boilers, before shipping, according to most current ASME Boiler and Pressure Vessel Code.

PART 3 EXECUTION

3.01 INSTALLATION

A. Installation shall be provided by the contractor in accordance with the requirements of the codes specified hereinbefore. All of the contractor's work shall be performed by experienced personnel previously engaged in boiler plant construction and shall be under the supervision of a qualified installation supervisor.

B. Install equipment in strict compliance with state and local codes and applicable NFPA standards.

C. Maintain manufacturer's recommended clearances around sides and over top of equipment

D. Install in accordance with manufacturer's instructions.

E. Install boiler and provide connection of natural gas service in accordance with requirements of NFPA 54 and applicable codes.

F. Install boiler and provide connection of No. fuel oil service in accordance with requirements of NFPA 31 and applicable codes.

G. Install boiler on concrete housekeeping base, sized minimum of 4 inches (100 mm) larger than boiler base in accordance with Section 033000.

H. Coordinate factory installed controls with Section 230913.

I. Coordinate provisions for water treatment in accordance with Section 232500.

J. Pipe relief valves to nearest floor drain.

K. Pipe cooled condensate produced by the combustion process from the boiler condensate connection and/or flue stack with suitable piping material to neutralizer prior to discharging into nearest floor drain.

L. Provide piping connection and accessories in accordance with Section 232114.

M. Provide for connection to electrical service in accordance with Section 260583.

N. Vent combustion fumes in accordance with manufacturer's recommendations. Refer to Section 235100.

3.02 CONNECTIONS

A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to boiler to allow service and maintenance.

C. Install piping from equipment drain connection to nearest floor drain. Piping shall be at least full size of connection. Provide an isolation valve if required.

D. Connect gas piping to boiler gas-train inlet with union. Piping shall be at least full size of gas-train connection. Provide a reducer if required. Piping shall be properly sized to minimize pressure drops for longer gas piping runs. Refer to boiler IOM for sizing and header recommendations.

E. Connect hot-water piping to supply- and return-boiler tappings with shutoff valve and union or flange at each connection.

F. Install piping from safety relief valves to nearest floor drain.

G. Boiler Venting:
   1. Exhaust Stack: Complete system, per UL 1738 for Category IV appliances, stainless steel, pipe, vent terminal, thimble, vent adapter, and sealant.
      a. Stack to be designed and manufactured by boiler manufacturer.

H. Ground equipment according to specification requirements.

I. Connect wiring according to specification requirements.

3.03 FIELD QUALITY CONTROL

A. General: The boiler supplier’s factory authorized service organization shall be responsible for performance of inspections, start up and testing of the package boiler, and accessory equipment and materials furnished under this Section. A detailed written record of the startup performance, including burner setting data over the entire load range shall be furnished to the engineer before final acceptance. All labor, equipment, and test apparatus shall be furnished by the authorized service organization. All equipment defects discovered by the tests shall be rectified either by the service organization or boiler manufacturer.

B. Equipment inspection: Boiler representative shall inspect boilers and other equipment upon arrival, verifying completeness of equipment supplied and potential damages. All shipped loose components, to be mounted and installed on boiler by contractor.

C. Equipment shall be flushed prior to start-up per the water treatment company guidelines and product installation manual requirements.

D. Pre start-up walk through: Boiler representative shall review the installation with the mechanical contractor prior to start-up and note any required changes prior to start-up.

E. Start-up shall be conducted by experienced and factory authorized technician in the regular employment of the authorized service organization, and shall include:
   1. Demonstrate that boiler, burner, controls, and accessories comply with requirements of this Section as proposed by the boiler and accessories supplier. Pre-test all items prior to scheduling the final testing that will be witnessed by the test engineer.
   2. Readings at different firing rates (20, 50, 75 and 100%) of load for the modulating burner shall be taken with a written report of the tests submitted to the engineer. The reports shall include readings for each firing rate tested and include stack temperatures, O2, CO, NOx, and overall boiler efficiency.
   3. Auxiliary Equipment and Accessories: Observe and check all valves, draft fans, electric motors and other accessories and appurtenant equipment during the operational and capacity tests for leakage, malfunctioning, defects, and non-compliance with referenced standards or overloading as applicable.
   4. Commissioning Requirements:
      a. Fireside inspection
      b. Set up fuel train and combustion air system
      c. Set up operating set points
      d. Check all safeties, including Flame safeguard, LWCO, Airflow, Fuel pressures, High limits.
      e. Set up and verify efficiencies at 20%, 50%, 75%, and 100%
      f. Set up and verify burner turndown.

3.04 CLOSEOUT ACTIVITIES

A. See Section 017800 - Closeout Submittals, for closeout submittals.

B. See Section 017900 - Demonstration and Training, for additional requirements.

C. Demonstrate proper operation of equipment to Owner's designated representative.

D. Demonstration: Demonstrate operation of system to Owner's personnel.
   1. Use operation and maintenance data as reference during demonstration.
   2. Conduct walking tour of project.
   3. Briefly describe function, operation, and maintenance of each component.

E. Training: Train Owner's personnel on operation and maintenance of system.
   1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
   2. Provide minimum of two hours of training.
   3. Location: At project site.

END OF SECTION

SECTION 236213
PACKAGED AIR-COOLED REFRIGERANT COMPRESSOR AND CONDENSER UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Condensing unit package.

B. Charge of refrigerant and oil.

C. Controls and control connections.

D. Refrigerant piping connections.

E. Motor starters.

F. Electrical power connections.

1.02 REFERENCE STANDARDS

A. AHRI 210/240 - Standard for Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment.

B. ASHRAE Std 23.1 - Methods for Performance Testing Positive Displacement Refrigerant Compressors and Condensing Units that Operate at Subcritical Pressures of the Refrigerant.

C. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings.

D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

1.03 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide rated capacities, weights specialties and accessories, electrical nameplate data, and wiring diagrams. Include equipment served by condensing units in submittal, or submit at same time, to ensure capacities are complementary.

C. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

1.04 QUALITY ASSURANCE

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Comply with manufacturer's installation instructions for rigging, unloading, and transporting units.

1.06 WARRANTY

A. Provide a five year warranty to include coverage for refrigerant compressors.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Carrier, a part of UTC Building and Industrial Systems, a unit of United Technologies Corp.

B. Trane, a brand of Ingersoll Rand

C. York International Corporation/Johnson Controls, Inc.

D. Substitutions: Or equal.

202 MANUFACTURED UNITS

A. Units: Self-contained, packaged, factory assembled and pre-wired units suitable for outdoor use consisting of cabinet, compressors, condensing coil and fans, integral sub-cooling coil, controls, liquid receiver, wind deflector, and screens.

B. Construction and Ratings: In accordance with AHRI 210/240. Test in accordance with ASHRAE Std 23.1.

C. Performance Ratings: Energy Efficiency Rating (EER) and Coefficient of Performance (COP) not less than prescribed by ASHRAE Std 90.1.

D. Refrigerant: Use only refrigerants that have ozone depletion potential (ODP) of zero and global warming potential (GWP) of less than 50.

203 CASING

A. House components in welded steel frame with galvanized steel panels with weather resistant, baked enamel finish.

B. Mount starters, disconnects, and controls in weatherproof panel provided with full opening access doors. Provide mechanical interlock to disconnect power when door is opened.

C. Provide removable access doors or panels with quick fasteners and piano hinges.

204 CONDENSER COILS

A. Coils: Aluminum fins mechanically bonded to seamless copper tubing. Provide sub-cooling circuits. Air test under water to 425 psig, and vacuum dehydrate. Seal with holding charge of nitrogen.

B. Coil Guard: Expanded metal.

205 FANS AND MOTORS

A. Vertical discharge direct driven propeller type condenser fans with fan guard on discharge. Equip with roller or ball bearings with grease fittings extended to outside of casing.

B. Weatherproof motors suitable for outdoor use, single phase permanent split capacitor or 3 phase, with permanent lubricated ball bearings and built in current and thermal overload protection. Refer to Section 23 0513.

206 COMPRESSORS

A. Compressor: Semi-hermetic reciprocating type.

B. Mounting: Statically and dynamically balance rotating parts and mount on spring vibration isolators.

C. Lubrication System: Reversible, positive displacement oil pump with oil charging valve, oil level sight glass, and magnetic plug or strainer.

D. Motor: Constant speed 1800 rpm suction gas cooled with electronic sensor and winding over temperature protection, designed for across-the-line starting. Furnish with starter.

E. Capacity Reduction Equipment: Suction valve unloaders, with lifting mechanism operated by electrically actuated solenoid valve, with unloaded compressor start; controlled from suction pressure.

F. Sump Oil Heater: Evaporates refrigerant returning to sump during shut down. Energize heater continuously when compressor is not operating.

207 REFRIGERANT CIRCUIT

A. Provide each unit with two independent refrigerant circuits, factory supplied and piped. Refer to Section 232300.

B. For each refrigerant circuit, provide:
   1. Filter dryer replaceable core type.
   2. Liquid line sight glass and moisture indicator.
   3. Thermal expansion valve for maximum operating pressure.
   4. Insulated suction line.
   5. Suction and liquid line service valves and gauge ports.
   6. Liquid line solenoid valve.
   7. Charging valve.
   8. Discharge line check valve.
   9. Compressor discharge service valve.
   10. Condenser pressure relief valve.

C. For heat pump units, provide reversing valve, suction line accumulator, discharge muffler, flow control check valve, and solid-state defrost control utilizing thermistors.

2.08 CONTROLS

A. On unit, mount weatherproof steel control panel, NEMA 250, containing power and control wiring, molded case disconnect switch, factory wired with single point power connection.

B. For each compressor, provide across-the-line starter, non-recycling compressor overload, starter relay, and control power transformer or terminal for controls power. Provide manual reset current overload protection. For each condenser fan, provide across-the-line starter with starter relay.

C. Provide safety controls arranged so any one will shut down machine:
   1. High discharge pressure switch (manual reset) for each compressor.
   2. Low suction pressure switch (automatic reset) for each compressor.
   3. Oil Pressure switch (manual reset).

D. Provide the following operating controls:
   1. Refer to Section 230993.
   2. One minute off timer prevents compressor from short cycling.
   3. Low ambient temperature controls.
   4. Hot gas bypass sized for minimum compressor loading on one compressor only, bypasses hot refrigerant gas to evaporator.

E. Provide controls to permit operation down to 0 degrees F ambient temperature.

F. Gauges: Prepiped for suction and discharge refrigerant pressures and oil pressure for each compressor.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's installation instructions.

B. Complete structural, mechanical, and electrical connections in accordance with manufacturer's installation instructions.

3.02 SYSTEM STARTUP

A. Supply initial charge of refrigerant and oil for each refrigeration system. Replace losses of oil or refrigerant prior to end of correction period.

B. Charge system with refrigerant and test entire system for leaks after completion of installation. Repair leaks, put system into operation, and test equipment performance.

END OF SECTION

SECTION 236426
ROTARY-SCREW WATER CHILLERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Factory-assembled packaged chiller.

B. Charge of refrigerant and oil.

C. Controls and control connections.

D. Chilled water connections.

E. Condenser water connections.

F. Starters.

G. Variable frequency drives.

H. Electrical power connections.

1.02 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete: Concrete housekeeping pads.

B. Section 230513 - Common Motor Requirements for HVAC Equipment.

C. Section 230593 - Testing, Adjusting, and Balancing for HVAC.

D. Section 230800 - Commissioning of HVAC.

E. Section 230923 - Direct-Digital Control System for HVAC.

F. Section 230993 - Sequence of Operations for HVAC Controls.

G. Section 232113 - Hydronic Piping.

H. Section 232114 - Hydronic Specialties.

I. Section 260583 - Wiring Connections.

1.03 REFERENCE STANDARDS

A. AHRI 550/590 (I-P) - Performance Rating of Water-chilling and Heat Pump Water-heating Packages Using the Vapor Compression Cycle.

B. ASHRAE Std 15 - Safety Standard for Refrigeration Systems and Designation and Classification of Refrigerants .

C. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings.

D. ASME BPVC-VIII-1 - Boiler and Pressure Vessel Code, Section VIII, Division 1: Rules for Construction of Pressure Vessels.

E. IEEE 519 - IEEE Recommended Practice and Requirements for Harmonic Control in Electric Power Systems.

F. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

G. NEMA MG 1 - Motors and Generators.

H. UL 1995 - Heating and Cooling Equipment.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide rated capacities, weights, specialties and accessories, electrical requirements and wiring diagrams.

C. Shop Drawings: Indicate components, assembly, dimensions, weights and loadings, required clearances, and location and size of field connections. Indicate equipment, piping and connections, valves, strainers, and thermostatic valves required for complete system.

D. Manufacturer's Performance Data: Indicate energy input versus cooling load output from 0 to 100 percent of full load at specified and minimum condenser water temperature for water-cooled chillers and at specified and minimum outdoor air temperature for air-cooled chillers.

E. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Comply with manufacturer's written installation instructions for rigging, unloading, and transporting units.

B. Deliver units to the job site completely assembled and charged with refrigerant and oil by manufacturer.

1.06 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Manufacturer's Warranty: Provide minimum five year warranty to include coverage for materials only for complete assembly.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Carrier, a part of UTC Building and Industrial Systems, a unit of United Technologies Corp

B. Daikin Applied

C. Trane, a brand of Ingersoll Rand

D. York International Corporation/Johnson Controls, Inc

E. Substitutions: See Section 016000 - Product Requirements.

1. The chilled water system has been designed based on specific capacities and characteristics of equipment specified in this section and other sections.
2. When substitution of a different manufacturer or model number is desired, submit sufficient information to demonstrate to Architect that the substitute will have the same or better performance as that specified AND that the related equipment in the system will perform acceptably with the substitute.
3. If the related equipment must be modified to perform acceptably with the substitute, the entity proposing the substitution is responsible for all additional costs due to re-design and provision of different related equipment.

2.02 CHILLERS

A. Chillers: Factory assemble and test chiller consisting of compressor(s), compressor motor(s), motor starter(s) or variable frequency drives as indicated, evaporator, condenser, enclosure, refrigeration circuits(s) and specialties, interconnecting piping, microprocessor-based controls, readouts, and diagnostics.

1. Rating: AHRI 550/590 (I-P).
2. Safety: ASHRAE Std 15 and UL 1995.
3. Construction & Testing: ASME BPVC-VIII-1.
4. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.
5. Energy Efficiency: ASHRAE Std 90.1.

6. Enclosures:
    a. Chiller Structural Framing:
        1) Mount structural steel on welded steel base.
        2) Factory apply hot-dip galvanized finish.
    b. Steel Chiller Cabinets:
        1) Factory apply baked on enamel finish.
    c. Steel Control Panels:
        1) Factory apply baked on powder paint or applied corrosion resistant paint prior to assembly.
        2) Provide gasketing and weather-proofing to panels with fully opening doors containing starters or variable frequency drives, terminal blocks, through-the-door type disconnects and circuit breaker with lockable handles indicating "power-on" or "power-off".
        3) Provide door stays.
    d. Electrical Equipment: NEMA 250.
7. Motors: NEMA MG 1. See Section 230513 for additional requirements.

203 COMPRESSORS AND EVAPORATOR

A. Compressors: Rotary-screw type.
1. Unit: Semi-hermetic type with direct drive compressors with independent refrigeration circuit(s), internal muffler, discharge, check, and suction service valves.
2. Oil Lubrication System: Positive pressure system, oil heater, oil separator, check valves, solenoid valves, and filtration devices.
3. Valves: Check valves in compressor discharge.
4. Capacity Reduction System: Load/unload valve control down to 20 percent of full load without the activation of hot gas by-bass.
5. Motor: 3600 rpm, suction gas-cooled, hermetically sealed, squirrel cage induction with starter.

B. Evaporator: Shell and tube type.
1. Three pass type, with three independent refrigeration circuits.
2. Shell, Removable Heads and Tube Support Sheets: Carbon steel.
3. Tubes: Mechanically expand and fasten, seamless, externally or internally enhanced, copper tubes into intermediate tube support sheets along the length of shell to avoid contact and relative motion between tubes with the capability of being cleanable.
4. Tube Size: 1.0 inches diameter.
5. Comply with ASME BPVC-VIII-1 as applicable.
6. Refrigerant Working-Side Pressure Rating: 200 psig.
7. Water Working-Side Pressure Rating: 150 psig.
8. Connections: Flanged and designed for 150 psig waterside working pressure.

C. Insulation for All Cold Surfaces:
1. Factory install on shell and all other cold surfaces.
2. 0.75 inches minimum thick, closed cell, expanded polyvinyl chloride flexible foam insulation with a maximum K value of 0.28.

D. Provide vents and water drain connections.

E. Provide fittings for temperature control sensors.

F. Freeze Protection: Provide evaporator heater with thermostat to protect from freezing at ambient temperatures down to minus 20 degrees F.

204 WATER-COOLED CONDENSER

A. Condenser: Shell and tube type.
   1. Three pass type.
   2. Shell, Removable Heads and Tube Sheets Material: Carbon steel.
   3. Tubes: Mechanically expand and fasten, seamless, externally or internally enhanced, copper tubes into intermediate tube support sheets along the length of shell to avoid contact and relative motion between tubes with the capability of being cleanable.
   4. Tube Size: 1.0 inch (25.4 mm) diameter with 0.025 inches (0.64 mm) tube wall thickness.
   5. Comply with ASME BPVC-VIII-1 as applicable.
   6. Refrigerant Working-Side Pressure Rating: 354 psig.
   7. Water Working-Side Pressure Rating: 300 psig.
   8. Connections: Provide flanged type and design for 150 psig waterside working pressure.
   9. Design for returning condenser water temperature up to 95 degrees F and leaving condenser water temperature up to 105 degrees F.

B. Provide vent and water drain connections.

C. Provide fittings for temperature control sensors.

205 REFRIGERATION CIRCUITS

A. Provide two independent refrigeration circuit(s) with two compressor(s) per circuit.

B. Minimum Refrigerant Specialties per Circuit:
   1. Isolation and service valves for refrigerant removal and charging.
   2. Removable-core filter driers.
   3. ASHRAE Std 15 compliant relief valves.
   4. Liquid line sight glass with moisture indicator.
   5. Refrigerant expansion valves or metering devices.
   6. Complete operating charge of both refrigerant and oil.

206 STARTERS AND DRIVES

A. Starters: Design unit mounted, across-the-line starter to operate in temperatures up to 104 degrees F.
   1. Provide incoming line provisions for aluminum, mechanical type incoming line lugs based on the number and cable sizes shown on drawings.
   2. Provide properly sized, double break main contacts with weld resistant silver cadmium faces and low resistance auxiliary interlocks with palladium silver contacts for interlocks that interface with control panel.
   3. Provide control power transformer with fused primary, secondary, and current transformers of the proper size, ratio and burden capacity.
   4. Provide control relays to interface with control panel.
   5. Wiring:
      a. Type MTW copper stranded 90 degree C for power and control wiring.
      b. 14 gauge, 0.0641 inch, minimum, for control wiring.
   6. Motor Protection System Attributes:
      a. Three phase overload protection.
      b. Startup overload protection.
      c. Phase imbalance, loss and reversal.
      d. Low voltage.
      e. Distribution fault protection.

B. Variable Frequency Drives: Completely assemble, wire, pipe, and factory test, factory or field mounted variable frequency drive (VFD). Limit the field electrical connections for compressor motor power to the main power leads to the VFD, wiring of liquid pumps and tower fans to the control panel.
   1. Characteristics:
      a. Refrigerant cooled.
      b. Microprocessor based pulse width modulation (PWM) with input/output power devices, DC voltage rectifier, and inverter/control regulator to convert DC voltage to sinusoidal PWM waveform.
      c. Isolate low voltage control physically from main power sections.
      d. Control motor speed by integrated controls over wide range of operating conditions.
      e. Provide short circuit interrupt and withstand rating suitable for available current.
   2. Performance:
      a. Do not exceed IEEE-519 requirements for voltage total harmonic distortion (THD) and harmonic current total demand distortion (TDD) using VFD circuit breaker input terminals as the point of common coupling (PCC).
      b. Full Load Efficiency: Minimum 97 percent at 100 percent VFD rated capacity.
      c. Unity Displacement Power Factor: 0.99 minimum.
      d. Voltage Boost Capability: Full motor voltage at reduced line voltage conditions.
      e. Soft start, linear acceleration, and coast to stop capabilities.
      f. Base Motor Adjustable Frequency Range: Control to 15 percent capacity at nameplate voltage.
      g. Torque Generation: 150 percent instantaneous.
   3. Heat Sink and Mating Flange:
      a. Design for 185 psig waterside working pressure.
      b. Meter to maintain temperature within acceptable limits.
   4. Suitable Ratings:
      a. Operation at plus or minus 10 percent nameplate voltage.
      b. Continuous Operation at:
         1) 100 percent of nameplate amperes and 5 seconds at 15 percent.
         2) Ambient temperature range of 40 to122 degrees F, 95 percent humidity non-condensing for altitudes up to 6000 feet.
      c. Comply with NEMA 250 and NEMA MG 1.
   5. User Interface for Programming and Display of the Following Parameters:
      a. Operating, configuration and fault messages.
      b. Hertz frequency.
      c. VFD load, line side voltage, and current.
      d. kW.
      e. Input/output power devices temperature.
   6. Electrical Service (single point power):
      a. Input Circuit Breaker: Suitable for the available current indicated.
      b. Provide power for chiller oil pump via factory wired standard branch circuit breaker.
      c. Provide power for oil heater, VFD and controls via 3 KVA control power transformer and factory wired circuit breaker.
   7. Discrete Contact Outputs (115 volt):
      a. Circuit breaker shunt trip.
      b. Chilled water pump.
      c. Condenser water pump.
      d. Alarm status.

8. Analog Outputs: (4 to 20 mA) for head pressure reference and condenser water control valve as applicable.
9. Provide protection for under/over-voltage, phase loss/reversal/unbalance, ground fault, single cycle voltage loss, programmable auto restart after power loss, and motor overload/over temperature protection.

2.07 MICROPROCESSOR-BASED, PROPORTIONAL AND INTEGRAL CONTROLLER

A. Control Components for Preventing Shutdown:
   1. Provide high pressure limit with indicating light for each compressor, set lower than factory pressure switch to automatically unload compressor and prevent nuisance high pressure condenser control trip.
   2. Provide one protector with indicating light for each compressor, with current limit set point of 120 percent of compressor running load amperage to automatically unload compressor preventing over-current trip.
   3. Provide low refrigerant limit to automatically unload each compressor preventing a low evaporator temperature trip.

B. Chiller Operation in Abnormal Operating Conditions:
   1. Unloaded Running: Adequate chilled water production.
   2. Trip-out Limit Reached: Chiller goes off-line and manual reset is required for continued operation.

C. Control Panel Display:
   1. Evaporator pressure.
   2. Condenser refrigerant pressure.
   3. Entering and leaving evaporator water temperature.
   4. Chilled water set-point.
   5. Electrical 3 phase current limit and percent RLA setpoint.
   6. Electrical 3 phase amp draw.
   7. Chiller operating mode.
   8. Condenser refrigerant temperature.
   9. Elapsed time and number of starts counter.
   10. Chiller compressor run status relay.
   11. Minimum of 20 diagnostics with time and date stamp.
   12. Identification of the fault, date, time and operating mode at time of occurrence, type of reset required, and help message.

D. Points for BAS Control and Monitoring:
   1. Relay output energized upon detecting a fault requiring manual reset.
   2. Relay output energized whenever unit is operating in a limit mode for an extended period of time.
   3. Analog input to control leaving chilled water temperature set-point based upon a 4-20ma or 0-10 VDC signal from the building automation system.
   4. Programmable soft during pull-down period via ramped current limit or fully adjustable, temperature pull-down rate.
   5. Leaving chilled water reset based upon return water temperature.
   6. Provide RS-232 for printer interface.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Align chiller package on steel or concrete foundations.

C. Install units on vibration isolators.

D. Connect to electrical service.

E. Connect to chilled water piping.

F. Connect to condenser water piping.

G. Arrange piping for easy dismantling to permit tube cleaning and removal.

3.02 MANUFACTURER'S FIELD SERVICES

A. Perform factory startup of the chiller by factory trained and authorized servicing technicians confirming equipment has been correctly installed prior to equipment becoming operational and covered under the manufacturer's warranty.

B. Supply initial charge of refrigerant and oil if not completely factory charged.

C. Demonstrate system operations and verify specified performance.

3.03 CLOSEOUT ACTIVITIES

A. Demonstration: Demonstrate operation of system to Owner's personnel.
   1. Use operation and maintenance data as reference during demonstration.
   2. Briefly describe function, operation, and maintenance of each component.

B. Training: Train Owner's personnel on operation and maintenance of system.
   1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
   2. Provide minimum of two hours of training.

END OF SECTION

SECTION 237413
PACKAGED OUTDOOR CENTRAL-STATION AIR-HANDLING UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Packaged roof top unit.

B. Unit controls.

C. Roof mounting curb and base.

D. Maintenance service.

1.02 RELATED REQUIREMENTS

A. Section 230548 - Vibration and Seismic Controls for HVAC.

1.03 REFERENCE STANDARDS

A. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide capacity and dimensions of manufactured products and assemblies required for this project. Indicate electrical service with electrical characteristics and connection requirements, and duct connections.

C. Manufacturer's Instructions: Indicate assembly, support details, connection requirements, and include start-up instructions.

D. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect units from physical damage by storing off site until roof mounting curbs are in place, ready for immediate installation of units.

1.06 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Provide a five year warranty to include coverage for refrigeration compressors.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Carrier, a part of UTC Building and Industrial Systems, a unit of United Technologies Corp.

B. Trane, a brand of Ingersoll Rand

C. York International Corporation/Johnson Controls Inc.

D. Daikin

E. Substitutions: Or equal.

2.02 MANUFACTURED UNITS

A. General: Roof mounted units having an electric heating coil and electric refrigeration.

B. Description: Self-contained, pack aged, factory assembled and prewired, consisting of cabinet and frame, supply fan, heat exchanger and burner or electric heating coil, controls, air filters, refrigerant cooling coil and compressor, condenser coil and condenser fan.

C. Refrigerant: Use only refrigerants that have ozone depletion potential (ODP) of zero and global warming potential (GWP) of less than 50.

D. Disconnect Switch: Factory mount disconnect switch in control panel.

203 FABRICATION

A. Cabinet: Steel with baked enamel finish, including access panels with screwdriver operated flush cam type fasteners. Structural members shall be minimum 18 gage, 0.0478 inch, with access doors or panels of minimum 20 gage, 0.0359 inch.

B. Insulation: one inch thick neoprene coated glass fiber with edges protected from erosion.

C. Heat Exchangers: Stainless steel, of welded construction.

D. Supply Fan: Forward curved centrifugal type, resiliently mounted with V-belt drive, and rubber isolated hinge mounted high efficiency motor or direct drive as indicated. Isolate complete fan assembly. Refer to Section 230548.

E. Air Filters:
   1. 2 inch thick glass fiber disposable media in metal frames.

F. Roof Mounting Curb: 14 inches high galvanized steel, channel frame with gaskets, nailer strips.

204 BURNER

A. Gas Burner: Atmospheric type burner with adjustable combustion air supply, pressure regulator, gas valves, manual shut-off, intermittent spark or glow coil ignition, flame sensing device, and automatic 100 percent shut-off pilot.

B. Gas Burner Safety Controls: Energize ignition, limit time for establishment of flame, prevent opening of gas valve until pilot flame is proven, stop gas flow on ignition failure, energize blower motor, and after air flow proven and slight delay, allow gas valve to open.

C. High Limit Control: Temperature sensor with fixed stop at maximum permissible setting, de-energize burner on excessive bonnet temperature and energize burner when temperature drops to lower safe value.

205 ELECTRIC HEATING COIL

A. Finned tube heating elements easily accessible with automatic reset thermal cut-out, built-in magnetic contactors, galvanized steel frame, control circuit transformer and fuse, manual reset thermal cut-out, airflow proving device, toggle switch (pilot duty), load fuses.

B. Controls: Start supply fan before electric elements are energized and continue operating until air temperature reaches minimum setting, with switch for continuous fan operation.

206 EVAPORATOR COIL

A. Provide copper tube aluminum fin coil assembly with galvanized drain pan and connection.

B. Provide capillary tubes or thermostatic expansion valves for units of 6 tons capacity and less, and thermostatic expansion valves and alternate row circuiting for units 7.5 tons cooling capacity and larger.

207 COMPRESSOR

A. Provide hermetic compressors, 3600 rpm maximum, resiliently mounted with positive lubrication, crankcase heater, high and low pressure safety controls, motor overload protection, suction and discharge service valves and gauge ports, and filter drier.

B. Provide step capacity control by hot gas by-pass.

C. For heat pump units, provide reversing valve, suction line accumulator, discharge muffler, flow control check valve, and solid-state defrost control utilizing thermistors.

2.08 CONDENSER COIL

A. Provide copper tube aluminum fin coil assembly with subcooling rows and coil guard.

B. Provide direct drive propeller fans, resiliently mounted with fan guard, motor overload protection, wired to operate with compressor. Provide high efficiency fan motors.

C. Provide refrigerant pressure switches to cycle condenser fans.

2.09 MIXED AIR CASING

A. Dampers: Provide outside, return, and relief dampers with damper operator and control package to automatically vary outside air quantity. Outside air damper to fall to closed position. Relief dampers may be gravity balanced.

B. Gaskets: Provide tight fitting dampers with edge gaskets.

C. Damper Operator: 24 volt with gear train sealed in oil.

D. Mixed Air Controls: Maintain selected supply air temperature and return dampers to minimum position on call for heating and above 75 degrees F ambient, or when ambient air temperature exceeds return air temperature.

2.10 OPERATING CONTROLS - SINGLE ZONE UNITS

A. Electric solid state microcomputer based room thermostat, located as indicated in service area with remote sensor located as indicated.

B. Room thermostat shall incorporate:
   1. Automatic switching from heating to cooling.
   2. Preferential rate control to minimize overshoot and deviation from set point.
   3. Set-up for four separate temperatures per day.
   4. Instant override of set point for continuous or timed period from one hour to 31 days.
   5. Short cycle protection.
   6. Programming based on weekdays, Saturday and Sunday.
   7. Switch selection features including imperial or metric display, 12 or 24 hour clock, keyboard disable, remote sensor, fan on-auto.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that roof is ready to receive work and opening dimensions are as indicated on shop drawings.

B. Verify that proper power supply is available.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NFPA 90A.

C. Mount units on factory built roof mounting curb providing watertight enclosure to protect ductwork and utility services. Install roof mounting curb level.

3.03 SYSTEM STARTUP

A. Prepare and start equipment. Adjust for proper operation.

3.04 CLOSEOUT ACTIVITIES

A. See Section 017900 - Demonstration and Training, for additional requirements.

3.05 MAINTENANCE

A. Provide service and maintenance of packaged roof top units for one year year from Date of Substantial Completion.

B. Provide routine maintenance service with a two month interval as maximum time period between calls.

C. Include maintenance items as outlined in manufacturer's operating and maintenance data, including minimum of six filter replacements, minimum of one fan belt replacement, and controls check-out, adjustments, and recalibration.

D. After each service call, submit copy of service call work order or report that includes description of work performed.

END OF SECTION

SECTION 238100
DECENTRALIZED UNITARY HVAC EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. self-contained heat pump unit ventilators and accessories

1.02 QUALITY ASSURANCE

A. AHRI Compliance: Test and rate Self Contained Heat Pump unit ventilator in accordance with AHRI Standard 390 “Single Packaged Vertical Air Conditioners and Heat Pumps”.

B. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2010, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

D. ANSI/ASHRAE/IES 90.1-2013 Compliance: Applicable requirements in ANSI/ASHRAE/IES 90.1-2013, Section 6 - "Heating, Ventilating, and Air-Conditioning."

E. Listed on https://www.regulations.doe.gov/certification-data/. Complies with Energy Policy and Conservation Act (42 USC 6311-6317).

F. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum ten years documented experience.

G. The unit shall be constructed in accordance with ANSI standards, and a label shall be affixed to the unit listing the product code under which it is registered.

1.03 WARRANTY

A. Standard Unit Warranty:
   1. For units equipped with Modine Controls System - All Components Warranty: Two years from date of first beneficial use by buyer or any other user, within two years from date of resale by buyer in any unchanged condition, or within 30 months from date of shipment from seller, whichever occurs first.

B. Extended Compressor Warranty: Compressor warranty five years from date of first beneficial use by buyer or any other user, within five years from date of resale by buyer in any unchanged condition, or within sixty-six months from date of shipment from seller, whichever occurs first.

PART 2 PRODUCTS

2.01 GENERAL

A. Furnish and install a self-contained vertical floor standing heat pump unit ventilator. Constructed in accordance with UL 1995 standards with a label affixed to the unit listing the product code under which it is registered. Unit performance shall be rated in accordance with AHRI 390. Unit shall be constructed following ISO: 9001 quality control program procedures and be fully assembled, charged, wired, and tested prior to shipment.

2.02 MANUFACTURERS

A. Basis-of-Design Product: The design for Single Packaged Vertical Air-Conditioners and Heat Pumps is based on Modine ClassMate Model.

B. Or equal.

203 CABINET

A. Insulation: 1-inch thick, acoustic Hushcloth Polyester/Polyurethane foam with density of 2-pounds per cubic foot containing no fibrous materials.
   1. Fire-Hazard Classification: Insulation shall have a fire rating of UL94HF-1.
   2. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2010.

B. Cabinet Construction: Constructed from aluminized steel with 20 gauge panels, degreased and coated with electrostatically applied baked-on polyester powder paint.

C. Cabinet Interior: Interior right and left hand sides shall employ 20 gauge galvanized steel full double wall construction.

D. Cabinet Finish: The unit color shall be Beige (Hammertone Finish)
   1. Paint finish shall be easily cleanable and hard wearing to give maximum protection.

E. Service and Maintenance Access: All service and maintenance access shall be possible through the front of the unit only.

F. Return air openings shall be integrated into the cabinet sides.

G. Access door is factory installed on the front of the unit. Face of door shall be absent of return air openings to allow for easy cleaning. Door shall be fully insulated to provide for superior noise deadening at front of unit. Door shall employ heavy duty ¼" zinc plated steel plunger hinges with a spring-loaded ¼" zinc plated steel pin to allow for easy removal, if required. Door is secured with two (2) key locks. Door swing designed to turn into itself allowing side of the unit to be installed directly against a wall in the corner of a room.

H. Condensate Connection: Factory installed condensate connection stub provided for connection to the field installed building condensate drain.

204 REFRIGERATION SYSTEM

A. Compressor: Two stage hermetic scroll compressor mounted on four (4) 125# all neoprene rubber 35-45 durometer vibration isolators for quiet operation. Compressor contains an internal unloading mechanism to provide capacity control and enable part load efficiencies to be increased.
   1. An internal overload protector included to protect compressor against excessive motor temperatures and currents.
   2. Compressor is equipped with a crankcase heater to guard against liquid flood-back conditions and the elimination of oil foaming upon start up.
   3. Factory set high and low-pressure switches, automatic reset high pressure cutout, and automatic reset low-pressure cutout.

B. Compressor Acoustic Wrap with Base: For improved sound attenuation, compressor casing consists of 18oz PVC barrier laminated to 1/2 inch non-woven polyester. Casing includes integral 4 inch foil backed fiberglass heat shield for use with crankcase heater. Compressor base consists of 2 pound EVA barrier with embedded ¼ inch layered closed cell foam. Cover is easily removable for service.

C. Refrigeration Circuit (Heat Pump): Heat pump systems shall utilize HFC-R410A and shall be fitted with dual thermal expansion devices and a reversing valve to enable the unit to operate in either cooling or heat pump mode. A factory set defrost control fitted allows defrosting of the outside coil when in heat pump mode. Fitted with factory set automatic reset high-pressure and low-pressure cut-out switches and a sight glass for system observation.

D. Indoor Coil: Patented micro-channel CFTM evaporator coil designed for maximum heat transfer with minimum footprint and pressure drop. Quick draining evaporator coil designed,

tested and fabricated by unit ventilator manufacturer for optimal airflow and heat transfer specific to the unit. Coil is fitted to non-corrosive stainless steel drain trays.

E. Outdoor Coil: Enhanced, high efficiency, cross rifled coil designed, tested and fabricated by unit ventilator manufacturer for optimal airflow and heat transfer specific to the unit. Coil is fitted to non-corrosive stainless steel drain trays.

205 FANS AND MOTORS

A. The indoor fan assembly consists of one blower inside teardrop housing assembly engineered specifically for optimal airflow with low noise and minimal power consumption. Blower is powered by electronically commutated motor (ECM). The DC motor features brushless, permanently lubricated ball bearing construction for maintenance free operation. A wide range of programmable speeds and torque characteristics is possible for ultra-high efficiency and low audible noise. The ECM provides constant airflow by automatically adjusting the speed if the external static pressure changes. Electrical and control wiring to fan assembly includes quick disconnect plug local to assembly.

B. Outdoor (Condenser) Fan Assembly: The outdoor fan assembly consists of one backward curved plug fan with centrifugal blower wheel powered by an electronically commutated motor (ECM). The DC motor features brushless, permanently lubricated ball bearing construction for maintenance free operation. A wide range of programmable speeds and torque characteristics are possible for ultra-high efficiency and low audible noise. Fan design capable of overcoming external static pressures brought on by rear extensions backs and duct work connected to the fan discharge opening. Fan is sized such that powered exhaust shall be integral to the unit to prevent over pressurization of the space when the unit is introducing outside air. Capable of exhausting 100% equivalent of the fresh air intake of the unit. Electrical and control wiring to fan assembly includes quick disconnect plug local to assembly.

206 FILTER

A. Filter: 2” thick radial pleated disposable cotton and synthetic blend filters. Minimum Efficiency Reporting Value of MERV 8 per ASHRAE standard 52.2.

207 CONTROL PANEL

A. Control Panel: Located at top of the unit behind the front door for direct, centrally located access to controller, controller transformer (24V), and all necessary contactors, relays, and circuit breakers.

B. Wiring: Individually numbered terminal blocks and wires are to match job-specific wiring diagrams. All electrical wires in the control panel will run in an enclosed trough. Wiring outside the control panel to be contained in a protective sleeve. All controls and wiring is factory installed in a clean, organized arrangement.

C. Plug and Socket Wiring: Supply and Exhaust Fan decks, compressor, damper assembly, and energy wheel assembly (if applicable) wiring includes plugs local to the assembly allowing for quick wiring disconnect when the component requires removal for service.

208 ENERGY RECOVERY VENTILATOR WITH ECONOMIZER DAMPER

A. Energy recovery ventilation (ERV) provided within the unit through an enthalpy transfer wheel mounted in an insulated cassette frame complete with seals, drive motor, and belt. The rotary wheel is coated with silica gel desiccant and is sized to handle a maximum of 500 cfm of outside air. The entire assembly shall be a UL tested component. Performance shall be certified in accordance with the ASHRAE Standard 84 method of test and AHRI Rating Standard of 1060.

B. ERV Fans: ERV section employs dual electronically commutated ventilation fans to ensure precise control of airflow through energy wheel and provide optimal wheel frost protection as

required.

C. Outside Air Damper: Separate outside air damper and actuator provided for protection from outdoor elements when unit is not in use.

D. Complete energy recovery ventilator installed on rails to allow the entire assembly to be slid out of the unit for service. Electrical and control wiring to damper assembly includes quick disconnect plug local to assembly.

E. Enhanced Economizer Mode: Includes the addition of an economizer damper with actuator. This enables enhanced economizer functionality allowing up to 75% volume of outside air during free cooling applications.

209 HOT GAS REHEAT

A. Unit is equipped with a reclaim valve and a second condenser coil (reheat coil). When the unit enters the dehumidification mode, the unit will direct refrigerant to reheat coil to maintain space dry bulb temperature. When unit exits dehumidification mode, valve will reclaim refrigerant in reheat coil back to the system.

210 CONTROLS

A. Modine Control System: The unit is fitted with a programmable microprocessor controller provided by the unit manufacturer mounted outside the air stream in the control panel. The controller is designed specifically for operating the unit in its most energy efficient manner using pre-engineered control strategies. The microprocessor determines mode of operation based on the factory installed return air and supply air temperature sensors.

B. Factory installed controls shall enable the unit to operate in the following modes:
   1. Free Cooling - using outside air in favorable conditions
   2. Stage One Mechanical Cooling: 67% capacity compressor, low speed supply fan, reversing valve closed
   3. Stage Two Mechanical Cooling: Controller adjusts compressor capacity and supply fan speed based on load conditions through a sequence that is proprietary to Modine Controls, reversing valve closed
   4. Stage Three Mechanical Cooling: 100% capacity compressor, high speed supply fan, reversing valve closed
   5. Dehumidification: Controller adjusts compressor capacity based on dehumidification requirements through a sequence that is proprietary to Modine Controls, low speed supply fan, hot gas reheat valve is opened, reversing valve closed

C. Factory installed controls will allow the following additional modes of operation during heat pump mode:
   1. Stage One Heating: 67% capacity compressor, low speed supply fan
   2. Stage Two Heating: 67% capacity compressor, high speed supply fan
   3. Stage Three Heating: 100% capacity compressor, high speed supply fan
   4. Stage Four Heating: First stage Electric heat or modulate hot water heat, high speed supply fan

D. The microprocessor controller shall also modify the minimum damper position to compensate for mode of operation and fan speed.

E. Free Cooling Sequence: If the return air temperature is higher than the occupied set point and if the ambient air temperature is low enough to satisfy the cooling load in the occupied space, the microprocessor controller will de-energize the energy recovery ventilator. Outdoor air ventilation fan is 100% energized and economizer damper will automatically modulate between 0-100% allowing up to 75% free cooling to maintain conditioned space temperature. The free cooling mode of operation leads to much reduced running time for the compressor leading to

cost and equipment savings.

F. Heat Pump Heating Sequence: If the return air temperature is below the set point and the ambient air temperature is high enough (the heat pump will be locked out at 28°F ambient), the microprocessor controller will de-energize the reversing valve allowing the unit to operate in the reverse cycle DX heating mode. The microprocessor controller will also determine which stage of DX heating is most efficient to handle the heating load based on pre-engineered control strategies and the return air, supply air, and ambient air temperatures. The microprocessor controller will then place the unit in one of two DX heating stages of operation.

G. BACnet Card: The factory Microprocessor Control includes a plug-in card allowing for complete compatibility with an MS/TP BACnet control system.

H. Time Clock Card: The Modine Control System microprocessor includes a time clock card for units where time functions, night and weekend setback, etc. are not transmitted from a building management system or remote central time clock. The time clock shall have a full 7-day schedule and calendar function incorporated. The 7-day schedule shall have two adjustable occupied/unoccupied periods per day. The calendar function shall allow 20 calendar periods (start date / stop date = 1 period).

I. Display Module: User Interface for the Factory Microprocessor Controller. Displays status of controllers inputs and outputs, allows for unoccupied/occupied set-point changes, displays service settings, allows adjustment of control parameters, and is used for troubleshooting the unit.

J. Door Mounted Digital Thermostat: Digital thermostat used in conjunction with the Factory Microprocessor Control displays current room temperature, cooling/heating set-point, current time and day, current occupied mode, and the unit's compressor and fan speeds. The display will also display a remote alarm from the Microprocessor Control. Thermostat allows for occupied temperature set-point adjustment. The allowable set-point adjustment range can be limited by the Microprocessor Control. Thermostat allows for occupied override activation allowing user to select the amount of time the unit is to remain in the override state. Mounted on the front door of the unit, 48" above the finished floor (48" AFF only if no floor stand selected).

K. CO2 Sensor: Single beam, dual-wavelength NDIR sensor mounted in the interior return air passage of the unit to provide demand ventilation. When the level of CO2 rises over a predetermined set point, the sensor proportionally adjusts the minimum damper position to allow larger quantities of outside air into the room. The sensor shall have the capability of measuring CO2 levels from 0 to 2,000 ppm with an accuracy of +/- 40 ppm CO2 + 3.0% of the reading.

211 ELECTRIC HEATING (WHERE INDICATED)

A. Units equipped with electric resistance heating elements are controlled in one or two stages, depending on capacity. Electric heat is factory mounted downstream of the evaporator coil. A manual thermal protection and automatic thermal protection switch is included.

212 HOT WATER HEATING (WHERE INDICATED)

A. Hot Water Coil (unit mounted): Unit is equipped with a one row hot water heating coil integral to the unit mounted in the reheat position relative to the evaporator coil. The coil is manufactured from refrigeration quality copper tubing mechanically bonded onto aluminum fins. Coil is fitted with both an air bleed and a drain plug.

B. The hot water coil shall include the following:
   1. 3/4" two way modulating valve for capacity control
   2. Two 3/4" manual shut-off valves

3. 3/4" hot water strainer
4. 3/4" hot water circuit setter
5. 3/4" hot water drain with hose and bib
6. 3/4” PT Ports

2.13 ADDITIONAL FACTORY INSTALLED OPTIONS

A. Outdoor Coil Filter: A set of two 20-30 PPI polyester foam washable filters attached to a corrosion resistant metal wire frame fitted across the air inlet of the outdoor coil. Average synthetic dust weight arrestance of 60-80%. The filter is reusable and can be vacuum cleaned.

B. Disconnect Switch: Located on the control panel, a amp power disconnect switch sized for the full load amperage of the unit. Allows the unit to be disconnected from the power supply prior to any maintenance. In the off position the switch can be locked out.

2.14 FIELD INSTALLED ACCESSORIES

A. Outside Air Rear Extension: Where site conditions do not permit the use of the standard locations for outside air intake and exhaust air discharge, an insulated outside air rear extension is supplied for site installation between the back of the unit and the outside wall by the mechanical contractor. The outside air rear extension is 6” deep and designed to meet up with an EdPac wall opening.

B. Duct Shroud: 38” three sided duct shroud field mounted on top of the unit for extending the cabinet through the ceiling/soffit. Field trimmed by the installing contractor to suit the ceiling height. Finished and painted to match the unit

C. Supply Air Replacement Filters: The unit shall be provided with 1 set(s) of MERV 8 supply air replacement filters (Qty of 2).

PART 3 EXECUTION

3.01 EXAMINATION

A. General: Examine areas and conditions under which self-contained heat pumps are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to installer.

3.02 INSTALLATION

A. General: Install self-contained heat pumps in accordance with manufacturer’s installation instructions. Install units plumb and level, firmly anchored in locations indicated, and maintain manufacturer’s recommended clearances.

B. Electrical Wiring: Install electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer’s wiring diagram submittal to Electrical Installer.
   1. Verify that electrical wiring installation is in accordance with manufacturer’s submittal and installation requirements of Division-16 sections. Do not proceed with equipment start-up until wiring installation is acceptable to equipment installer. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

C. Ductwork: Refer to Division-23 section “HVAC Ducts and Casings”. Connect supply and return ducts to units with flexible duct connections. Provide transitions to exactly match unit duct connection size.

D. Drain Piping: Connect self-contained heat pump's condensate drain to nearest indirect waste connection, or as indicated.

3.03 SYSTEM STARTUP

A. Start-up units in accordance with manufacturer's start-up instructions. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.

END OF SECTION

SECTION 238113
PACKAGED TERMINAL AIR-CONDITIONERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Air conditioning units.

B. Cabinet.

C. Evaporator fan.

D. Compressor.

E. Evaporator coil.

F. Condenser.

G. Heating coil.

H. Air filters.

I. Controls.

1.02 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data for manufactured products and assemblies. Indicate water, drain, thermostatic valves, and electrical rough-in connections with electrical characteristics and connection requirements.

C. Manufacturer's Instructions: Indicate assembly, support details, connection requirements, and include start-up instructions.

D. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016000 - Product Requirements, for additional provisions.

1.03 QUALITY ASSURANCE

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.04 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Provide a five year warranty to include coverage for refrigeration compressors.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Daikin Industries Co, Ltd.

B. Friedrich Air Conditioning Co.

C. Trane Inc.

D. Substitutions: Or equal.

2.02 AIR CONDITIONING UNITS

A. Description: Packaged, self-contained, factory assembled, prewired unit, consisting of cabinet, compressor, condensing coil, evaporator fan, evaporator coil, outside air connection, heating coil, air filters, and controls; fully charged with refrigerant and filled with oil.

B. Assembly: Up flow air delivery, in draw-through configuration as indicated.

C. Refrigerant: Use only refrigerants that have ozone depletion potential (ODP) of zero and global warming potential (GWP) of less than 50.

2.03 CABINET

A. Frame and Panels: Galvanized steel with baked enamel finish, easily removed access doors or panels with quick fasteners.

B. Insulation: Minimum 1/2 inch thick acoustic duct liner for lining cabinet interior.

C. Drain Pan: Galvanized steel with corrosion-resistant coating.

2.04 EVAPORATOR FAN

A. Fan: Direct drive fan, statically and dynamically balanced, resiliently mounted.

2.05 COMPRESSOR

A. Hermetically sealed, 3600 rpm maximum, resiliently mounted with positive lubrication and internal motor protection.

2.06 EVAPORATOR COIL

A. Direct expansion coiling coil of seamless copper or aluminum tubes expanded into aluminum fins.

B. Refrigeration circuit with externally equalized thermal expansion valve, filter-drier, and charging valves.

2.07 CONDENSER

A. Co-Axial: Copper tube in copper tube or shell and tube with finned copper tubes in steel shell with water temperature actuated water regulating valve.

B. Fan: Double width, double inlet, forward curved centrifugal fan, statically and dynamically balanced, with permanently lubricated bearings.

C. V-Belt Drive: Cast iron or steel sheaves, dynamically balanced, bored to fit shafts and keyed. Variable and adjustable pitch motor sheave selected so required rpm is obtained with sheaves set at mid-position as recommended by manufacturer or minimum 1.5 times nameplate rating of the motor.

2.08 HEATING COIL

A. Helical nickel-chrome resistance wire coil heating elements with refractory ceramic support bushings, with automatic reset thermal cut-out, built-in magnetic contactors, manual reset thermal cut-out, airflow proving device, load fuses.

2.09 AIR FILTERS

A. Easily removed one inch thick permanent cleanable panel filters.

2.10 CONTROLS

A. Factory wired controls shall include contactor, high and low pressure cutouts, internal winding thermostat for compressor, control circuit transformer, non-cycling reset relay.

B. Provide thermostat to cycle cooling, mounted within unit with 'fan-off-cool' switch allowing continuous fan operation, or cycling fan on call for cooling.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Pipe condensate from drain pan to nearest available discharge location .

END OF SECTION

SECTION 238200
CONVECTION HEATING AND COOLING UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Unit ventilators.

B. Electric cabinet unit heaters.

C. Air coils.

1.02 REFERENCE STANDARDS

A. AHRI Directory of Certified Product Performance - Air-Conditioning, Heating, and Refrigeration Institute (AHRI).

B. AHRI 350 - Sound Performance Rating of Non-Ducted Indoor Air-Conditioning and Heat Pump Equipment.

C. AHRI 410 - Forced-Circulation Air-Cooling and Air-Heating Coils.

D. AHRI 840 - Unit Ventilators.

E. ASHRAE (HVACA) - ASHRAE Handbook - HVAC Applications.

PART 2 PRODUCTS

2.01 UNIT VENTILATORS

A. Manufacturers:
   1. Carrier, a part of UTC Building and Industrial Systems, a unit of United Technologies Corp.
   2. Daikin Applied
   3. Trane, a brand of Ingersoll Rand; [_____]
   4. Substitutions: Or equal.

B. Performance Data and Safety Requirements:
   1. Unit capacities certified and tested in accordance with AHRI 840 and AHRI 350.
   2. Provide products listed, classified, and labeled by as suitable for the purpose indicated.

C. Required Directory Listings: AHRI Directory of Certified Product Performance - Air-Conditioning, Heating, and Refrigeration Institute (AHRI).

D. Hydronic Coils:
   1. Copper tubes mechanically expanded or bonded into evenly spaced aluminum fins.
   2. Factory pressure tested, hydrostatically, to not less than 350 psi.
   3. Provide insulated drain pan under chilled water coils, to prevent sweating, with field convertible left or right hand drain connections.

E. Refrigerant Coils:
   1. Provide factory installed thermal expansion valves, properly sized to accommodate the selected condensing unit.
   2. Factory proof and leak tested to ensure leak tight operation.
   3. Provide insulated drain pan, to prevent condensation, with field convertible left or right hand connections.

F. Cabinet: 14 gage, 0.0747 inch sheet steel on solid base pan with exposed edges rounded. Provide removable front panels with quick-acting, key-operated cam locks. Provide removable die-cast or fabricated steel discharge grilles. For units having cooling coils, insulate internal parts and surfaces exposed to conditioned air stream with moisture resistant insulation.

G. Cabinet Accessories: Matching steel construction, reinforced, for use with unit ventilators or finned radiation, with steel alignment pins, adjustable kick plates with leveling bolts, shelves and sliding doors with locks as indicated, sinks, corner, end, and wall filler sections as required.

H. Finish: Factory applied baked primer coat on visible surfaces of enclosure or cabinet.

I. Fans: Centrifugal forward-curved double-width wheels, statically and dynamically balanced, direct driven, arranged to draw air through coil.

J. Wall Louvers: Anodized aluminum wall intake box and louvers removable from frame with 1/2 inch square mesh galvanized screen in back of louver.

K. Motor: Tap wound multiple speed permanent split capacitor with sleeve bearings, resiliently mounted.

L. Controls:

1. Unit Ventilator Manufacturer's Controls:
   a. Fan speed switch for unit mounting.
   b. Disconnect switch.
2. Controls Interface:
   a. Relay board.
   b. 24-volt transformer.
3. Provide ASHRAE Cycle I as defined in ASHRAE (HVACA) Handbook - HVAC Applications.

M. Filter: Easily removed 1 inch thick glass fiber throw-away type, located to filter air before coil.

N. Mixing Dampers: Multi-blade with compressible seal, capable of varying proportion of mixed air from 100 percent room air to 100 percent outside air.

O. Electrical Characteristics:
1. As called out on schedules.

202 ELECTRIC CABINET UNIT HEATERS

A. Manufacturers:
1. INDEECO (Industrial Engineering and Equipment Company)
2. Marley Engineered Products
3. Trane, a brand of Ingersoll Rand
4. Substitutions: Or equal.

B. Provide products listed, classified, and labeled byUnderwriters Laboratories Inc. (UL), Intertek (ETL), or testing firm acceptable to Authority Having Jurisdiction as suitable for the purpose indicated.

C. Heating Elements: Provide open-wire, finned tubular, resistance wire enclosed in steel sheath, or [_____]

D. Cabinet: Minimum 18 gage, 0.0478 inch thick steel front panel with exposed corners and edges rounded, easily removed panels, glass fiber insulation and integral air outlet, and inlet grilles.

E. Finish:
1. Factory applied, painted finish.
2. Color: As selected from color chart.

F. Fans: Centrifugal forward-curved double-width wheels, statically and dynamically balanced, direct driven.

G. Motor: Tap wound multiple speed permanent split capacitor with sleeve bearings, resiliently mounted.

H. Controls:
   1. Control transformer.
   2. Control relays.
   3. Thermal cutout with automatic reset to de-energize electric heating elements in the event of overheating.
   4. Fan speed switch.
   5. Thermostat.

I. Filter: Easily removed, 1 inch thick glass fiber throw-away type, located to filter air before coil.

J. Electrical Characteristics:
   1. As called out on the drawing scedules

2.03 AIR COILS

A. Manufacturers:
   1. Water Coils:
      a. Trane, a brand of Ingersoll Rand; [_____]: www.trane.com/#sle.
      b. USA Coil & Air; [_____]: www.usacoil.com/#sle.
      c. Or equal.

B. Water Coils:
   1. Coils rated and tested in accordance with AHRI 410.
   2. Tubes: Material to consist of seamless copper, brass, or [_____], mechanically expanded, tension wound, or [_____] to fins; appropriate tube joining methods based on tube material.
   3. Fins: Material to consist of aluminum or copper, continuous plate type with full fin collars, individual helical finned tube type wound under tension, or [_____].
   4. Casing: Heavy gage galvanized steel with mounting holes, including intermediate tube supports if required by coil design and length.
   5. Headers (Manifolds): Construct of seamless copper pipe, cast iron, nonferrous, or [_____] material with tube connection appropriate to header material provided.
   6. Acceptable Factory Testing Methods:
      a. Leak test at minimum 300 psig air pressure under water.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are suitable for installation.

B. Verify that field measurements are as indicated on drawings.

3.02 INSTALLATION

A. Install in accordance with manufacturer's recommendations.

B. Install equipment exposed to finished areas after walls and ceilings are finished and painted.

C. Do not damage equipment or finishes.

D. Cabinet Unit Heaters:
   1. Install as indicated.
   2. Coordinate to ensure correct recess size for recessed units.

E. Unit Ventilators:
   1. Locate as indicated, level and shim units, and anchor to structure.

2. Coordinate exact location of wall louvers.
3. Install shelving and auxiliary cabinetry.
4. Provide wall trim pieces for continuous wall-to-wall installation.

F. Units with Cooling Coils: Connect drain pan to condensate drain.

G. Units with Electric Heating Elements:
1. Install as indicated including electrical devices furnished by manufacturer but not factory installed.
2. Install wiring in accordance with the manufacturer's wiring diagram submittal and Section 260583.

3.03 CLEANING

A. After construction and painting is completed, clean exposed surfaces of units.

B. Vacuum clean coils and inside of units.

C. Touch-up marred or scratched surfaces of factory-finished cabinets using finish materials furnished by the manufacturer.

D. Install new filters.

END OF SECTIO

SECTION 260500
COMMON WORK RESULTS FOR ELECTRICAL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electrical equipment coordination and installation.

B. Sleeves for raceways and cables.

C. Sleeve seals.

D. Grout.

1.02 RELATED REQUIREMENTS

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

1.03 SUMMARY

A. Common electrical installation requirements.

B. Coordinate with all other trades for all site and perimeter work included within the scope of work. All work to be performed below grade shall be coordinated with all other trades performing work below grade. Provide a planned excavation submittal showing all coordinated systems to be installed below grade, and the associated elevations, prior to commencing any installation of work required in order to complete the scope of work.

1.04 DEFINITIONS

A. EPDM: Ethylene-propylene-diene terpolymer rubber.

1.05 COORDINATION

A. Coordinate arrangement, mounting, and support of electrical equipment:
   1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
   2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
   3. To allow right of way for piping and conduit installed at required slope.
   4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.

B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

C. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed.

D. Coordinate sleeve selection and application with selection and application of Firestopping.

PART 2 PRODUCTS

2.01 SLEEVES FOR RACEWAYS AND CABLES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Sleeves for Rectangular Openings: Galvanized sheet steel.
   1. Minimum Metal Thickness:
      a. For sleeve cross-section rectangle perimeter less than 50 inches and no side more than 16 inches, thickness shall be 0.052 inch.

b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches and 1 or more sides equal to, or more than, 16 inches, thickness shall be 0.138 inch.

2.02 SLEEVE SEALS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Advance Products & Systems, Inc.
      b. Or equal.
   2. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
   3. Pressure Plates: Plastic. Include two for each sealing element.
   4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.03 GROUT

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

PART 3 EXECUTION

3.01 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

A. Comply with NECA 1.

B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

E. Right of Way: Give to piping systems installed at a required slope.

3.02 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

E. Cut sleeves to length for mounting flush with both surfaces of walls.

F. Extend sleeves installed in floors 2 inches above finished floor level.

G. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable, unless indicated otherwise.

H. Seal space outside of sleeves with grout for penetrations of concrete and masonry
   1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.

I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint.

J. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials.

K. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

L. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

M. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals.

3.03 SLEEVE-SEAL INSTALLATION

A. Install to seal exterior wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.04 FIRESTOPPING

A. Apply Firestopping to penetrations of fire-rated floor and wall assemblies for electrical installations to restore original fire-resistance rating of assembly.

END OF SECTION

SECTION 260502
BASIC ELECTRICAL REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes general administrative, procedural, and installation requirements for electrical installations.

1.02 DEFINITIONS

A. Definitions pertaining to Division 26:
   1. Provide: Furnish and install.
   2. Furnish: Furnish only (installation by others).
   3. Install: Mount, make all connections and have in operation.
   4. Indicated: On Contract Drawings or stated herein.
   5. Concealed: Hidden from sight at completion of work.
   6. Homerun: Branch circuit conductors and conduit between over current protection and load.
   7. Circuit: Electrical conductors (power, control, instrumentation, etc.) and associated conduit.
   8. Trade: General Contractor, HVAC, plumbing, etc.
   9. Or Approved Equal: Equal in the judgment of the Engineer.
   10. Utility: Local provider of electrical power, telephone, or cable television.

1.03 QUALITY ASSURANCE

A. Qualifications of Installers:
   1. For the actual fabrication, installation and testing of the Work of this Division, only use thoroughly trained and experienced personnel who are completely familiar with the codes and requirements for this Work and with the installation recommendations of the manufacturers of the specified items.

B. Workmanship:
   1. Complete electrical installation shall be made in a neat and workmanlike manner and to the full satisfaction and approval of the Owner and Engineer.
   2. Work not meeting Owner's or Engineer's standard for adequate workmanship shall be removed and replaced at once, at no additional Contract cost to the Owner.
   3. Remove and replace all work rejected by Owner or Engineer as defective, non-operational or not in conformance with intent of this Contract.

1.04 SUBMITTALS

A. Submit shop drawings and pertinent product information as per Division 1 and as specified herein.

B. Substitutions:
   1. Materials of greater or equal quality, function, and performance may be proposed for substitution by submitting product information as described above two weeks minimum prior to the bid date. Submittal shall clearly indicate that it is a substitution, and clearly list all differences from the specified.

C. Samples: Where indicated or requested, provide the Engineer with a sample of the intended product.

D. Submittals shall be clear and concise. The submittals shall clearly indicate the product name, applicable Specification Section, proposed location, equipment supplier with telephone number and all features and ratings. The intended product shall be differentiated from others with a

model number or highlighting. Product differences from that specified shall be noted and brought to the attention of the Engineer. Such differences shall be listed at the beginning of the submittal.

E. Submittals for equipment that is to be installed within “Electrical Rooms”, or rooms that have electrical equipment within them, shall include floor plans with scaled drawings showing equipment layout within room.

F. If equipment or materials are installed before proper approvals have been obtained, each Contractor shall be liable for their removal and replacement including work of other trades affected by such work, at no additional cost to the Owner, if such items do not meet intent of the Drawings and Specifications.

G. The Engineer reserves the right to reject any submittal that contains equipment from various manufacturers if suitable materials can be secured from fewer manufacturers.

1.05 TRAINING

A. Provide system training for all systems included herein. Training shall be complete and include all individual system functions, features, operation and maintenance. The training shall be scheduled at the Owner’s convenience and be for the Owner and its designated representatives. A minimum of two copies of materials used (videos, pamphlets, manuals, presentations, etc.) shall be provided to the Owner. The training shall be thorough enough for the attendees to understand all that is presented and additional sessions shall be scheduled as needed for a full understanding.

1.06 COORDINATION DRAWINGS

A. Prepare coordination drawings in accordance with Division 1 detailing major elements, components, and systems of electrical equipment and materials in relationship with other systems, installations, and building components. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are of importance to the efficient flow of the Work, including (but not necessarily limited to) the following:

1. Indicate the proposed locations of major raceway systems, equipment, and materials. Include the following:
    a. Clearances for servicing equipment, including space for equipment disassembly required for periodic maintenance.
    b. Exterior wall and foundation penetrations.
    c. Fire-rated wall and floor penetrations.
    d. Equipment connections and support details.
    e. Sizes and location of required concrete pads and bases.

B. Indicate scheduling, sequencing, movement, and positioning of large equipment into the building during construction.

C. Prepare floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.

D. Prepare reflected ceiling plans to coordinate and integrate installations, air outlets and inlets, luminaries, communications systems components, sprinklers, and other ceiling-mounted devices.

E. Coordinate with other trades to determine areas of conflict. Inform the Engineer of such areas of conflict and the proposed resolution.

1.07 RECORD DOCUMENTS

A. Prepare record documents in accordance with the requirements in Division 1. In addition to the requirements specified in Division 1, indicate installed conditions for:

1. Major raceway systems, size and location, for both exterior and interior; locations of control devices; distribution and branch electrical circuitry; and fuse and circuit breaker size and arrangements.
2. Equipment locations (exposed and concealed), dimensioned from prominent building lines.
3. Approved substitutions, Contract Modifications, and actual equipment and materials installed.

B. Engage the services of a Land Surveyor or Professional Engineer registered in the state in which the project is located as specified in Division 1 to record the locations and invert elevations of underground installations.

C. During progress of the Work, maintain an accurate record of the installation of the electrical system, locating each circuit precisely by dimension.

D. Record drawings shall be acceptable to the Owner and Engineer. Any changes to the Record Drawings, as directed by the Owner or Engineer, shall be made by the Contractor.

1.08 OPERATIONS AND MAINTENANCE MANUALS

A. Prepare operations and maintenance manuals in accordance with Division 1. In addition to the requirements specified in Division 1, include the following information for equipment items:
1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.
2. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.
3. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
4. Servicing instructions and lubrication charts and schedules.
5. Names and telephone numbers of local service and parts supply organization.

1.09 TEST RESULTS

A. Provide test results in accordance with Division 1.

PART 2 PRODUCTS

2.01 PRODUCT STORAGE AND HANDLING

A. Protection: Use all means necessary to protect electrical system materials before, during and after installation and to protect the installed work and materials of all other trades.

B. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Engineer and at no additional cost to the Owner.

C. The Contractor shall be responsible for the work of other trades that may be damaged or disturbed in the course of his work and shall restore the damaged work to the condition existing prior to damage without additional cost to the Owner.

2.02 EQUIPMENT AND MATERIALS

A. All equipment and materials shall be of the capacity and type shown on the Drawings and specified herein and shall be as manufactured by one of the manufacturers designated or shall be an equal approved in advance by the Engineer.

B. All other materials, not specifically described but required for a complete and operable electrical installation, shall be new, first quality of their respective kinds, and as selected by the Contractor subject to the approval of the Engineer.

C. Install all equipment and materials in complete accordance with the manufacturer's recommendations and all pertinent codes and regulations.

D. Materials and equipment shall be listed by Underwriters Laboratories.

E. Equipment and component parts thereof shall bear manufacturer's nameplate, giving manufacturer's name, size, type and model number or serial number, electrical characteristic to facilitate maintenance and replacements. Nameplates of distributors or contractors are not acceptable.

F. Equipment shall be suitable for the intended location and use.

G. Equipment terminations/lugs shall be sized for the required temperature rating and indicated wire size as a minimum.

PART 3 EXECUTION

3.01 SURFACE CONDITIONS

A. Inspection:
   1. Prior to all work of this Division, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.
   2. Verify that the electrical installation may be made in complete accordance with all pertinent codes and regulations and the original design.

B. Discrepancies:
   1. In the event of discrepancy, immediately notify the Engineer.
   2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.02 PREPARATION

A. Coordination:
   1. Coordinate the installation of electrical items with the schedules for work of other trades and building components to prevent unnecessary delays in the total Work. Coordinate specific equipment connections and requirements with the trade providing the equipment.
   2. Coordinate with utility company and make all installations for their services in accordance with all utility company requirements. The Contractor shall arrange for and assume all utility costs associated with this contract.
   3. Any changes due to improper coordination shall be done at the Contractor's expense.
   4. Where luminaires and other electrical items are shown in conflict with locations of structural members and mechanical or other equipment, furnish and install all required supports and wiring to clear the encroachment.
   5. Any Work installed contrary to or without approval of the Engineer shall be subject to change as directed by the Engineer, and no extra compensation will be allowed the Contractor for making these changes.

B. Accuracy of Data:
   1. The Drawings are diagrammatic and functional only, and are not intended to show exact layouts, number of fittings, or other installation details. The Contractor shall furnish all labor and materials necessary to install and place in satisfactory operation all power, lighting, and other electrical systems shown. The Contractor shall install additional circuits wherever needed to conform to the specific requirements of the equipment.
   2. The locations of equipment, materials, outlets, and similar devices shown on the Drawings are approximate only. Exact locations shall be verified during construction so that they shall coordinate with all other work, equipment and trades. The Contractor shall obtain in the field all information relevant to the placing of electrical work and, in case of any

interference with other work, shall proceed as directed by the Engineer and shall furnish all labor and materials necessary to complete the Work in an approved manner.

3. The ratings of motors and other electrically operated devices, together with the size shown for their branch circuit conductors and conduits, are approximate only, and are indicative of the probable power requirements insofar as they can be determined in advance of the purchase of equipment. Equipment sizes may vary from sizes indicated on the drawings and must be verified with actual equipment to be furnished and coordinated with all other equipment and material sizes.

3.03 DIMENSIONS, ELEVATIONS, AND LAYOUTS

A. It shall be the responsibility of the Contractor to verify dimensions and elevations shown or scaled on Drawings by actual field measurements after building construction has progressed to the point where such measurements may be taken.

B. Advise Owner & Architect in writing regarding those critical dimensions that must be held by other Trades as they perform their work.

C. Assume full responsibility for accuracy of all work under this Division and make corrections as required.

D. It shall be this Division's responsibility to coordinate with all other Trades and separate equipment contracts regarding mechanical equipment layouts, space requirements, mounting details, "roughing-in" dimensions, and for items substituted for those specified herein to avoid conflict.

E. Arrange for disassembling large pieces of equipment for entry into buildings as necessary to pass through available openings. Disassembly shall not void UL Listing or manufacturer's warranty. If such disassembly voids UL listing, the Contractor is responsible for obtaining and paying for UL re-certification of equipment.

F. Layouts of feeders and wiring shown on Drawings are diagrammatic, and shall be constructed as such, intended to show scope of work and general arrangement, unless otherwise noted.

G. Equipment locations shall be as indicated unless prohibited by equipment dimensions, codes or the manufacturer's recommendations. In such an event, contact the Engineer.

3.04 EQUIPMENT CLEANING

A. Thoroughly inspect all equipment and any items dented, scratched or otherwise damaged in any manner shall be replaced or repaired and painted to match original finish:

1. All items so repaired and refinished shall be brought to the attention of the Engineer for inspection and approval.

B. Upon completion of all installation, lamping, and testing, thoroughly inspect all exposed portions of the electrical installation and completely remove all exposed labels, soil, markings and foreign material.

3.05 EXISTING SERVICES

A. Active: When encountered in work, protect, brace, support existing active drains, gas, electric, water, other services where required for proper execution of work. If existing active services are encountered that require relocation, make request in writing for determination. Do not prevent or disturb operation of active services that are to remain. Repair existing service disturbed during work under this contract at no cost to the Owner. Record any existing services encountered on "as-built" drawings.

B. Inactive Services: When encountered in work, remove cap or plug inactive services. Notify Owner; protect or remove these services as directed. Record on "as-built" drawings.

C. Interruption of Services: Where work makes temporary shutdowns of services unavoidable, shutdown at night or at such terms as approved by Owner, which will cause least interference with established operating routine. Arrange to work continuously, including overtime, if required, to assure that services will be shutdown only during time actually required to make necessary connections to existing work.

3.06 TEMPORARY SERVICES

A. Coordinate temporary requirements with those indicated in Division 1.

B. Electric: Provide temporary electric service as needed for all trades included with this project throughout the construction period. If there is no existing service or the existing service is not sufficient for the added construction load or if no service exists, temporary electrical service shall be provided, including securing and paying for all services rendered by the utility company which is required in order to provide temporary service.
   1. Temporary electrical service shall be coordinated with the utility and be sized for the maximum construction load.
   2. All power requirements of individual trades shall be provided except that temporary power shall not be used for heating or welding applications.
   3. All wiring shall be in accordance with the NEC.
   4. All receptacles shall be ground fault protected.

C. Lighting: Provide temporary lighting for construction needs throughout the construction period, including re-lamping throughout the duration of construction. Areas to be illuminated shall include but not be limited to:
   1. Construction areas: Uniform 20 foot candles minimum.
   2. Security area: Uniform 1 foot candle minimum.
   3. Temporary offices, storage, shop and other construction buildings: Light levels as required.

D. Telephone: Each prime contractor shall be responsible to provide temporary telephone service for their own use.

3.07 ELECTRICAL INSTALLATIONS

A. General: Sequence, coordinate, and integrate the various elements of electrical systems, materials, and equipment. Comply with the following requirements:
   1. Coordinate electrical systems, equipment, and materials installation with other building components.
   2. Verify all dimensions by field measurements.
   3. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for electrical installations.
   4. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
   5. Sequence, coordinate, and integrate installations of electrical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.
   6. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.
   7. Coordinate connection of electrical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
   8. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements

indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Engineer.

9. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.
10. Install electrical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.
11. Install access panels or doors where splices, junctions, pull points, etc. are concealed behind finished surfaces.
12. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.

B. Coordinate with the Owner, architectural drawings, etc for the locations of the expansion joints, fire walls and smoke walls/partitions. Suitable expansion/deflection fittings shall be provided at all expansion joints and at recommended lengths of raceway. Fire/gas stopping shall be provided at all walls/floor/partitions penetrations. Fire stopping rating shall match or exceed the walls/floor/partitions rating.

3.08 CUTTING AND PATCHING

A. General: Perform cutting and patching in accordance with Division 1. In addition to the requirements specified in Division 1, the following requirements apply:

1. Perform cutting, fitting, and patching of electrical equipment and materials required to:
   a. Uncover Work to provide for installation of ill-timed Work.
   b. Remove and replace defective Work.
   c. Remove and replace Work not conforming to requirements of the Contract Documents.
   d. Remove samples of installed Work as specified for testing.
   e. Install equipment and materials in existing structures.
2. Upon written instructions from the Engineer, uncover and restore Work to provide for Engineer's observation of concealed Work.
3. Cut, remove, and legally dispose of selected electrical equipment, components, and materials as indicated, including but not limited to removal of electrical items indicated to be removed and items made obsolete by the new Work.
4. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.
5. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.
6. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.

3.09 GUARANTEE

A. Furnish guarantee covering all work in accordance with general requirements of the contract for minimum period of one year. This personal guarantee shall exist for a period of one (1) year from the date of final acceptance of the work and shall apply to defects in materials and to defective workmanship of any kind.

B. For factory-assembled equipment and devices on which the manufacturers furnish standard published guarantees as regular trade practice, obtain such guarantees and replace any such equipment that proves defective during the life of these guarantees.

C. Guarantee all work for which materials are furnished, fabricated or field erected by the Contractor, all factory-assembled equipment for which no specific manufacturer's guarantee is

furnished, and all work in connection with installing manufacturer's guaranteed equipment.

D. In the event of failure of any work, equipment or device during the life of the guarantee, repair or replace the equipment or defective work. Remove, replace or restore, at no cost to the Owner, any part of the structure or building which may be damaged either as the direct result of the defective work or in the course of the contractor's making replacement of the defective work or materials. Work shall be done at a time and in a manner as to cause no undue inconvenience to the Owner. Provide new materials, equipment, apparatus and labor to replace that determined by Engineer to be defective or faulty.

E. This guarantee also applies to services including instructions, adjusting, testing, etc.

3.10 PROJECT OBSERVATION

A. Contractor shall accompany the Engineer for all project observation/walk through, remove equipment covers as directed and provide all requested equipment (meters, samples, ladder, etc.).

3.11 VIBRATION ISOLATION

A. Vibration isolators shall prevent, as far as practicable, transmission of vibration, noise or hum to any part of building.

B. Design isolators to suit vibration frequency to be absorbed; provide isolator units of area, distribution to obtain proper resiliency under machinery load, impact.

C. Wiring and other electrical connections to equipment mounted on vibration isolators shall utilize flexible metal conduit in order to avoid restraining equipment and short circuiting vibration isolator.

END OF SECTION

SECTION 260505
SELECTIVE DEMOLITION FOR ELECTRICAL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electrical demolition.

1.02 SUBMITTALS

A. Sustainable Design Documentation: Submit certification of removal and appropriate disposal of abandoned cables containing lead stabilizers.

PART 2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. Materials and equipment for patching and extending work: As specified in individual sections.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify field measurements and circuiting arrangements are as indicated.

B. Verify that abandoned wiring and equipment serve only abandoned facilities.

C. Demolition drawings are based on casual field observation and existing record documents.

D. Report discrepancies to Architect before disturbing existing installation.

E. Beginning of demolition means installer accepts existing conditions.

3.02 PREPARATION

A. Disconnect electrical systems in walls, floors, and ceilings to be removed.

B. Coordinate utility service outages with utility company.

C. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations.

D. Existing Electrical Service: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Minimize outage duration.

E. Existing Fire Alarm System: Maintain existing system in service. Disable system only to make switchovers and connections. Minimize outage duration.

3.03 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

A. Perform work for removal and disposal of equipment and materials containing toxic substances regulated under the Federal Toxic Substances Control Act (TSCA) in accordance with applicable federal, state, and local regulations. Applicable equipment and materials include, but are not limited to:
   1. PCB-containing electrical equipment, including transformers, capacitors, and switches.
   2. PCB- and DEHP-containing lighting ballasts.
   3. Mercury-containing lamps and tubes, including fluorescent lamps, high intensity discharge (HID), arc lamps, ultra-violet, high pressure sodium, mercury vapor, ignitron tubes, neon, and incandescent.

B. Remove, relocate, and extend existing installations to accommodate new construction.

C. Remove abandoned wiring to source of supply.

D. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.

E. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets that are not removed.

F. Disconnect and remove abandoned panelboards and distribution equipment.

G. Repair adjacent construction and finishes damaged during demolition and extension work.

H. Maintain access to existing electrical installations that remain active. Modify installation or provide access panel as appropriate.

3.04 CLEANING AND REPAIR

A. Clean and repair existing materials and equipment that remain or that are to be reused.

B. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangement.

END OF SECTION

SECTION 260519
LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Single conductor building wire.

B. Wiring connectors.

C. Electrical tape.

D. Wire pulling lubricant.

E. Cable ties.

1.02 RELATED REQUIREMENTS

A. Section 078400 - Firestopping.

B. Section 260505 - Selective Demolition for Electrical: Disconnection, removal, and/or extension of existing electrical conductors and cables.

C. Section 260526 - Grounding and Bonding for Electrical Systems: Additional requirements for grounding conductors and grounding connectors.

D. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

1.03 REFERENCE STANDARDS

A. ASTM B3 - Standard Specification for Soft or Annealed Copper Wire.

B. ASTM B8 - Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft.

C. ASTM B33 - Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes.

D. ASTM B787/B787M - Standard Specification for 19 Wire Combination Unilay-Stranded Copper Conductors for Subsequent Insulation.

E. ASTM D3005 - Standard Specification for Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape.

F. NECA 1 - Standard for Good Workmanship in Electrical Construction.

G. NEMA WC 70 - Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy.

H. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems.

I. NFPA 70 - National Electrical Code.

J. UL 44 - Thermoset-Insulated Wires and Cables.

K. UL 83 - Thermoplastic-Insulated Wires and Cables.

L. UL 486A-486B - Wire Connectors.

M. UL 486C - Splicing Wire Connectors.

N. UL 486D - Sealed Wire Connector Systems.

O. UL 510 - Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate sizes of raceways, boxes, and equipment enclosures installed under other sections with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
2. Coordinate with electrical equipment installed under other sections to provide terminations suitable for use with the conductors to be installed.
3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for conductors and cables, including detailed information on materials, construction, ratings, listings, and available sizes, configurations, and stranding.

B. Field Quality Control Test Reports.

C. Project Record Documents: Record actual installed circuiting arrangements. Record actual routing for underground circuits.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conductors and cables in accordance with manufacturer's instructions.

1.08 FIELD CONDITIONS

A. Do not install or otherwise handle thermoplastic-insulated conductors at temperatures lower than 14 degrees F, unless otherwise permitted by manufacturer's instructions. When installation below this temperature is unavoidable, notify Architect and obtain direction before proceeding with work.

PART 2 PRODUCTS

2.01 CONDUCTOR AND CABLE APPLICATIONS

A. Do not use conductors and cables for applications other than as permitted by NFPA 70 and product listing.

B. Provide single conductor building wire installed in suitable raceway unless otherwise indicated, permitted, or required.

2.02 CONDUCTOR AND CABLE GENERAL REQUIREMENTS

A. Provide products that comply with requirements of NFPA 70.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.

D. Comply with NEMA WC 70.

E. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.

F. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.

G. Conductors for Grounding and Bonding: Also comply with Section 260526.

H. Conductor Material:
1. Provide copper conductors only. Aluminum conductors are not acceptable for this project. Conductor sizes indicated are based on copper.

2. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B787M unless otherwise indicated.
3. Tinned Copper Conductors: Comply with ASTM B33.

I. Minimum Conductor Size:
1. Branch Circuits: 12 AWG.
a. Exceptions:
1) 20 A, 120 V circuits longer than 75 feet: 10 AWG, for voltage drop.
2) 20 A, 120 V circuits longer than 150 feet: 8 AWG, for voltage drop.
3) 20 A, 277 V circuits longer than 150 feet: 10 AWG, for voltage drop.
2. Control Circuits: 14 AWG.

J. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

K. Conductor Color Coding:
1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.
2. Color Coding Method: Integrally colored insulation.
3. Color Code:
a. 480Y/277 V, 3 Phase, 4 Wire System:
1) Phase A: Brown.
2) Phase B: Orange.
3) Phase C: Yellow.
4) Neutral/Grounded: Gray.
b. 208Y/120 V, 3 Phase, 4 Wire System:
1) Phase A: Black.
2) Phase B: Red.
3) Phase C: Blue.
4) Neutral/Grounded: White.
c. 240/120 V, 1 Phase, 3 Wire System:
1) Phase A: Black.
2) Phase B: Red.
3) Neutral/Grounded: White.
d. Equipment Ground, All Systems: Green.
e. For control circuits, comply with manufacturer's recommended color code.

203 SINGLE CONDUCTOR BUILDING WIRE

A. Description: Single conductor insulated wire.

B. Conductor Stranding:
1. Feeders and Branch Circuits:
a. Size 10 AWG and Smaller: Solid.
b. Size 8 AWG and Larger: Stranded.

C. Insulation Voltage Rating: 600 V.

D. Insulation:
1. Copper Building Wire: Type THHN/THWN or THHN/THWN-2, except as indicated below.
a. Size 4 AWG and Larger: Type XHHW-2.
b. Installed Underground: Type XHHW-2.
c. Fixture Wiring Within Luminaires: Type TFFN/TFN for luminaires with labeled maximum temperature of 90 degrees C; Approved suitable type for luminaires with

labeled maximum temperature greater than 90 degrees C.

2.04 WIRING CONNECTORS

A. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as applicable.

B. Connectors for Grounding and Bonding: Comply with Section 260526.

C. Wiring Connectors for Splices and Taps:
   1. Copper Conductors Size 8 AWG and Smaller: Use twist-on insulated spring connectors.
   2. Copper Conductors Size 6 AWG and Larger: Use mechanical connectors or compression connectors.

D. Wiring Connectors for Terminations:
   1. Provide terminal lugs for connecting conductors to equipment furnished with terminations designed for terminal lugs.
   2. Provide compression adapters for connecting conductors to equipment furnished with mechanical lugs when only compression connectors are specified.
   3. Where over-sized conductors are larger than the equipment terminations can accommodate, provide connectors suitable for reducing to appropriate size, but not less than required for the rating of the overcurrent protective device.
   4. Provide motor pigtail connectors for connecting motor leads in order to facilitate disconnection.
   5. Copper Conductors Size 8 AWG and Larger: Use mechanical connectors or compression connectors where connectors are required.
   6. Stranded Conductors Size 10 AWG and Smaller: Use crimped terminals for connections to terminal screws.

E. Twist-on Insulated Spring Connectors: Rated 600 V, 221 degrees F for standard applications and 302 degrees F for high temperature applications; pre-filled with sealant and listed as complying with UL 486D for damp and wet locations.

F. Mechanical Connectors: Provide bolted type or set-screw type.

G. Compression Connectors: Provide circumferential type or hex type crimp configuration.

H. Crimped Terminals: Nylon-insulated, with insulation grip and terminal configuration suitable for connection to be made.

2.05 ACCESSORIES

A. Electrical Tape:
   1. Vinyl Insulating Electrical Tape: Complying with ASTM D3005 and listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; conformable for application down to 0 degrees F and suitable for continuous temperature environment up to 221 degrees F.

B. Wire Pulling Lubricant: Listed; suitable for use with the conductors or cables to be installed and suitable for use at the installation temperature.

C. Cable Ties: Material and tensile strength rating suitable for application.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that interior of building has been protected from weather.

B. Verify that work likely to damage wire and cable has been completed.

C. Verify that raceways, boxes, and equipment enclosures are installed and are properly sized to accommodate conductors and cables in accordance with NFPA 70.

D. Verify that field measurements are as indicated.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Clean raceways thoroughly to remove foreign materials before installing conductors and cables.

3.03 INSTALLATION

A. Circuiting Requirements:
   1. Unless dimensioned, circuit routing indicated is diagrammatic.
   2. When circuit destination is indicated without specific routing, determine exact routing required.
   3. Arrange circuiting to minimize splices.
   4. Include circuit lengths required to install connected devices within 10 ft of location indicated.
   5. Maintain separation of Class 1, Class 2, and Class 3 remote-control, signaling, and power-limited circuits in accordance with NFPA 70.
   6. Maintain separation of wiring for emergency systems in accordance with NFPA 70.
   7. Circuiting Adjustments: Unless otherwise indicated, when branch circuits are indicated as separate, combining them together in a single raceway is permitted, under the following conditions:
      a. Provide no more than six current-carrying conductors in a single raceway. Dedicated neutral conductors are considered current-carrying conductors.
      b. Increase size of conductors as required to account for ampacity derating.
      c. Size raceways, boxes, etc. to accommodate conductors.
   8. Common Neutrals: Unless otherwise indicated, sharing of neutral/grounded conductors among single phase branch circuits of different phases installed in the same raceway is not permitted. Provide dedicated neutral/grounded conductor for each individual branch circuit.

B. Install products in accordance with manufacturer's instructions.

C. Perform work in accordance with NECA 1 (general workmanship).

D. Installation in Raceway:
   1. Tape ends of conductors and cables to prevent infiltration of moisture and other contaminants.
   2. Pull all conductors and cables together into raceway at same time.
   3. Do not damage conductors and cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.
   4. Use suitable wire pulling lubricant where necessary, except when lubricant is not recommended by the manufacturer.

E. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.

F. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by the authority having jurisdiction. Provide independent support from building structure. Do not provide support from raceways, piping, ductwork, or other systems.

G. Install conductors with a minimum of 12 inches of slack at each outlet.

H. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.

I. Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 70.

J. Make wiring connections using specified wiring connectors.
   1. Make splices and taps only in accessible boxes. Do not pull splices into raceways or make splices in conduit bodies or wiring gutters.
   2. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors.
   3. Do not remove conductor strands to facilitate insertion into connector.
   4. Clean contact surfaces on conductors and connectors to suitable remove corrosion, oxides, and other contaminates. Do not use wire brush on plated connector surfaces.
   5. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
   6. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

K. Insulate splices and taps that are made with uninsulated connectors using methods suitable for the application, with insulation and mechanical strength at least equivalent to unspliced conductors.

L. Insulate ends of spare conductors using vinyl insulating electrical tape.

M. Identify conductors and cables in accordance with Section 260553.

N. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 078400.

O. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.

3.04 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA ATS, except Section 4.

B. Perform inspections and tests listed in NETA ATS, Section 7.3.2. The insulation resistance test is required for all conductors. The resistance test for parallel conductors listed as optional is not required.

C. Correct deficiencies and replace damaged or defective conductors and cables.

END OF SECTION

SECTION 260526
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Grounding and bonding requirements.

B. Conductors for grounding and bonding.

C. Connectors for grounding and bonding.

D. Ground rod electrodes.

1.02 RELATED REQUIREMENTS

A. Section 260519 - Low-Voltage Electrical Power Conductors and Cables: Additional requirements for conductors for grounding and bonding, including conductor color coding.

B. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

1.03 REFERENCE STANDARDS

A. IEEE 81 - IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Grounding System.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction.

C. NEMA GR 1 - Grounding Rod Electrodes and Grounding Rod Electrode Couplings.

D. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems.

E. NFPA 70 - National Electrical Code.

F. UL 467 - Grounding and Bonding Equipment.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Verify exact locations of underground metal water service pipe entrances to building.
   2. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Do not install ground rod electrodes until final backfill and compaction is complete.

1.05 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for grounding and bonding system components.

B. Field quality control test reports.

C. Project Record Documents: Record actual locations of grounding electrode system components and connections.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 GROUNDING AND BONDING REQUIREMENTS

A. Do not use products for applications other than as permitted by NFPA 70 and product listing.

B. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.

C. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

D. Grounding System Resistance:
   1. Achieve specified grounding system resistance under normally dry conditions unless otherwise approved by Architect. Precipitation within the previous 48 hours does not constitute normally dry conditions.
   2. Grounding Electrode System: Not greater than 5 ohms to ground, when tested according to IEEE 81 using "fall-of-potential" method.
   3. Between Grounding Electrode System and Major Electrical Equipment Frames, System Neutral, and Derived Neutral Points: Not greater than 0.5 ohms, when tested using "point-to-point" methods.

E. Grounding Electrode System:
   1. Provide connection to required and supplemental grounding electrodes indicated to form grounding electrode system.
      a. Provide continuous grounding electrode conductors without splice or joint.
      b. Install grounding electrode conductors in raceway where exposed to physical damage. Bond grounding electrode conductor to metallic raceways at each end with bonding jumper.
   2. Metal Underground Water Pipe(s):
      a. Provide connection to underground metal domestic and fire protection (where present) water service pipe(s) that are in direct contact with earth for at least 10 feet at an accessible location not more than 5 feet from the point of entrance to the building.
      b. Provide bonding jumper(s) around insulating joints/pipes as required to make pipe electrically continuous.
      c. Provide bonding jumper around water meter of sufficient length to permit removal of meter without disconnecting jumper.
   3. Metal In-Ground Support Structure:
      a. Provide connection to metal in-ground support structure that is in direct contact with earth in accordance with NFPA 70.
   4. Ground Rod Electrode(s):
      a. Provide three electrodes in an equilateral triangle configuration unless otherwise indicated or required.
      b. Space electrodes not less than 10 feet from each other and any other ground electrode.
      c. Where location is not indicated, locate electrode(s) at least 5 feet outside building perimeter foundation as near as possible to electrical service entrance; where possible, locate in softscape (uncovered) area.
   5. Provide additional ground electrode(s) as required to achieve specified grounding electrode system resistance.

F. Service-Supplied System Grounding:
   1. For each service disconnect, provide grounding electrode conductor to connect neutral (grounded) service conductor to grounding electrode system. Unless otherwise indicated, make connection at neutral (grounded) bus in service disconnect enclosure.
   2. For each service disconnect, provide main bonding jumper to connect neutral (grounded) bus to equipment ground bus where not factory-installed. Do not make any other

connections between neutral (grounded) conductors and ground on load side of service disconnect.

G. Grounding for Separate Building or Structure Supplied by Feeder(s) or Branch Circuits:
   1. Provide grounding electrode system for each separate building or structure.
   2. Provide equipment grounding conductor routed with supply conductors.
   3. For each disconnecting means, provide grounding electrode conductor to connect equipment ground bus to grounding electrode system.
   4. Do not make any connections and remove any factory-installed jumpers between neutral (grounded) conductors and ground.

H. Separately Derived System Grounding:
   1. Separately derived systems include, but are not limited to:
      a. Transformers (except autotransformers such as buck-boost transformers).
   2. Provide grounding electrode conductor to connect derived system grounded conductor to nearest effectively grounded metal building frame. Unless otherwise indicated, make connection at neutral (grounded) bus in source enclosure.
   3. Provide bonding jumper to connect derived system grounded conductor to nearest metal building frame and nearest metal water piping in the area served by the derived system, where not already used as a grounding electrode for the derived system. Make connection at same location as grounding electrode conductor connection.
   4. Provide system bonding jumper to connect system grounded conductor to equipment ground bus. Make connection at same location as grounding electrode conductor connection. Do not make any other connections between neutral (grounded) conductors and ground on load side of separately derived system disconnect.
   5. Where the source and first disconnecting means are in separate enclosures, provide supply-side bonding jumper between source and first disconnecting means.

I. Bonding and Equipment Grounding:
   1. Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing electrical conductors/equipment or likely to become energized as indicated and in accordance with NFPA 70.
   2. Provide insulated equipment grounding conductor in each feeder and branch circuit raceway. Do not use raceways as sole equipment grounding conductor.
   3. Where circuit conductor sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally in accordance with NFPA 70.
   4. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
   5. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) or isolated/insulated ground bus.
   6. Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.
   7. Provide bonding for interior metal piping systems in accordance with NFPA 70. This includes, but is not limited to:
      a. Metal water piping where not already effectively bonded to metal underground water pipe used as grounding electrode.
      b. Metal gas piping.
   8. Provide bonding for interior metal air ducts.

J. Communications Systems Grounding and Bonding:

1. Provide intersystem bonding termination at service equipment or metering equipment enclosure and at disconnecting means for any additional buildings or structures in accordance with NFPA 70.

2.02 GROUNDING AND BONDING COMPONENTS

A. General Requirements:
   1. Provide products listed, classified, and labeled as suitable for the purpose intended.
   2. Provide products listed and labeled as complying with UL 467 where applicable.

B. Conductors for Grounding and Bonding, in Addition to Requirements of Section 260526:
   1. Use insulated copper conductors unless otherwise indicated.
      a. Exceptions:
         1) Use bare copper conductors where installed underground in direct contact with earth.
         2) Use bare copper conductors where directly encased in concrete (not in raceway).

C. Connectors for Grounding and Bonding:
   1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.
   2. Unless otherwise indicated, use exothermic welded connections for underground, concealed and other inaccessible connections.
   3. Unless otherwise indicated, use mechanical connectors, compression connectors, or exothermic welded connections for accessible connections.

D. Ground Rod Electrodes:
   1. Comply with NEMA GR 1.
   2. Material: Copper-bonded (copper-clad) steel.
   3. Size: 3/4 inch diameter by 10 feet length, unless otherwise indicated.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that work likely to damage grounding and bonding system components has been completed.

B. Verify that field measurements are as indicated.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Ground Rod Electrodes: Unless otherwise indicated, install ground rod electrodes vertically. Where encountered rock prohibits vertical installation, install at 45 degree angle or bury horizontally in trench at least 30 inches (750 mm) deep in accordance with NFPA 70 or provide ground plates.

D. Make grounding and bonding connections using specified connectors.
   1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.
   2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.

3. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.
4. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
5. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

E. Identify grounding and bonding system components in accordance with Section 260553.

3.03 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA ATS except Section 4.

B. Perform inspections and tests listed in NETA ATS, Section 7.13.

C. Perform ground electrode resistance tests under normally dry conditions. Precipitation within the previous 48 hours does not constitute normally dry conditions.

D. Investigate and correct deficiencies where measured ground resistances do not comply with specified requirements.

END OF SECTION

SECTION 260529
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Support and attachment requirements and components for equipment, conduit, cable, boxes, and other electrical work.

1.02 RELATED REQUIREMENTS

A. Section 260533.13 - Conduit for Electrical Systems: Additional support and attachment requirements for conduits.

B. Section 260533.16 - Boxes for Electrical Systems: Additional support and attachment requirements for boxes.

C. Section 265100 - Interior Lighting: Additional support and attachment requirements for interior luminaires.

D. Section 265600 - Exterior Lighting: Additional support and attachment requirements for exterior luminaires.

1.03 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel.

D. MFMA-4 - Metal Framing Standards Publication.

E. NECA 1 - Standard for Good Workmanship in Electrical Construction.

F. NFPA 70 - National Electrical Code.

G. UL 5B - Strut-Type Channel Raceways and Fittings.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components to be installed.
   2. Coordinate the work with other trades to provide additional framing and materials required for installation.
   3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
   4. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
   5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured.

1.05 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for channel (strut) framing systems, non-penetrating rooftop supports, and post-installed concrete and

masonry anchors.

1.06 QUALITY ASSURANCE

A. Comply with NFPA 70.

B. Comply with applicable building code.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 SUPPORT AND ATTACHMENT COMPONENTS

A. General Requirements:
   1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of electrical work.
   2. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.
   3. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported with a minimum safety factor of 1.5. Include consideration for vibration, equipment operation, and shock loads where applicable.
   4. Do not use products for applications other than as permitted by NFPA 70 and product listing.
   5. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
      a. Indoor Dry Locations: Use zinc-plated steel or approved equivalent unless otherwise indicated.
      b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel, stainless steel, or approved equivalent unless otherwise indicated.
      c. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
      d. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.

B. Conduit and Cable Supports: Straps, clamps, etc. suitable for the conduit or cable to be supported.
   1. Conduit Straps: One-hole or two-hole type; steel or malleable iron.
   2. Conduit Clamps: Bolted type unless otherwise indicated.

C. Outlet Box Supports: Hangers, brackets, etc. suitable for the boxes to be supported.

D. Metal Channel (Strut) Framing Systems: Factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.
   1. Comply with MFMA-4.
   2. Channel (Strut) Used as Raceway (only where specifically indicated): Listed and labeled as complying with UL 5B.
   3. Minimum Channel Thickness: Steel sheet, 12 gage, 0.1046 inch.
   4. Minimum Channel Dimensions: 1-5/8 inch width by 13/16 inch height.

E. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.
   1. Minimum Size, Unless Otherwise Indicated or Required:
      a. Equipment Supports: 1/2 inch diameter.
      b. Single Conduit up to 1 inch (27 mm) trade size: 1/4 inch diameter.
      c. Single Conduit larger than 1 inch (27 mm) trade size: 3/8 inch diameter.

d. Trapeze Support for Multiple Conduits: 3/8 inch diameter.
e. Outlet Boxes: 1/4 inch diameter.
f. Luminaires: 1/4 inch diameter.

F. Non-Penetrating Rooftop Supports for Low-Slope Roofs: Steel pedestals with thermoplastic or rubber bases that rest on top of roofing membrane, not requiring any attachment to the roof structure and not penetrating the roofing assembly, with support fixtures as specified.
1. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
2. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports.
3. Mounting Height: Provide minimum clearance of 6 inches under supported component to top of roofing.

G. Anchors and Fasteners:
1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.
2. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.
3. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.
4. Hollow Masonry: Use toggle bolts.
5. Hollow Stud Walls: Use toggle bolts.
6. Steel: Use beam clamps, machine bolts, or welded threaded studs.
7. Sheet Metal: Use sheet metal screws.
8. Wood: Use wood screws.
9. Preset Concrete Inserts: Continuous metal channel (strut) and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
a. Comply with MFMA-4.
b. Channel Material: Use galvanized steel.
c. Manufacturer: Same as manufacturer of metal channel (strut) framing system.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive support and attachment components.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

D. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.

E. Unless specifically indicated or approved by Architect, do not provide support from roof deck.

F. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

G. Equipment Support and Attachment:
1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.

2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
4. Unless otherwise indicated, mount floor-mounted equipment on properly sized 4 inch high concrete pad.
5. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

H. Conduit Support and Attachment: Also comply with Section 260533.13.

I. Box Support and Attachment: Also comply with Section 260533.16.

J. Interior Luminaire Support and Attachment: Also comply with Section 265100.

K. Exterior Luminaire Support and Attachment: Also comply with Section 265600.

L. Preset Concrete Inserts: Use manufacturer provided closure strips to inhibit concrete seepage during concrete pour.

M. Secure fasteners according to manufacturer's recommended torque settings.

N. Remove temporary supports.

O. Identify independent electrical component support wires above accessible ceilings (only where specifically indicated or permitted) with color distinguishable from ceiling support wires in accordance with NFPA 70.

3.03 FIELD QUALITY CONTROL

A. Inspect support and attachment components for damage and defects.

B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

C. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION

SECTION 260533.13
CONDUIT FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Galvanized steel rigid metal conduit (RMC).

B. Flexible metal conduit (FMC).

C. Liquidtight flexible metal conduit (LFMC).

D. Electrical metallic tubing (EMT).

E. Rigid polyvinyl chloride (PVC) conduit.

F. Conduit fittings.

G. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 078400 - Firestopping.

B. Section 260526 - Grounding and Bonding for Electrical Systems.
   1. Includes additional requirements for fittings for grounding and bonding.

C. Section 260529 - Hangers and Supports for Electrical Systems.

D. Section 260533.16 - Boxes for Electrical Systems.

E. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

F. Section 262100 - Low-Voltage Electrical Service Entrance: Additional requirements for electrical service conduits.

1.03 REFERENCE STANDARDS

A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC).

B. ANSI C80.3 - American National Standard for Electrical Metallic Tubing -- Steel (EMT-S).

C. NECA 1 - Standard for Good Workmanship in Electrical Construction.

D. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT).

E. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC).

F. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable.

G. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit.

H. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing.

I. NFPA 70 - National Electrical Code.

J. UL 1 - Flexible Metal Conduit.

K. UL 6 - Electrical Rigid Metal Conduit-Steel.

L. UL 360 - Liquid-Tight Flexible Steel Conduit.

M. UL 514B - Conduit, Tubing, and Cable Fittings.

N. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings.

O. UL 797 - Electrical Metallic Tubing-Steel.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate minimum sizes of conduits with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
   2. Coordinate the arrangement of conduits with structural members, ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
   3. Verify exact conduit termination locations required for boxes, enclosures, and equipment installed under other sections or by others.
   4. Coordinate the work with other trades to provide roof penetrations that preserve the integrity of the roofing system and do not void the roof warranty.
   5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Do not begin installation of conductors and cables until installation of conduit is complete between outlet, junction and splicing points.

1.05 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for conduits and fittings.

B. Project Record Documents: Record actual routing for conduits installed underground.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conduit and fittings in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 CONDUIT APPLICATIONS

A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70 and product listing.

B. Unless otherwise indicated and where not otherwise restricted, use the conduit types indicated for the specified applications. Where more than one listed application applies, comply with the most restrictive requirements. Where conduit type for a particular application is not specified, use galvanized steel rigid metal conduit.

C. Underground:
   1. Under Slab on Grade: Use rigid PVC conduit.
   2. Exterior, Direct-Buried: Use rigid PVC conduit.
   3. Exterior, Embedded Within Concrete: Use rigid PVC conduit.
   4. Where rigid polyvinyl (PVC) conduit is provided, transition to galvanized steel rigid metal conduit where emerging from underground.
   5. Where rigid polyvinyl (PVC) conduit is provided, use galvanized steel rigid metal conduit elbows for bends.
   6. Where steel conduit emerges from concrete into soil, use corrosion protection tape to provide supplementary corrosion protection for a minimum of 4 inches on either side of where conduit emerges.

D. Concealed Within Masonry Walls: Use electrical metallic tubing (EMT).

E. Concealed Within Hollow Stud Walls: Use electrical metallic tubing (EMT).

F. Concealed Above Accessible Ceilings: Use electrical metallic tubing (EMT).

G. Interior, Damp or Wet Locations: Use galvanized steel rigid metal conduit.

H. Exposed, Interior, Not Subject to Physical Damage: Use electrical metallic tubing (EMT).

I. Exposed, Interior, Subject to Physical Damage: Use galvanized steel rigid metal conduit.
   1. Locations subject to physical damage include, but are not limited to:
      a. Where exposed below 8 feet, except within electrical and communication rooms or closets.

J. Exposed, Exterior: Use galvanized steel rigid metal conduit.

K. Concealed, Exterior, Not Embedded in Concrete or in Contact With Earth: Use galvanized steel rigid metal conduit.

L. Connections to Luminaires Above Accessible Ceilings: Use flexible metal conduit.
   1. Maximum Length: 6 feet.

M. Connections to Vibrating Equipment:
   1. Dry Locations: Use flexible metal conduit.
   2. Damp, Wet, or Corrosive Locations: Use liquidtight flexible metal conduit.
   3. Maximum Length: 6 feet unless otherwise indicated.
   4. Vibrating equipment includes, but is not limited to:
      a. Transformers.
      b. Motors.

202 CONDUIT REQUIREMENTS

A. Electrical Service Conduits: Also comply with Section 262100.

B. Fittings for Grounding and Bonding: Also comply with Section 260526.

C. Provide all conduit, fittings, supports, and accessories required for a complete raceway system.

D. Provide products listed, classified, and labeled as suitable for the purpose intended.

E. Minimum Conduit Size, Unless Otherwise Indicated:
   1. Branch Circuits: 3/4 inch (21 mm) trade size.
   2. Branch Circuit Homeruns: 3/4 inch (21 mm) trade size.
   3. Flexible Connections to Luminaires: 3/8 inch (12 mm) trade size.
   4. Underground, Interior: 1 inch (27 mm) trade size.
   5. Underground, Exterior: 1 inch (27 mm) trade size.

F. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

203 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

A. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.

B. Fittings:
   1. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   2. Material: Use steel or malleable iron.
   3. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

204 FLEXIBLE METAL CONDUIT (FMC)

A. Description: NFPA 70, Type FMC standard wall steel flexible metal conduit listed and labeled as complying with UL 1, and listed for use in classified firestop systems to be used.

B. Fittings:
   1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   2. Material: Use steel or malleable iron.

205 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

A. Description: NFPA 70, Type LFMC polyvinyl chloride (PVC) jacketed steel flexible metal conduit listed and labeled as complying with UL 360.

B. Fittings:
   1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   2. Material: Use steel or malleable iron.

206 ELECTRICAL METALLIC TUBING (EMT)

A. Description: NFPA 70, Type EMT steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.

B. Fittings:
   1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   2. Material: Use steel or malleable iron.
   3. Connectors and Couplings: Use compression (gland) type.
      a. Do not use indenter type connectors and couplings.

207 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT

A. Description: NFPA 70, Type PVC rigid polyvinyl chloride conduit complying with NEMA TC 2 and listed and labeled as complying with UL 651; Schedule 40 unless otherwise indicated, Schedule 80 where subject to physical damage; rated for use with conductors rated 90 degrees C.

B. Fittings:
   1. Manufacturer: Same as manufacturer of conduit to be connected.
   2. Description: Fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; material to match conduit.

208 ACCESSORIES

A. Corrosion Protection Tape: PVC-based, minimum thickness of 20 mil.

B. Conduit Joint Compound: Corrosion-resistant, electrically conductive; suitable for use with the conduit to be installed.

C. Solvent Cement for PVC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.

D. Pull Strings: Use nylon cord with average breaking strength of not less than 200 pound-force.

E. Duct Bank Spacers: Nonmetallic; designed for maintaining conduit/duct spacing for concrete encasement in open trench installation; suitable for the conduit/duct arrangement to be installed.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive conduits.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Install galvanized steel rigid metal conduit (RMC) in accordance with NECA 101.

D. Install rigid polyvinyl chloride (PVC) conduit in accordance with NECA 111.

E. Conduit Routing:
   1. Unless dimensioned, conduit routing indicated is diagrammatic.
   2. When conduit destination is indicated without specific routing, determine exact routing required.
   3. Conceal all conduits unless specifically indicated to be exposed.
   4. Conduits in the following areas may be exposed, unless otherwise indicated:
      a. Electrical rooms.
      b. Mechanical equipment rooms.
      c. Within joists in areas with no ceiling.
   5. Unless otherwise approved, do not route conduits exposed:
      a. Across floors.
      b. Across roofs.
      c. Across top of parapet walls.
      d. Across building exterior surfaces.
   6. Conduits installed underground or embedded in concrete may be routed in the shortest possible manner unless otherwise indicated. Route all other conduits parallel or perpendicular to building structure and surfaces, following surface contours where practical.
   7. Arrange conduit to maintain adequate headroom, clearances, and access.
   8. Arrange conduit to provide no more than the equivalent of four 90 degree bends between pull points.
   9. Arrange conduit to provide no more than 150 feet between pull points.
   10. Route conduits above water and drain piping where possible.
   11. Arrange conduit to prevent moisture traps. Provide drain fittings at low points and at sealing fittings where moisture may collect.
   12. Maintain minimum clearance of 6 inches between conduits and piping for other systems.
   13. Maintain minimum clearance of 12 inches between conduits and hot surfaces. This includes, but is not limited to:
      a. Heaters.
      b. Hot water piping.
      c. Flues.
   14. Group parallel conduits in the same area together on a common rack.

F. Conduit Support:
   1. Secure and support conduits in accordance with NFPA 70 and Section 260529 using suitable supports and methods approved by the authority having jurisdiction.

2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
3. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conduits to lay on ceiling tiles.
4. Use conduit strap to support single surface-mounted conduit.
    a. Use clamp back spacer with conduit strap for damp and wet locations to provide space between conduit and mounting surface.
5. Use metal channel (strut) with accessory conduit clamps to support multiple parallel surface-mounted conduits.
6. Use conduit clamp to support single conduit from beam clamp or threaded rod.
7. Use trapeze hangers assembled from threaded rods and metal channel (strut) with accessory conduit clamps to support multiple parallel suspended conduits.
8. Use non-penetrating rooftop supports to support conduits routed across rooftops (only where approved).

G. Connections and Terminations:
1. Use approved zinc-rich paint or conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.
2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.
3. Use suitable adapters where required to transition from one type of conduit to another.
4. Provide drip loops for liquidtight flexible conduit connections to prevent drainage of liquid into connectors.
5. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.
6. Provide insulating bushings or insulated throats at all conduit terminations to protect conductors.
7. Secure joints and connections to provide maximum mechanical strength and electrical continuity.

H. Penetrations:
1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
2. Make penetrations perpendicular to surfaces unless otherwise indicated.
3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.
4. Conceal bends for conduit risers emerging above ground.
5. Seal interior of conduits entering the building from underground at first accessible point to prevent entry of moisture and gases.
6. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
7. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty. Include proposed locations of penetrations and methods for sealing with submittals.
8. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 078400.

I. Underground Installation:
1. Provide trenching and backfilling in accordance with Division 31.
2. Minimum Cover, Unless Otherwise Indicated or Required:

a. Underground, Exterior: 24 inches.

3. Provide underground warning tape in accordance with Section 260553 along entire conduit length.

J. Concrete Encasement: Where conduits not otherwise embedded within concrete are indicated to be concrete-encased, provide concrete with minimum concrete cover of 3 inches on all sides unless otherwise indicated.

K. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:
1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
2. Where calculated in accordance with NFPA 70 for rigid polyvinyl chloride (PVC) conduit installed above ground to compensate for thermal expansion and contraction.
3. Where conduits are subject to earth movement by settlement or frost.

L. Condensation Prevention: Where conduits cross barriers between areas of potential substantial temperature differential, provide sealing fitting or approved sealing compound at an accessible point near the penetration to prevent condensation. This includes, but is not limited to:
1. Where conduits pass from outdoors into conditioned interior spaces.
2. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.

M. Provide pull string in all empty conduits and in conduits where conductors and cables are to be installed by others. Leave minimum slack of 12 inches at each end.

N. Provide grounding and bonding in accordance with Section 260526.

O. Identify conduits in accordance with Section 260553.

3.03 FIELD QUALITY CONTROL

A. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

B. Correct deficiencies and replace damaged or defective conduits.

3.04 CLEANING

A. Clean interior of conduits to remove moisture and foreign matter.

3.05 PROTECTION

A. Immediately after installation of conduit, use suitable manufactured plugs to provide protection from entry of moisture and foreign material and do not remove until ready for installation of conductors.

END OF SECTION

SECTION 260533.16
BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Outlet and device boxes up to 100 cubic inches, including those used as junction and pull boxes.

B. Cabinets and enclosures, including junction and pull boxes larger than 100 cubic inches.

C. Floor boxes.

D. Underground boxes/enclosures.

1.02 RELATED REQUIREMENTS

A. Section 078400 - Firestopping.

B. Section 083100 - Access Doors and Panels: Panels for maintaining access to concealed boxes.

C. Section 260526 - Grounding and Bonding for Electrical Systems.

D. Section 260529 - Hangers and Supports for Electrical Systems.

E. Section 260533.13 - Conduit for Electrical Systems:
   1. Conduit bodies and other fittings.
   2. Additional requirements for locating boxes to limit conduit length and/or number of bends between pulling points.

F. Section 260533.23 - Surface Raceways for Electrical Systems:

G. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

H. Section 262726 - Wiring Devices:
   1. Wall plates.
   2. Floor box service fittings.
   3. Poke-through assemblies.
   4. Additional requirements for locating boxes for wiring devices.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction.

B. NECA 130 - Standard for Installing and Maintaining Wiring Devices.

C. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable.

D. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports.

E. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

F. NFPA 70 - National Electrical Code.

G. SCTE 77 - Specification for Underground Enclosure Integrity.

H. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations.

I. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations.

J. UL 508A - UL Standard for Safety Industrial Control Panels .

K. UL 514A - Metallic Outlet Boxes.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
   2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   3. Coordinate minimum sizes of boxes with the actual installed arrangement of conductors, clamps, support fittings, and devices, calculated according to NFPA 70.
   4. Coordinate minimum sizes of pull boxes with the actual installed arrangement of connected conduits, calculated according to NFPA 70.
   5. Coordinate the placement of boxes with millwork, furniture, devices, equipment, etc. installed under other sections or by others.
   6. Coordinate the work with other trades to preserve insulation integrity.
   7. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted boxes where indicated.
   8. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for cabinets and enclosures, floor boxes, and underground boxes/enclosures.
   1. Underground Boxes/Enclosures: Include reports for load testing in accordance with SCTE 77 certified by an independent testing agency upon request.

B. Project Record Documents: Record actual locations for outlet and device boxes, pull boxes, cabinets and enclosures, floor boxes, and underground boxes/enclosures.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 BOXES

A. General Requirements:
   1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.
   2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.
   3. Provide products listed, classified, and labeled as suitable for the purpose intended.
   4. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
   5. Provide grounding terminals within boxes where equipment grounding conductors terminate.

B. Outlet and Device Boxes Up to 100 cubic inches, Including Those Used as Junction and Pull Boxes:
   1. Use sheet-steel boxes for dry locations unless otherwise indicated or required.
   2. Use cast iron boxes or cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.

3. Use suitable concrete type boxes where flush-mounted in concrete.
4. Use suitable masonry type boxes where flush-mounted in masonry walls.
5. Use raised covers suitable for the type of wall construction and device configuration where required.
6. Use shallow boxes where required by the type of wall construction.
7. Do not use "through-wall" boxes designed for access from both sides of wall.
8. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.
9. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.
10. Boxes for Supporting Luminaires and Ceiling Fans: Listed as suitable for the type and weight of load to be supported; furnished with fixture stud to accommodate mounting of luminaire where required.
11. Boxes for Ganged Devices: Use multigang boxes of single-piece construction. Do not use field-connected gangable boxes unless specifically indicated or permitted.
12. Minimum Box Size, Unless Otherwise Indicated:
    a. Wiring Devices (Other Than Communications Systems Outlets): 4 inch square by 1-1/2 inch deep (100 by 38 mm) trade size.
13. Wall Plates: Comply with Section 262726.

C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches:
1. Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E, or UL 508A.
2. NEMA 250 Environment Type, Unless Otherwise Indicated:
    a. Indoor Clean, Dry Locations: Type 1, painted steel.
    b. Outdoor Locations: Type 3R, painted steel.
3. Junction and Pull Boxes Larger Than 100 cubic inches:
    a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.

D. Floor Boxes:
1. Description: Floor boxes compatible with floor box service fittings provided in accordance with Section 262726; with partitions to separate multiple services; furnished with all components, adapters, and trims required for complete installation.
2. Use cast iron floor boxes within slab on grade.
3. Use sheet-steel floor boxes within slab above grade.
4. Metallic Floor Boxes: Fully adjustable (with integral means for leveling adjustment prior to and after concrete pour).
5. Manufacturer: Same as manufacturer of floor box service fittings.

E. Underground Boxes/Enclosures:
1. Description: In-ground, open bottom boxes furnished with flush, non-skid covers with legend indicating type of service and stainless steel tamper resistant cover bolts.
2. Size: As indicated on drawings.
3. Depth: As required to extend below frost line to prevent frost upheaval, but not less than 12 inches.
4. Provide logo on cover to indicate type of service.
5. Applications:
    a. Sidewalks and Landscaped Areas Subject Only to Occasional Nondeliberate Vehicular Traffic: Use polymer concrete enclosures, with minimum SCTE 77 Tier 8 load rating.
    b. Parking Lots, in Areas Subject Only To Occasional Nondeliberate Vehicular Traffic: Use polymer concrete enclosures, with minimum SCTE 77 Tier 15 load rating.

c. Do not use polymer concrete enclosures in areas subject to deliberate vehicular traffic.

6. Polymer Concrete Underground Boxes/Enclosures: Comply with SCTE 77.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive boxes.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install boxes in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards where mounting heights are not indicated.

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide separate boxes for emergency power and normal power systems.

E. Unless otherwise indicated, provide separate boxes for line voltage and low voltage systems.

F. Flush-mount boxes in finished areas unless specifically indicated to be surface-mounted.

G. Unless otherwise indicated, boxes may be surface-mounted where exposed conduits are indicated or permitted.

H. Box Locations:

1. Locate boxes to be accessible. Provide access panels in accordance with Section 083100 as required where approved by the Architect.
2. Unless dimensioned, box locations indicated are approximate.
3. Locate boxes as required for devices installed under other sections or by others.
   a. Switches, Receptacles, and Other Wiring Devices: Comply with Section 262726.
4. Locate boxes so that wall plates do not span different building finishes.
5. Locate boxes so that wall plates do not cross masonry joints.
6. Unless otherwise indicated, where multiple outlet boxes are installed at the same location at different mounting heights, install along a common vertical center line.
7. Do not install flush-mounted boxes on opposite sides of walls back-to-back. Provide minimum 6 inches horizontal separation unless otherwise indicated.
8. Fire Resistance Rated Walls: Install flush-mounted boxes such that the required fire resistance will not be reduced.
   a. Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches separation where wall is constructed with individual noncommunicating stud cavities or protect both boxes with listed putty pads.
   b. Do not install flush-mounted boxes with area larger than 16 square inches or such that the total aggregate area of openings exceeds 100 square inches for any 100 square feet of wall area.
9. Locate junction and pull boxes as indicated, as required to facilitate installation of conductors, and to limit conduit length and/or number of bends between pulling points in accordance with Section 260533.13.

I. Box Supports:

1. Secure and support boxes in accordance with NFPA 70 and Section 260529 using suitable supports and methods approved by the authority having jurisdiction.
2. Provide independent support from building structure except for cast metal boxes (other than boxes used for fixture support) supported by threaded conduit connections in accordance with NFPA 70. Do not provide support from piping, ductwork, or other systems.
3. Installation Above Suspended Ceilings: Do not provide support from ceiling grid or ceiling support system.

J. Install boxes plumb and level.

K. Flush-Mounted Boxes:
1. Install boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that front edge of box or associated raised cover is not set back from finished surface more than 1/4 inch or does not project beyond finished surface.
2. Install boxes in combustible materials such as wood so that front edge of box or associated raised cover is flush with finished surface.
3. Repair rough openings around boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that there are no gaps or open spaces greater than 1/8 inch at the edge of the box.

L. Install boxes as required to preserve insulation integrity.

M. Metallic Floor Boxes: Install box level at the proper elevation to be flush with finished floor.

N. Underground Boxes/Enclosures:
1. Install enclosure on gravel base, minimum 6 inches deep.
2. Flush-mount enclosures located in concrete or paved areas.
3. Mount enclosures located in landscaped areas with top at 1 inch above finished grade.
4. Install additional bracing inside enclosures in accordance with manufacturer's instructions to minimize box sidewall deflections during backfilling. Backfill with cover bolted in place.

O. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

P. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 078400.

Q. Close unused box openings.

R. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.

S. Provide grounding and bonding in accordance with Section 260526.

T. Identify boxes in accordance with Section 260553.

3.03 CLEANING

A. Clean interior of boxes to remove dirt, debris, plaster and other foreign material.

3.04 PROTECTION

A. Immediately after installation, protect boxes from entry of moisture and foreign material until ready for installation of conductors.

END OF SECTION

SECTION 260533.23
SURFACE RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface raceway systems.

B. Wireways.

1.02 RELATED REQUIREMENTS

A. Section 260526 - Grounding and Bonding for Electrical Systems.

B. Section 260529 - Hangers and Supports for Electrical Systems.

C. Section 260533.13 - Conduit for Electrical Systems.

D. Section 260533.16 - Boxes for Electrical Systems.

E. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

F. Section 262726 - Wiring Devices: Receptacles.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction.

B. NFPA 70 - National Electrical Code.

C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

D. UL 5 - Surface Metal Raceways and Fittings.

E. UL 111 - Outline of Investigation for Multioutlet Assemblies.

F. UL 870 - Wireways, Auxiliary Gutters, and Associated Fittings.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the placement of raceways with millwork, furniture, equipment, etc. installed under other sections or by others.
   2. Coordinate rough-in locations of outlet boxes provided under Section 260533.16 and conduit provided under Section 260533.13 as required for installation of raceways provided under this section.
   3. Verify minimum sizes of raceways with the actual conductors and components to be installed.
   4. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Do not install raceways until final surface finishes and painting are complete.
   2. Do not begin installation of conductors and cables until installation of raceways is complete between outlet, junction and splicing points.

1.05 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets including dimensions, knockout sizes and locations, materials, fabrication details, finishes, service condition requirements, and accessories.
   1. Surface Raceway Systems: Include information on fill capacities for conductors and cables.

B. Shop Drawings:

1. Wireways: Provide dimensioned plan and elevation views including adjacent equipment with all required clearances indicated.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 RACEWAY REQUIREMENTS

A. Provide all components, fittings, supports, and accessories required for a complete raceway system.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Do not use raceways for applications other than as permitted by NFPA 70 and product listing.

2.02 SURFACE RACEWAY SYSTEMS

A. Surface Metal Raceways: Listed and labeled as complying with UL 5.

B. Multioutlet Assemblies: Listed and labeled as complying with UL 111.

C. Surface Raceway System:
   1. Raceway Type: Single channel, painted steel.
   2. Length: As indicated on the drawings.
   3. Color: To be selected by Architect.
   4. Accessory Device Boxes: Suitable for the devices to be installed; color to match raceway.
   5. Integrated Device Provisions:
      a. Receptacles:
         1) Comply with Section 262726.
         2) Configuration: As indicated on the drawings.
         3) Spacing: As indicated on the drawings.
      b. Communications Outlets:
         1) Voice and Data Jacks: As specified in Division 27.

2.03 WIREWAYS

A. Description: Lay-in wireways and wiring troughs with removable covers; listed and labeled as complying with UL 870.

B. Wireway Type, Unless Otherwise Indicated:
   1. Indoor Clean, Dry Locations: NEMA 250, Type 1, painted steel with screw-cover.
   2. Outdoor Locations: NEMA 250, Type 3R, painted steel with screw-cover; include provision for padlocking.

C. Finish for Painted Steel Wireways: Manufacturer's standard grey unless otherwise indicated.

D. Where wireway size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes and conduit terminations are installed in proper locations and are properly sized in accordance with NFPA 70 to accommodate raceways.

C. Verify that mounting surfaces are ready to receive raceways and that final surface finishes are complete, including painting.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Install raceways plumb and level.

D. Arrange wireways and associated raceway connections to comply with NFPA 70, including but not limited to requirements for deflected conductors and wireways used as pullboxes. Increase size of wireway where necessary.

E. Secure and support raceways in accordance with Section 260529 at intervals complying with NFPA 70 and manufacturer's requirements.

F. Close unused raceway openings.

G. Provide grounding and bonding in accordance with Section 260526.

H. Identify raceways in accordance with Section 260553.

3.03 FIELD QUALITY CONTROL

A. Inspect raceways for damage and defects.

B. Surface Raceway Systems with Integrated Devices: Test each wiring device to verify operation and proper polarity.

C. Correct wiring deficiencies and replace damaged or defective raceways.

3.04 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.05 PROTECTION

A. Protect installed raceways from subsequent construction operations.

END OF SECTION

SECTION 260553
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electrical identification requirements.

B. Identification nameplates and labels.

C. Wire and cable markers.

D. Underground warning tape.

E. Warning signs and labels.

1.02 RELATED REQUIREMENTS

A. Section 260519 - Low-Voltage Electrical Power Conductors and Cables: Color coding for power conductors and cables 600 V and less; vinyl color coding electrical tape.

B. Section 260573 - Power System Studies: Arc flash hazard warning labels.

1.03 REFERENCE STANDARDS

A. ANSI Z535.2 - American National Standard for Environmental and Facility Safety Signs.

B. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels.

C. NFPA 70 - National Electrical Code.

D. UL 969 - Marking and Labeling Systems.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Verify final designations for equipment, systems, and components to be identified prior to fabrication of identification products.

B. Sequencing:

1. Do not conceal items to be identified, in locations such as above suspended ceilings, until identification products have been installed.
2. Do not install identification products until final surface finishes and painting are complete.

1.05 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.

B. Shop Drawings: Provide schedule of items to be identified indicating proposed designations, materials, legends, and formats.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

1.07 FIELD CONDITIONS

A. Do not install adhesive products when ambient temperature is lower than recommended by manufacturer.

PART 2 PRODUCTS

2.01 IDENTIFICATION REQUIREMENTS

A. Identification for Equipment:

1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.
    a. Switchboards:
        1) Identify ampere rating.
        2) Identify voltage and phase.
        3) Identify power source and circuit number. Include location when not within sight of equipment.
        4) Use identification nameplate to identify main overcurrent protective device.
        5) Use identification nameplate to identify load(s) served for each branch device. Identify spares and spaces.
    b. Panelboards:
        1) Identify ampere rating.
        2) Identify voltage and phase.
        3) Identify power source and circuit number. Include location when not within sight of equipment.
        4) Identify main overcurrent protective device. Use identification label for panelboards with a door. For power distribution panelboards without a door, use identification nameplate.
        5) Use typewritten circuit directory to identify load(s) served for panelboards with a door. Identify spares and spaces using pencil.
        6) For power panelboards without a door, use identification nameplate to identify load(s) served for each branch device. Identify spares and spaces.
    c. Transformers:
        1) Identify kVA rating.
        2) Identify voltage and phase for primary and secondary.
        3) Identify power source and circuit number. Include location when not within sight of equipment.
        4) Identify load(s) served. Include location when not within sight of equipment.
    d. Enclosed switches and motor controllers:
        1) Identify voltage and phase.
        2) Identify power source and circuit number. Include location when not within sight of equipment.
        3) Identify load(s) served. Include location when not within sight of equipment.
2. Service Equipment:
    a. Use identification nameplate to identify each service disconnecting means.
3. Emergency System Equipment:
    a. Use identification nameplate to identify emergency system equipment in accordance with NFPA 70.
4. Use identification label or handwritten text using indelible marker on inside of door at each fused switch to identify required NEMA fuse class and size.
5. Use identification label or handwritten text using indelible marker on inside of door at each motor controller to identify nameplate horsepower, full load amperes, code letter, service factor, voltage, and phase of motor(s) controlled.
6. Use identification label to identify overcurrent protective devices for branch circuits serving fire alarm circuits. Identify with text "FIRE ALARM CIRCUIT".
7. Available Fault Current Documentation: Use identification label to identify the available fault current and date calculations were performed at locations requiring documentation by NFPA 70 including but not limited to the following.
    a. Service equipment.
8. Arc Flash Hazard Warning Labels: Comply with Section 260573.

B. Identification for Conductors and Cables:
   1. Color Coding for Power Conductors 600 V and Less: Comply with Section 260519.
   2. Use identification nameplate or identification label to identify color code for ungrounded and grounded power conductors inside door or enclosure at each piece of feeder or branch-circuit distribution equipment when premises has feeders or branch circuits served by more than one nominal voltage system.
   3. Use wire and cable markers to identify circuit number or other designation indicated for power, control, and instrumentation conductors and cables at the following locations:
      a. At each source and load connection.
      b. Within boxes when more than one circuit is present.
      c. Within equipment enclosures when conductors and cables enter or leave the enclosure.
   4. Use wire and cable markers to identify connected grounding electrode system components for grounding electrode conductors.

C. Identification for Raceways:
   1. Use identification labels, handwritten text using indelible marker, or plastic marker tags to identify circuits enclosed for accessible conduits at wall penetrations, at floor penetrations, at roof penetrations, and at equipment terminations when source is not within sight.
   2. Use identification labels, handwritten text using indelible marker, or plastic marker tags to identify spare conduits at each end. Identify purpose and termination location.
   3. Use underground warning tape to identify underground raceways.

D. Identification for Boxes:
   1. Use identification labels or handwritten text using indelible marker to identify circuits enclosed.
      a. For exposed boxes in public areas, use only identification labels.

E. Identification for Devices:
   1. Wiring Device and Wallplate Finishes: Comply with Section 262726.
   2. Use identification label to identify serving branch circuit for all receptacles.
   3. Use identification label or engraved wallplate to identify load controlled for wall-mounted control devices controlling loads that are not visible from the control location and for multiple wall-mounted control devices installed at one location.

F. Identification for Luminaires:
   1. Use permanent red dot on luminaire frame to identify luminaires connected to emergency power system.

2.02 IDENTIFICATION NAMEPLATES AND LABELS

A. Identification Nameplates:
   1. Materials:
      a. Indoor Clean, Dry Locations: Use plastic nameplates.
      b. Outdoor Locations: Use plastic, stainless steel, or aluminum nameplates suitable for exterior use.
   2. Plastic Nameplates: Two-layer or three-layer laminated acrylic or electrically non-conductive phenolic with beveled edges; minimum thickness of 1/16 inch; engraved text.
   3. Stainless Steel Nameplates: Minimum thickness of 1/32 inch; engraved or laser-etched text.
   4. Aluminum Nameplates: Anodized; minimum thickness of 1/32 inch; engraved or laser-etched text.
   5. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch high; Four, located at corners for larger sizes.

B. Identification Labels:
   1. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.
      a. Use only for indoor locations.
   2. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.

C. Format for Equipment Identification:
   1. Minimum Size: 1 inch by 2.5 inches.
   2. Legend:
      a. Equipment designation or other approved description.
   3. Text: All capitalized unless otherwise indicated.
   4. Minimum Text Height:
      a. Equipment Designation: 1/2 inch.
      b. Other Information: 1/4 inch.
   5. Color:
      a. Normal Power System: White text on black background.
      b. Emergency Power System: White text on red background.

D. Format for General Information and Operating Instructions:
   1. Minimum Size: 1 inch by 2.5 inches.
   2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.
   3. Text: All capitalized unless otherwise indicated.
   4. Minimum Text Height: 1/4 inch.
   5. Color: Black text on white background unless otherwise indicated.

E. Format for Caution and Warning Messages:
   1. Minimum Size: 2 inches by 4 inches.
   2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.
   3. Text: All capitalized unless otherwise indicated.
   4. Minimum Text Height: 1/2 inch.
   5. Color: Black text on yellow background unless otherwise indicated.

F. Format for Receptacle Identification:
   1. Minimum Size: 3/8 inch by 1.5 inches.
   2. Legend: Power source and circuit number or other designation indicated.
   3. Text: All capitalized unless otherwise indicated.
   4. Minimum Text Height: 3/16 inch.
   5. Color: Black text on clear background.

G. Format for Control Device Identification:
   1. Minimum Size: 3/8 inch by 1.5 inches.
   2. Legend: Load controlled or other designation indicated.
   3. Text: All capitalized unless otherwise indicated.
   4. Minimum Text Height: 3/16 inch.
   5. Color: Black text on clear background.

H. Format for Fire Alarm Device Identification:
   1. Minimum Size: 3/8 inch by 1.5 inches.
   2. Legend: Designation indicated and device zone or address.
   3. Text: All capitalized unless otherwise indicated.

4. Minimum Text Height: 3/16 inch.
5. Color: Red text on white background.

2.03 WIRE AND CABLE MARKERS

A. Markers for Conductors and Cables: Use wrap-around self-adhesive vinyl cloth, wrap-around self-adhesive vinyl self-laminating, heat-shrink sleeve, plastic sleeve, plastic clip-on, or vinyl split sleeve type markers suitable for the conductor or cable to be identified.

B. Markers for Conductor and Cable Bundles: Use plastic marker tags secured by nylon cable ties.

C. Legend: Power source and circuit number or other designation indicated.

D. Text: Use factory pre-printed or machine-printed text, all capitalized unless otherwise indicated.

E. Minimum Text Height: 1/8 inch.

F. Color: Black text on white background unless otherwise indicated.

2.04 UNDERGROUND WARNING TAPE

A. Materials: Use foil-backed detectable type polyethylene tape suitable for direct burial, unless otherwise indicated.

B. Foil-backed Detectable Type Tape: 6 inches wide, with minimum thickness of 5 mil, unless otherwise required for proper detection.

C. Legend: Type of service, continuously repeated over full length of tape.

D. Color:
1. Tape for Buried Power Lines: Black text on red background.
2. Tape for Buried Communication, Alarm, and Signal Lines: Black text on orange background.

2.05 WARNING SIGNS AND LABELS

A. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.

B. Warning Signs:
1. Materials:
   a. Indoor Dry, Clean Locations: Use factory pre-printed rigid plastic or self-adhesive vinyl signs.
   b. Outdoor Locations: Use factory pre-printed rigid aluminum signs.
2. Rigid Signs: Provide four mounting holes at corners for mechanical fasteners.
3. Minimum Size: 7 by 10 inches unless otherwise indicated.

C. Warning Labels:
1. Materials: Use factory pre-printed or machine-printed self-adhesive polyester or self-adhesive vinyl labels; UV, chemical, water, heat, and abrasion resistant; produced using materials recognized to UL 969.
2. Machine-Printed Labels: Use thermal transfer process printing machines and accessories recommended by label manufacturer.
3. Minimum Size: 2 by 4 inches unless otherwise indicated.

PART 3 EXECUTION

3.01 PREPARATION

A. Clean surfaces to receive adhesive products according to manufacturer's instructions.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Unless otherwise indicated, locate products as follows:
   1. Surface-Mounted Equipment: Enclosure front.
   2. Flush-Mounted Equipment: Inside of equipment door.
   3. Free-Standing Equipment: Enclosure front; also enclosure rear for equipment with rear access.
   4. Elevated Equipment: Legible from the floor or working platform.
   5. Branch Devices: Adjacent to device.
   6. Interior Components: Legible from the point of access.
   7. Conduits: Legible from the floor.
   8. Boxes: Outside face of cover.
   9. Conductors and Cables: Legible from the point of access.
   10. Devices: Outside face of cover.

C. Install identification products centered, level, and parallel with lines of item being identified.

D. Secure nameplates to exterior surfaces of enclosures using stainless steel screws and to interior surfaces using self-adhesive backing or epoxy cement.

E. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.

F. Install underground warning tape above buried lines with one tape per trench at 3 inches below finished grade.

G. Secure rigid signs using stainless steel screws.

H. Mark all handwritten text, where permitted, to be neat and legible.

3.03 FIELD QUALITY CONTROL

A. Replace self-adhesive labels and markers that exhibit bubbles, wrinkles, curling or other signs of improper adhesion.

END OF SECTION

SECTION 260573
POWER SYSTEM STUDIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Short-circuit study.

B. Protective device coordination study.

C. Arc flash and shock risk assessment.
   1. Includes arc flash hazard warning labels.

D. Criteria for the selection and adjustment of equipment and associated protective devices not specified in this section, as determined by studies to be performed.

1.02 RELATED REQUIREMENTS

A. Section 260553 - Identification for Electrical Systems: Additional requirements for arc flash hazard warning labels.

B. Section 262100 - Low-Voltage Electrical Service Entrance.

C. Section 262413 - Switchboards.

D. Section 262416 - Panelboards.

E. Section 262813 - Fuses.

F. Section 262816.16 - Enclosed Switches.

G. Section 262913 - Enclosed Controllers.

1.03 REFERENCE STANDARDS

A. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels.

B. IEEE 141 - IEEE Recommended Practice for Electrical Power Distribution for Industrial Plants.

C. IEEE 242 - IEEE Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems.

D. IEEE 399 - IEEE Recommended Practice for Industrial and Commercial Power Systems Analysis.

E. IEEE 551 - IEEE Recommended Practice for Calculating Short-Circuit Currents in Industrial and Commercial Power Systems.

F. IEEE 1584 - IEEE Guide for Performing Arc Flash Hazard Calculations.

G. NEMA MG 1 - Motors and Generators.

H. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems.

I. NFPA 70 - National Electrical Code.

J. NFPA 70E - Standard for Electrical Safety in the Workplace.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Existing Installations: Coordinate with equipment manufacturer(s) to obtain data necessary for completion of studies.
   2. Coordinate the work to provide equipment and associated protective devices complying with criteria for selection and adjustment, as determined by studies to be performed.
   3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Submit study reports prior to or concurrent with product submittals.
   2. Do not order equipment until matching study reports and product submittals have both been evaluated by Architect.

1.05 SUBMITTALS

A. Study preparer's qualifications.

B. Field testing agency's qualifications.

C. Study reports, stamped or sealed and signed by study preparer.

D. Product Data: In addition to submittal requirements specified in other sections, include manufacturer's standard catalog pages and data sheets for equipment and protective devices indicating information relevant to studies.
   1. Include characteristic time-current trip curves for protective devices.
   2. Identify modifications made in accordance with studies.

E. Arc Flash Hazard Warning Label Samples: One of each type and legend specified.

F. Site-specific arc flash hazard warning labels.

G. Field quality control reports.

H. Certification that field adjustable protective devices have been set in accordance with requirements of studies.

I. Project Record Documents: Revise studies as required to reflect as-built conditions.
   1. Include hard copies with operation and maintenance data submittals.
   2. Include computer software files used to prepare studies with file name(s) cross-referenced to specific pieces of equipment and systems.

1.06 POWER SYSTEM STUDIES

A. Scope of Studies:
   1. Perform analysis of both new and directly affected existing portions of electrical distribution system as indicated on drawings.
   2. Except where study descriptions below indicate exclusions, analyze system at each bus from primary protective devices of utility source down to each piece of equipment involved, including parts of system affecting calculations being performed (e.g. fault current contribution from motors).
   3. Include in analysis alternate sources and operating modes (including known future configurations) to determine worst case conditions.

B. General Study Requirements:
   1. Comply with NFPA 70.
   2. Perform studies utilizing computer software complying with specified requirements; manual calculations are not permitted.

C. Data Collection:
   1. Compile information on project-specific characteristics of actual installed equipment, protective devices, feeders, etc. as necessary to develop single-line diagram of electrical distribution system and associated input data for use in system modeling.
      a. Utility Source Data: Include primary voltage, maximum and minimum three-phase and line-to-ground fault currents, impedance, X/R ratio, and primary protective device information.
         1) Obtain up-to-date information from Utility Company.
         2) Utility Company: As indicated on drawings.

b. Generators: Include manufacturer/model, kW and voltage ratings, and impedance.
c. Motors: Include manufacturer/model, type (e.g. induction, synchronous), horsepower rating, voltage rating, full load amps, and locked rotor current or NEMA MG 1 code letter designation.
d. Transformers: Include primary and secondary voltage ratings, kVA rating, winding configuration, percent impedance, and X/R ratio.
e. Protective Devices:
1) Circuit Breakers: Include manufacturer/model, type (e.g. thermal magnetic, electronic trip), frame size, trip rating, voltage rating, interrupting rating, available field-adjustable trip response settings, and features (e.g. zone selective interlocking).
2) Fuses: Include manufacturer/model, type/class (e.g. Class J), size/rating, and speed (e.g. time delay, fast acting).
f. Protective Relays: Include manufacturer/model, type, settings, current/potential transformer ratio, and associated protective device.
g. Conductors: Include feeder size, material (e.g. copper, aluminum), insulation type, voltage rating, number per phase, raceway type, and actual length.

2. Existing Installations:
a. Collect data on existing electrical distribution system necessary for completion of studies, including field verification of available existing data (e.g. construction documents, previous studies). Include actual settings for field-adjustable devices.

D. Short-Circuit Study:
1. Comply with IEEE 551 and applicable portions of IEEE 141, IEEE 242, and IEEE 399.
2. For purposes of determining equipment short circuit current ratings, consider conditions that may result in maximum available fault current, including but not limited to:
a. Maximum utility fault currents.
b. Maximum motor contribution.
c. Known operating modes (e.g. utility as source, generator as source, utility/generator in parallel, bus tie breaker open/close positions).
3. For each bus location, calculate the maximum available three-phase bolted symmetrical and asymmetrical fault currents. For grounded systems, also calculate the maximum available line-to-ground bolted fault currents.

E. Protective Device Coordination Study:
1. Comply with applicable portions of IEEE 242 and IEEE 399.
2. Analyze alternate scenarios considering known operating modes (e.g. utility as source, generator as source, utility/generator in parallel, bus tie breaker open/close positions).
3. Analyze protective devices and associated settings for suitable margins between time-current curves to achieve full selective coordination while providing adequate protection for equipment and conductors.

F. Arc Flash and Shock Risk Assessment:
1. Comply with NFPA 70E.
2. Perform incident energy and arc flash boundary calculations in accordance with IEEE 1584 (as referenced in NFPA 70E Annex D), where applicable.
a. To clarify IEEE 1584 statement that "equipment below 240 V need not be considered unless it involves at least one 125 kVA or larger low-impedance transformer in its immediate power supply" for purposes of studies, study preparer to include equipment rated less than 240 V fed by transformers less than 125 kVA in calculations.

b. For single-phase systems, study preparer to perform calculations assuming three-phase system in accordance with IEEE 1584 yielding conservative results.

3. Analyze alternate scenarios considering conditions that may result in maximum incident energy, including but not limited to:
   a. Maximum and minimum utility fault currents.
   b. Maximum and minimum motor contribution.
   c. Known operating modes (e.g. utility as source, generator as source, utility/generator in parallel, bus tie breaker open/close positions).

G. Study Reports:
1. General Requirements:
   a. Identify date of study and study preparer.
   b. Identify study methodology and software product(s) used.
   c. Identify scope of studies, assumptions made, implications of possible alternate scenarios, and any exclusions from studies.
   d. Identify base used for per unit values.
   e. Include single-line diagram and associated input data used for studies; identify buses on single-line diagram as referenced in reports, and indicate bus voltage.
   f. Include conclusions and recommendations.
2. Short-Circuit Study:
   a. For each scenario, identify at each bus location:
      1) Calculated maximum available symmetrical and asymmetrical fault currents (both three-phase and line-to-ground where applicable).
      2) Fault point X/R ratio.
      3) Associated equipment short circuit current ratings.
   b. Identify locations where the available fault current exceeds the equipment short circuit current rating, along with recommendations.
3. Protective Device Coordination Study:
   a. For each scenario, include time-current coordination curves plotted on log-log scale graphs.
   b. For each graph include (where applicable):
      1) Partial single-line diagram identifying the portion of the system illustrated.
      2) Protective Devices: Time-current curves with applicable tolerance bands for each protective device in series back to the source, plotted up to the maximum available fault current at the associated bus.
      3) Conductors: Damage curves.
      4) Transformers: Inrush points and damage curves.
      5) Generators: Full load current, overload curves, decrement curves, and short circuit withstand points.
      6) Motors: Full load current, starting curves, and damage curves.
      7) Capacitors: Full load current and damage curves.
   c. For each protective device, identify fixed and adjustable characteristics with available ranges and recommended settings.
      1) Circuit Breakers: Include long time pickup and delay, short time pickup and delay, and instantaneous pickup.
      2) Include ground fault pickup and delay.
      3) Include fuse ratings.
      4) Protective Relays: Include current/potential transformer ratios, tap, time dial, and instantaneous pickup.

d. Identify cases where either full selective coordination or adequate protection is not achieved, along with recommendations.

4. Arc Flash and Shock Risk Assessment:
   a. For each scenario, identify at each bus location:
      1) Calculated incident energy and associated working distance.
      2) Calculated arc flash boundary.
      3) Bolted fault current.
      4) Arcing fault current.
      5) Clearing time.
      6) Arc gap distance.
   b. For purposes of producing arc flash hazard warning labels, summarize the maximum incident energy and associated data reflecting the worst case condition of all scenarios at each bus location.
   c. Identify locations where the calculated maximum incident energy exceeds 40 calories per sq cm.
   d. Include recommendations for reducing the incident energy at locations where the calculated maximum incident energy exceeds 8 calories per sq cm.

1.07 QUALITY ASSURANCE

A. Study Preparer Qualifications: Professional electrical engineer licensed in the State in which the Project is located and with minimum five years experience in the preparation of studies of similar type and complexity using specified computer software.
   1. Study preparer may be employed by the manufacturer of the electrical distribution equipment.

B. Field Testing Agency Qualifications: Independent testing organization specializing in testing, analysis, and maintenance of electrical systems with minimum five years experience; NETA Accredited Company.

C. Computer Software for Study Preparation: Use the latest edition of commercially available software utilizing specified methodologies.

PART 2 PRODUCTS

2.01 ARC FLASH HAZARD WARNING LABELS

A. Provide warning labels complying with ANSI Z535.4 to identify arc flash hazards for each work location analyzed by the arc flash and shock risk assessment.
   1. Materials: Comply with Section 260553.
   2. Legend: Provide custom legend in accordance with NFPA 70E based on equipment-specific data as determined by arc flash and shock risk assessment.
      a. Include the following information:
         1) Arc flash boundary.
         2) Available incident energy and corresponding working distance.
         3) Site-specific PPE (personnel protective equipment) requirements.
         4) Nominal system voltage.
         5) Limited approach boundary.
         6) Restricted approach boundary.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install arc flash warning labels in accordance with Section 260553.

3.02 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA ATS, except Section 4.

B. Adjust equipment and protective devices for compliance with studies and recommended settings.

C. Notify Architect of any conflicts with or deviations from studies. Obtain direction before proceeding.

D. Submit detailed reports indicating inspection and testing results, and final adjusted settings.

3.03 CLOSEOUT ACTIVITIES

A. Training: Include as part of the base bid training for Owner's personnel on electrical safety pertaining to arc flash and shock hazards.

1. Use site-specific arc flash and shock risk assessment report as training reference, supplemented with additional training materials as required.

END OF SECTION

SECTION 260583
WIRING CONNECTIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electrical connections to equipment.

1.02 RELATED REQUIREMENTS

A. Section 260519 - Low-Voltage Electrical Power Conductors and Cables.

B. Section 260533.13 - Conduit for Electrical Systems.

C. Section 260533.16 - Boxes for Electrical Systems.

D. Section 262726 - Wiring Devices.

E. Section 262816.16 - Enclosed Switches.

F. Section 262913 - Enclosed Controllers.

1.03 REFERENCE STANDARDS

A. NEMA WD 1 - General Color Requirements for Wiring Devices.

B. NEMA WD 6 - Wiring Devices - Dimensional Specifications.

C. NFPA 70 - National Electrical Code.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Obtain and review shop drawings, product data, manufacturer's wiring diagrams, and manufacturer's instructions for equipment furnished under other sections.
   2. Determine connection locations and requirements.

B. Sequencing:
   1. Install rough-in of electrical connections before installation of equipment is required.
   2. Make electrical connections before required start-up of equipment.

1.05 SUBMITTALS

A. Product Data: Provide wiring device manufacturer’s catalog information showing dimensions, configurations, and construction.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Products: Listed, classified, and labeled as suitable for the purpose intended.

PART 2 PRODUCTS

2.01 MATERIALS

A. Cords and Caps: NEMA WD 6; match receptacle configuration at outlet provided for equipment.
   1. Colors: Comply with NEMA WD 1.
   2. Cord Construction: NFPA 70, Type SO, multiconductor flexible cord with identified equipment grounding conductor, suitable for use in damp locations.
   3. Size: Suitable for connected load of equipment, length of cord, and rating of branch circuit overcurrent protection.

B. Disconnect Switches: As specified in Section 262816.16 and in individual equipment sections.

C. Wiring Devices: As specified in Section 262726.

D. Flexible Conduit: As specified in Section 260533.13.

E. Wire and Cable: As specified in Section 260519.

F. Boxes: As specified in Section 260533.16.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that equipment is ready for electrical connection, wiring, and energization.

3.02 ELECTRICAL CONNECTIONS

A. Make electrical connections in accordance with equipment manufacturer's instructions.

B. Make conduit connections to equipment using flexible conduit. Use liquidtight flexible conduit with watertight connectors in damp or wet locations.

C. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.

D. Provide receptacle outlet to accommodate connection with attachment plug.

E. Provide cord and cap where field-supplied attachment plug is required.

F. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.

G. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.

H. Install terminal block jumpers to complete equipment wiring requirements.

I. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.

END OF SECTION

SECTION 262100
LOW-VOLTAGE ELECTRICAL SERVICE ENTRANCE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electrical service requirements.

1.02 RELATED REQUIREMENTS

A. Section 260519 - Low-Voltage Electrical Power Conductors and Cables.

B. Section 260526 - Grounding and Bonding for Electrical Systems.

C. Section 260529 - Hangers and Supports for Electrical Systems.

D. Section 260533.13 - Conduit for Electrical Systems.

E. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

F. Section 262413 - Switchboards: Service entrance equipment.

1.03 DEFINITIONS

A. Service Point: The point of connection between the facilities of the serving utility and the premises wiring as defined in NFPA 70, and as designated by the Utility Company.

1.04 REFERENCE STANDARDS

A. IEEE C2 - National Electrical Safety Code.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction.

C. NFPA 70 - National Electrical Code.

1.05 ADMINISTRATIVE REQUIREMENTS

A. No later than two weeks following date of the Agreement, notify Utility Company of anticipated date of service.

B. Coordination:
   1. Verify the following with Utility Company representative:
      a. Utility Company requirements, including division of responsibility.
      b. Exact location and details of utility point of connection.
      c. Utility easement requirements.
      d. Utility Company charges associated with providing service.
   2. Coordinate the work with other trades to avoid placement of other utilities or obstructions within the spaces dedicated for electrical service and associated equipment.
   3. Coordinate arrangement of service entrance equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   4. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

C. Arrange for Utility Company to provide permanent electrical service. Prepare and submit documentation required by Utility Company.

D. Utility Company charges associated with providing permanent service to be paid by Contractor..

E. Preinstallation Meeting: Convene one week prior to commencing work of this section to review service requirements and details with Utility Company representative.

F. Scheduling:
   1. Where work of this section involves interruption of existing electrical service, arrange service interruption with Owner.

2. Arrange for inspections necessary to obtain Utility Company approval of installation.

1.06 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product. Include ratings, configurations, standard wiring diagrams, outline and support point dimensions, finishes, weights, service condition requirements, and installed features.

B. Shop Drawings: Include dimensioned plan views and sections indicating locations and arrangement of Utility Company and service entrance equipment, metering provisions, required clearances, and proposed service routing.

C. Project Record Documents: Record actual locations of equipment and installed service routing.

1.07 QUALITY ASSURANCE

A. Comply with the following:
   1. IEEE C2 (National Electrical Safety Code).
   2. NFPA 70 (National Electrical Code).
   3. The requirements of the Utility Company.

B. Products: Listed, classified, and labeled as suitable for the purpose intended.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

B. Store products indoors in a clean, dry space having a uniform temperature to prevent condensation (including outdoor rated products which are not weatherproof until completely and properly installed). Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

C. Handle products carefully to avoid damage to internal components, enclosure, and finish.

PART 2 PRODUCTS

2.01 ELECTRICAL SERVICE REQUIREMENTS

A. Provide new electrical service consisting of all required conduits, conductors, equipment, metering provisions, supports, accessories, etc. as necessary for connection between Utility Company point of supply and service entrance equipment.

B. Electrical Service Characteristics: As indicated on drawings.

C. Utility Company: As indicated on drawings.

D. Division of Responsibility: As indicated on drawings.

E. Products Furnished by Contractor: Comply with Utility Company requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that ratings and configurations of service entrance equipment are consistent with the indicated requirements.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Verify and mark locations of existing underground utilities.

3.03 INSTALLATION

A. Install products in accordance with manufacturer's instructions and Utility Company requirements.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Arrange equipment to provide minimum clearances and required maintenance access.

D. Provide required trenching and backfilling in accordance with Division 31.

E. Provide required protective bollards in accordance with Utility Company requirements.

F. Provide required support and attachment components in accordance with Section 260529.

G. Provide grounding and bonding for service entrance equipment in accordance with Section 260526.

H. Identify service entrance equipment, including main service disconnect(s) in accordance with Section 260553.

3.04 PROTECTION

A. Protect installed equipment from subsequent construction operations.

END OF SECTION

SECTION 262200
LOW-VOLTAGE TRANSFORMERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General purpose transformers.

1.02 RELATED REQUIREMENTS

A. Section 260526 - Grounding and Bonding for Electrical Systems.

B. Section 260529 - Hangers and Supports for Electrical Systems.

C. Section 260533.13 - Conduit for Electrical Systems: Flexible conduit connections.

D. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

E. Section 262416 - Panelboards.

1.03 REFERENCE STANDARDS

A. 10 CFR 431, Subpart K - Energy Efficiency Program for Certain Commercial and Industrial Equipment - Distribution Transformers.

B. IEEE C57.94 - IEEE Recommended Practice for Installation, Application, Operation, and Maintenance of Dry-Type Distribution and Power Transformers.

C. IEEE C57.96 - IEEE Standard Guide for Loading Dry-Type Distribution and Power Transformers.

D. NECA 1 - Standard for Good Workmanship in Electrical Construction.

E. NECA 409 - Standard for Installing and Maintaining Dry-Type Transformers.

F. NEMA ST 20 - Dry-Type Transformers for General Applications.

G. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

H. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems.

I. NFPA 70 - National Electrical Code.

J. UL 506 - Standard for Specialty Transformers.

K. UL 1561 - Standard for Dry-Type General Purpose and Power Transformers.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances required by NFPA 70.
2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Coordinate the work with placement of supports, anchors, etc. required for mounting.
4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. Product Data: Include voltage, kVA, impedance, tap configurations, insulation system class and rated temperature rise, efficiency, sound level, enclosure ratings, outline and support point dimensions, weight, required clearances, service condition requirements, and installed

features.

B. Shop Drawings: Provide dimensioned plan and elevation views of transformers and adjacent equipment with all required clearances indicated.

C. Field Quality Control Test Reports.

D. Project Record Documents: Record actual locations of transformers.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

B. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to transformer internal components, enclosure, and finish.

1.08 FIELD CONDITIONS

A. Ambient Temperature: Do not exceed the following maximum temperatures during and after installation of transformers.
   1. Greater than 10 kVA: 104 degrees F maximum.
   2. Less than 10 kVA: 77 degrees F maximum.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Source Limitations: Furnish transformers produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

2.02 TRANSFORMERS - GENERAL REQUIREMENTS

A. Description: Factory-assembled, dry type transformers for 60 Hz operation designed and manufactured in accordance with NEMA ST 20 and listed, classified, and labeled as suitable for the purpose intended.

B. Unless noted otherwise, transformer ratings indicated are for continuous loading according to IEEE C57.96 under the following service conditions:
   1. Altitude: Less than 3,300 feet.
   2. Ambient Temperature:
      a. Greater than 10 kVA: Not exceeding 104 degrees F.
      b. Less than 10 kVA: Not exceeding 77 degrees F.

C. Core: High grade, non-aging silicon steel with high magnetic permeability and low hysteresis and eddy current losses. Keep magnetic flux densities substantially below saturation point, even at 10 percent primary overvoltage. Tightly clamp core laminations to prevent plate movement and maintain consistent pressure throughout core length.

D. Impregnate core and coil assembly with non-hydroscopic thermo-setting varnish to effectively seal out moisture and other contaminants.

E. Basic Impulse Level: 10 kV.

F. Ground core and coil assembly to enclosure by means of a visible flexible copper grounding strap.

G. Isolate core and coil from enclosure using vibration-absorbing mounts.

H. Nameplate: Include transformer connection data, ratings, wiring diagrams, and overload capacity based on rated winding temperature rise.

2.03 GENERAL PURPOSE TRANSFORMERS

A. Description: Self-cooled, two winding transformers listed and labeled as complying with UL 506 or UL 1561; ratings as indicated on the drawings.

B. Insulation System and Allowable Average Winding Temperature Rise:
   1. Less than 15 kVA: Class 180 degrees C insulation system with 115 degrees C average winding temperature rise.
   2. 15 kVA and Larger: Class 220 degrees C insulation system with 150 degrees C average winding temperature rise.

C. Coil Conductors: Continuous copper windings with terminations brazed or welded.

D. Winding Taps:
   1. Less than 3 kVA: None.
   2. 3 kVA through 15 kVA: Two 5 percent full capacity primary taps below rated voltage.
   3. 15 kVA through 300 kVA: Two 2.5 percent full capacity primary taps above and four 2.5 percent full capacity primary taps below rated voltage.
   4. 500 kVA and Larger: Two 2.5 percent full capacity primary taps above and two 2.5 percent full capacity primary taps below rated voltage.

E. Energy Efficiency: Comply with 10 CFR 431, Subpart K.

F. Sound Levels: Standard sound levels complying with NEMA ST 20

G. Mounting Provisions:
   1. Less than 15 kVA: Suitable for wall mounting.
   2. 15 kVA through 75 kVA: Suitable for wall, floor, or trapeze mounting.
   3. Larger than 75 kVA: Suitable for floor mounting.

H. Transformer Enclosure: Comply with NEMA ST 20.
   1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
      a. Indoor clean, dry locations: Type 2.
   2. Construction: Steel.
      a. Less than 15 kVA: Totally enclosed, non-ventilated.
      b. 15 kVA and Larger: Ventilated.
   3. Finish: Manufacturer's standard grey, suitable for outdoor installations.
   4. Provide lifting eyes or brackets.

2.04 SOURCE QUALITY CONTROL

A. Factory test transformers according to NEMA ST 20.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that suitable support frames and anchors are installed where required and that mounting surfaces are ready to receive transformers.

C. Perform pre-installation tests and inspections on transformers per manufacturer's instructions and as specified in NECA 409. Correct deficiencies prior to installation.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).

B. Install products in accordance with manufacturer's instructions.

C. Install transformers in accordance with NECA 409 and IEEE C57.94.

D. Use flexible conduit, under the provisions of Section 260533.13, 2 feet minimum length, for connections to transformer case. Make conduit connections to side panel of enclosure.

E. Arrange equipment to provide minimum clearances as specified on transformer nameplate and in accordance with manufacturer's instructions and NFPA 70.

F. Install transformers plumb and level.

G. Transformer Support:
   1. Provide required support and attachment in accordance with Section 260529, where not furnished by transformer manufacturer.
   2. Use integral transformer flanges, accessory brackets furnished by manufacturer, or field-fabricated supports to support wall-mounted transformers.
   3. Unless otherwise indicated, mount floor-mounted transformers on properly sized 3 inch high concrete pad constructed.
   4. Use trapeze hangers assembled from threaded rods and metal channel (strut) to support suspended transformers. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

H. Provide grounding and bonding in accordance with Section 260526.

I. Remove shipping braces and adjust bolts that attach the core and coil mounting bracket to the enclosure according to manufacturer's recommendations in order to reduce audible noise transmission.

J. Where not factory-installed, install lugs sized as required for termination of conductors as indicated.

K. Identify transformers in accordance with Section 260553.

3.03 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA ATS, except Section 4.

B. Perform inspections and tests listed in NETA ATS Sections 7.2.1.1 and 7.2.1.2. Tests and inspections listed as optional are not required.

3.04 ADJUSTING

A. Measure primary and secondary voltages and make appropriate tap adjustments.

B. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.05 CLEANING

A. Clean dirt and debris from transformer components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

SECTION 262413
SWITCHBOARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Low-voltage (600 V and less) switchboards and associated accessories for service and distribution applications.

B. Overcurrent protective devices for switchboards.

1.02 RELATED REQUIREMENTS

A. Section 260526 - Grounding and Bonding for Electrical Systems.

B. Section 260529 - Hangers and Supports for Electrical Systems.

C. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

D. Section 260573 - Power System Studies: Additional criteria for the selection and adjustment of equipment and associated protective devices specified in this section.

E. Section 262100 - Low-Voltage Electrical Service Entrance.

F. Section 264300 - Surge Protective Devices.

1.03 REFERENCE STANDARDS

A. IEEE C57.13 - IEEE Standard Requirements for Instrument Transformers.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction.

C. NECA 400 - Standard for Installing and Maintaining Switchboards.

D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

E. NEMA PB 2 - Deadfront Distribution Switchboards.

F. NEMA PB 2.1 - General Instructions for Proper Handling, Installation, Operation, and Maintenance of Deadfront Distribution Switchboards Rated 600 Volts or Less.

G. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems.

H. NFPA 70 - National Electrical Code.

I. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures.

J. UL 869A - Reference Standard for Service Equipment.

K. UL 891 - Switchboards.

L. UL 1053 - Ground-Fault Sensing and Relaying Equipment.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances required by NFPA 70.
2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
4. Coordinate with manufacturer to provide shipping splits suitable for the dimensional constraints of the installation.

5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Service Entrance Switchboards:
   1. Coordinate with Utility Company to provide switchboards with suitable provisions for electrical service and utility metering, where applicable.
   2. Coordinate with Owner to arrange for Utility Company required access to equipment for installation and maintenance.
   3. Obtain Utility Company approval of switchboard prior to fabrication.
   4. Arrange for inspections necessary to obtain Utility Company approval of installation.

1.05 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for switchboards, enclosures, overcurrent protective devices, and other installed components and accessories.

B. Shop Drawings: Indicate dimensions, voltage, bus ampacities, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
   1. Include dimensioned plan and elevation views of switchboards and adjacent equipment with all required clearances indicated.
   2. Include wiring diagrams showing all factory and field connections.

C. Field Quality Control Test Reports.

D. Project Record Documents: Record actual installed locations of switchboards and final equipment settings.

E. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store switchboards in accordance with manufacturer's instructions, NECA 400, and NEMA PB 2.1.

B. Store in a clean, dry space having a uniform temperature to prevent condensation (including outdoor switchboards, which are not weatherproof until completely and properly installed). Where necessary, provide temporary enclosure space heaters or temporary power for permanent factory-installed space heaters.

C. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

D. Handle carefully to avoid damage to switchboard internal components, enclosure, and finish.

1.08 FIELD CONDITIONS

A. Maintain field conditions within required service conditions during and after installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Source Limitations: Furnish switchboards and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

202 SWITCHBOARDS

A. Provide switchboards consisting of all required components, control power transformers, instrumentation and control wiring, accessories, etc. as necessary for a complete operating system.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Description: Dead-front switchboard assemblies complying with NEMA PB 2, and listed and labeled as complying with UL 891; ratings, configurations and features as indicated on the drawings.

D. Front-Connected Switchboards:
   1. Main Device(s): Individually-mounted.
   2. Feeder Devices: Panel/group-mounted.
   3. Arrangement: Front accessible only (not rear accessible), rear aligned.
   4. Gutter Access: Bolted covers.

E. Service Entrance Switchboards:
   1. Listed and labeled as suitable for use as service equipment according to UL 869A.
   2. For solidly-grounded wye systems, provide factory-installed main bonding jumper between neutral and ground busses, and removable neutral disconnecting link for testing purposes.
   3. Comply with Utility Company requirements for electrical service.

F. Service Conditions:
   1. Provide switchboards and associated components suitable for operation under the following service conditions without derating:
      a. Altitude: Less than 6,600 feet.
      b. Ambient Temperature:
         1) Switchboards Containing Molded Case or Insulated Case Circuit Breakers: Between 23 degrees F and 104 degrees F.
   2. Provide switchboards and associated components suitable for operation at indicated ratings under the service conditions at the installed location.

G. Short Circuit Current Rating:
   1. Provide switchboards with listed short circuit current rating not less than the available fault current at the installed location as determined by short circuit study performed in accordance with Section 260573.
   2. Minimum Rating: 65,000 rms symmetrical amperes.

H. Selectivity: Where the requirement for selectivity is indicated, furnish products as required to achieve selective coordination.

I. Main Devices: Configure for top or bottom incoming feed as indicated or as required for the installation. Provide separate pull section and/or top-mounted pullbox as indicated or as required to facilitate installation of incoming feed.

J. Bussing: Sized in accordance with UL 891 temperature rise requirements.
   1. Through bus (horizontal cross bus) to be fully rated through full length of switchboard (non-tapered). Tapered bus is not permitted.
   2. Provide fully rated neutral bus unless otherwise indicated, with a suitable lug for each feeder or branch circuit requiring a neutral connection.
   3. Provide solidly bonded equipment ground bus through full length of switchboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.
   4. Phase and Neutral Bus Material: Copper.
   5. Ground Bus Material: Copper.

K. Conductor Terminations: Suitable for use with the conductors to be installed.
   1. Line Conductor Terminations:
      a. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
      b. Main and Neutral Lug Type: Mechanical.
   2. Load Conductor Terminations:
      a. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
      b. Lug Type:
         1) Provide mechanical lugs unless otherwise indicated.

L. Enclosures:
   1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
      a. Indoor Clean, Dry Locations: Type 1 or Type 2 (drip-proof).
   2. Finish: Manufacturer's standard unless otherwise indicated.

M. Future Provisions:
   1. Prepare designated spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.

N. Surge Protective Devices: Where factory-installed, internally mounted surge protective devices are provided in accordance with Section 264300, list switchboards as a complete assembly including surge protective device.

O. Ground Fault Protection: Where ground-fault protection is indicated, provide system listed and labeled as complying with UL 1053.

P. Arc Flash Energy-Reducing Maintenance Switching: For circuit breakers rated 1200 A or higher, provide a local accessory switch with status indicator light that permits selection of a maintenance mode with alternate electronic trip unit settings for reduced fault clearing time.

Q. Owner Metering:
   1. Provide microprocessor-based digital electrical metering system including all instrument transformers, wiring, and connections necessary for measurements specified.
   2. Measured Parameters:
      a. Voltage (Volts AC): Line-to-line, line-to-neutral for each phase.
      b. Current (Amps): For each phase and neutral.
      c. Frequency (Hz).
      d. Real power (kW): For each phase, 3-phase total.
      e. Reactive power (kVAR): For each phase, 3-phase total.
      f. Apparent power (kVA): For each phase, 3-phase total.
      g. Power factor.
   3. Meter Accuracy: Plus/minus 1.0 percent.

R. Instrument Transformers:
   1. Comply with IEEE C57.13.
   2. Select suitable ratio, burden, and accuracy as required for connected devices.
   3. Current Transformers: Connect secondaries to shorting terminal blocks.
   4. Potential Transformers: Include primary and secondary fuses with disconnecting means.

2.03 OVERCURRENT PROTECTIVE DEVICES

A. Circuit Breakers:
   1. Interrupting Capacity:

a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than specified minimum requirements.
b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.

2. Molded Case Circuit Breakers:
   a. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers; listed and labeled as complying with UL 489; ratings, configurations, and features as indicated on the drawings.
      1) Provide thermal magnetic circuit breakers unless otherwise indicated.
      2) Provide electronic trip circuit breakers where indicated.
   b. Minimum Interrupting Capacity:
      1) 10,000 rms symmetrical amperes at 240 VAC or 208 VAC.
      2) 14,000 rms symmetrical amperes at 480 VAC.
   c. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
      1) Provide field-adjustable magnetic instantaneous trip setting for circuit breaker frame sizes 225 amperes and larger.
   d. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units.
      1) Provide the following field-adjustable trip response settings:
         (a) Long time pickup, adjustable by replacing interchangeable trip unit or by setting dial.
         (b) Long time delay.
         (c) Short time pickup and delay.
         (d) Instantaneous pickup.
         (e) Ground fault pickup and delay where ground fault protection is indicated.
   e. Provide the following circuit breaker types where indicated:
      1) 100 Percent Rated Circuit Breakers: Listed for application within the switchboard where installed at 100 percent of the continuous current rating.

2.04 SOURCE QUALITY CONTROL

A. Factory test switchboards according to NEMA PB 2, including the following production (routine) tests on each switchboard assembly or component:
   1. Dielectric tests.
   2. Mechanical operation tests.
   3. Grounding of instrument transformer cases test.
   4. Electrical operation and control wiring tests, including polarity and sequence tests.
   5. Ground-fault sensing equipment test.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings and configurations of the switchboards and associated components are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive switchboards.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install switchboards in accordance with NECA 1 (general workmanship), NECA 400, and NEMA PB 2.1.

C. Arrange equipment to provide required clearances and maintenance access, including accommodations for any drawout devices.

D. Where switchboard is indicated to be mounted with inaccessible side against wall, provide minimum clearance of 1/2 inch between switchboard and wall.

E. Provide required support and attachment in accordance with Section 260529.

F. Install switchboards plumb and level.

G. Unless otherwise indicated, mount switchboards on properly sized 4 inch high concrete pad.

H. Provide grounding and bonding in accordance with Section 260526.

I. Install all field-installed devices, components, and accessories.

J. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.

K. Set field-adjustable circuit breaker tripping function settings as determined by overcurrent protective device coordination study performed in accordance with Section 260573.

L. Set field-adjustable ground fault protection pickup and time delay settings as indicated.

M. Provide filler plates to cover unused spaces in switchboards.

N. Identify switchboards in accordance with Section 260553.

3.03 FIELD QUALITY CONTROL

A. Disconnect surge protective devices (SPDs) prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPDs connected.

B. Before energizing switchboard, perform insulation resistance testing in accordance with NECA 400 and NEMA PB 2.1.

C. Inspect and test in accordance with NETA ATS, except Section 4.

D. Perform inspections and tests listed in NETA ATS, Section 7.1.

E. Molded Case and Insulated Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for all main circuit breakers and circuit breakers larger than 100 amperes. Tests listed as optional are not required.

F. Ground Fault Protection Systems: Test in accordance with manufacturer's instructions as required by NFPA 70.
   1. Perform inspections and tests listed in NETA ATS, Section 7.14. The insulation-resistance test on control wiring listed as optional is not required.

G. Meters: Perform inspections and tests listed in NETA ATS, Section 7.11.2.

H. Instrument Transformers: Perform inspections and tests listed in NETA ATS, Section 7.10. The dielectric withstand tests on primary windings with secondary windings connected to ground listed as optional are not required.

I. Correct deficiencies and replace damaged or defective switchboards or associated components.

J. Submit detailed reports indicating inspection and testing results and corrective actions taken.

3.04 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

B. Adjust alignment of switchboard covers and doors.

3.05 CLEANING

A. Clean dirt and debris from switchboard enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred surfaces to match original factory finish.

3.06 CLOSEOUT ACTIVITIES

A. Training: Train Owner's personnel on operation, adjustment, and maintenance of switchboard and associated devices.

1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.

3.07 PROTECTION

A. Protect installed switchboards from subsequent construction operations.

END OF SECTION

SECTION 262416
PANELBOARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Power distribution panelboards.

B. Lighting and appliance panelboards.

C. Overcurrent protective devices for panelboards.

1.02 RELATED REQUIREMENTS

A. Section 260526 - Grounding and Bonding for Electrical Systems.

B. Section 260529 - Hangers and Supports for Electrical Systems.

C. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

D. Section 260573 - Power System Studies: Additional criteria for the selection and adjustment of equipment and associated protective devices specified in this section.

E. Section 264300 - Surge Protective Devices.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction.

B. NECA 407 - Standard for Installing and Maintaining Panelboards.

C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

D. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts.

E. NEMA PB 1 - Panelboards.

F. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.

G. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems.

H. NFPA 70 - National Electrical Code.

I. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations.

J. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations.

K. UL 67 - Panelboards.

L. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures.

M. UL 943 - Ground-Fault Circuit-Interrupters.

N. UL 1053 - Ground-Fault Sensing and Relaying Equipment.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted panelboards where indicated.

4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for panelboards, enclosures, overcurrent protective devices, and other installed components and accessories.

B. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
   1. Include dimensioned plan and elevation views of panelboards and adjacent equipment with all required clearances indicated.
   2. Include wiring diagrams showing all factory and field connections.

C. Field Quality Control Test Reports.

D. Project Record Documents: Record actual installed locations of panelboards and actual installed circuiting arrangements.

E. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store panelboards in accordance with manufacturer's instructions and NECA 407.

B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

C. Handle carefully in accordance with manufacturer's written instructions to avoid damage to panelboard internal components, enclosure, and finish.

1.08 FIELD CONDITIONS

A. Maintain ambient temperature within the following limits during and after installation of panelboards:
   1. Panelboards Containing Circuit Breakers: Between 23 degrees F and 104 degrees F.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Source Limitations: Furnish panelboards and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

2.02 PANELBOARDS - GENERAL REQUIREMENTS

A. Provide products listed, classified, and labeled as suitable for the purpose intended.

B. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
   1. Altitude: Less than 6,600 feet.
   2. Ambient Temperature:

a. Panelboards Containing Circuit Breakers: Between 23 degrees F and 104 degrees F.

C. Short Circuit Current Rating:
   1. Provide panelboards with listed short circuit current rating not less than the available fault current at the installed location as determined by short circuit study performed in accordance with Section 260573.

D. Mains: Configure for top or bottom incoming feed as indicated or as required for the installation.

E. Branch Overcurrent Protective Devices: Replaceable without disturbing adjacent devices.

F. Bussing: Sized in accordance with UL 67 temperature rise requirements.
   1. Provide fully rated neutral bus unless otherwise indicated, with a suitable lug for each feeder or branch circuit requiring a neutral connection.
   2. Provide solidly bonded equipment ground bus in each panelboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.

G. Conductor Terminations: Suitable for use with the conductors to be installed.

H. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
   1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
      a. Indoor Clean, Dry Locations: Type 1.
      b. Outdoor Locations: Type 3R.
   2. Boxes: Galvanized steel unless otherwise indicated.
      a. Provide wiring gutters sized to accommodate the conductors to be installed.
   3. Fronts:
      a. Fronts for Surface-Mounted Enclosures: Same dimensions as boxes.
      b. Fronts for Flush-Mounted Enclosures: Overlap boxes on all sides to conceal rough opening.
      c. Finish for Painted Steel Fronts: Manufacturer's standard grey unless otherwise indicated.
   4. Lockable Doors: All locks keyed alike unless otherwise indicated.

I. Future Provisions: Prepare all unused spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.

J. Surge Protective Devices: Where factory-installed, internally mounted surge protective devices are provided in accordance with Section 264300, list and label panelboards as a complete assembly including surge protective device.

K. Panelboard Contactors: Where panelboard contactors are indicated, provide electrically operated, mechanically held magnetic contactor complying with NEMA ICS 2.
   1. Ampere Rating: Not less than ampere rating of panelboard bus.
   2. Short Circuit Current Rating: Not less than the panelboard short circuit current rating.
   3. Coil Voltage: As required for connection to control system indicated.

L. Ground Fault Protection: Where ground-fault protection is indicated, provide system listed and labeled as complying with UL 1053.

M. Selectivity: Where the requirement for selectivity is indicated, furnish products as required to achieve selective coordination.

N. Multi-Section Panelboards: Provide enclosures of the same height, with feed-through lugs or sub-feed lugs and feeders as indicated or as required to interconnect sections.

O. Provide the following features and accessories where indicated or where required to complete installation:
   1. Feed-through lugs.
   2. Sub-feed lugs.

203 POWER DISTRIBUTION PANELBOARDS

A. Description: Panelboards complying with NEMA PB 1, power and feeder distribution type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.

B. Conductor Terminations:
   1. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
   2. Main and Neutral Lug Type: Mechanical.

C. Bussing:
   1. Phase and Neutral Bus Material: Copper.
   2. Ground Bus Material: Copper.

D. Circuit Breakers:
   1. Provide bolt-on type or plug-in type secured with locking mechanical restraints.
   2. Provide thermal magnetic circuit breakers unless otherwise indicated.
   3. Provide electronic trip circuit breakers where indicated.

E. Enclosures:
   1. Provide surface-mounted enclosures unless otherwise indicated.
   2. Fronts: Provide door-in-door trim with hinged cover for access to load terminals and wiring gutters, and separate lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
   3. Provide clear plastic circuit directory holder mounted on inside of door.

204 LIGHTING AND APPLIANCE PANELBOARDS

A. Description: Panelboards complying with NEMA PB 1, lighting and appliance branch circuit type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.

B. Conductor Terminations:
   1. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
   2. Main and Neutral Lug Type: Mechanical.

C. Bussing:
   1. Phase Bus Connections: Arranged for sequential phasing of overcurrent protective devices.
   2. Phase and Neutral Bus Material: Copper.
   3. Ground Bus Material: Copper.

D. Circuit Breakers: Thermal magnetic bolt-on type unless otherwise indicated.

E. Enclosures:
   1. Provide surface-mounted or flush-mounted enclosures as indicated.
   2. Fronts: Provide door-in-door trim with hinged cover for access to load terminals and wiring gutters, and separate lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
   3. Provide clear plastic circuit directory holder mounted on inside of door.

2.05 OVERCURRENT PROTECTIVE DEVICES

A. Molded Case Circuit Breakers:
   1. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489; ratings, configurations, and features as indicated on the drawings.
   2. Interrupting Capacity:
      a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than:
         1) 10,000 rms symmetrical amperes at 240 VAC or 208 VAC.
         2) 14,000 rms symmetrical amperes at 480 VAC.
      b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
   3. Conductor Terminations:
      a. Provide mechanical lugs unless otherwise indicated.
      b. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
   4. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
      a. Provide field-adjustable magnetic instantaneous trip setting for circuit breaker frame sizes 225 amperes and larger.
   5. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units.
      a. Provide the following field-adjustable trip response settings:
         1) Long time pickup, adjustable by replacing interchangeable trip unit or by setting dial.
         2) Long time delay.
         3) Short time pickup and delay.
         4) Instantaneous pickup.
         5) Ground fault pickup and delay where ground fault protection is indicated.
   6. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.
   7. Provide the following circuit breaker types where indicated:
      a. Ground Fault Circuit Interrupter (GFCI) Circuit Breakers: Listed as complying with UL 943, class A for protection of personnel.
      b. Ground Fault Equipment Protection Circuit Breakers: Designed to trip at 30 mA for protection of equipment.
      c. 100 Percent Rated Circuit Breakers: Listed for application within the panelboard where installed at 100 percent of the continuous current rating.
   8. Do not use tandem circuit breakers.
   9. Do not use handle ties in lieu of multi-pole circuit breakers.

2.06 SOURCE QUALITY CONTROL

A. Factory test panelboards according to NEMA PB 1.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings and configurations of the panelboards and associated components are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive panelboards.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).

B. Install products in accordance with manufacturer's instructions.

C. Install panelboards in accordance with NECA 407 and NEMA PB 1.1.

D. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

E. Provide required support and attachment in accordance with Section 260529.

F. Install panelboards plumb.

G. Install flush-mounted panelboards so that trims fit completely flush to wall with no gaps and rough opening completely covered.

H. Mount panelboards such that the highest position of any operating handle for circuit breakers or switches does not exceed 79 inches above the floor or working platform.

I. Mount floor-mounted power distribution panelboards on properly sized 3 inch high concrete pad constructed.

J. Provide minimum of six spare 1 inch trade size conduits out of each flush-mounted panelboard stubbed into accessible space above ceiling and below floor.

K. Provide grounding and bonding in accordance with Section 260526.

L. Install all field-installed branch devices, components, and accessories.

M. Set field-adjustable circuit breaker tripping function settings as determined by overcurrent protective device coordination study performed according to Section 260573.

N. Set field-adjustable ground fault protection pickup and time delay settings as indicated.

O. Provide filler plates to cover unused spaces in panelboards.

P. Provide circuit breaker lock-on devices to prevent unauthorized personnel from de-energizing essential loads where indicated. Also provide for the following:
   1. Emergency and night lighting circuits.
   2. Fire detection and alarm circuits.
   3. Communications equipment circuits.
   4. Intrusion detection and access control system circuits.
   5. Video surveillance system circuits.

Q. Identify panelboards in accordance with Section 260553.

3.03 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA ATS, except Section 4.

B. Molded Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for all main circuit breakers and circuit breakers larger than 100 amperes. Tests listed as optional are not required.

C. Ground Fault Protection Systems: Test in accordance with manufacturer's instructions as required by NFPA 70.

D. Test GFCI circuit breakers to verify proper operation.

E. Correct deficiencies and replace damaged or defective panelboards or associated components.

3.04 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

B. Adjust alignment of panelboard fronts.

C. Load Balancing: For each panelboard, rearrange circuits such that the difference between each measured steady state phase load does not exceed 20 percent and adjust circuit directories accordingly. Maintain proper phasing for multi-wire branch circuits.

3.05 CLEANING

A. Clean dirt and debris from panelboard enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

SECTION 262726
WIRING DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall switches.

B. Wall dimmers.

C. Receptacles.

D. Wall plates.

E. Floor box service fittings.

F. Poke-through assemblies.

1.02 RELATED REQUIREMENTS

A. Section 260519 - Low-Voltage Electrical Power Conductors and Cables: Manufactured wiring systems for use with access floor boxes with compatible pre-wired connectors.

B. Section 260526 - Grounding and Bonding for Electrical Systems.

C. Section 260533.16 - Boxes for Electrical Systems.

D. Section 260533.23 - Surface Raceways for Electrical Systems: Surface raceway systems, including multioutlet assemblies.

E. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

F. Section 260583 - Wiring Connections: Cords and plugs for equipment.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction.

B. NECA 130 - Standard for Installing and Maintaining Wiring Devices.

C. NEMA WD 1 - General Color Requirements for Wiring Devices.

D. NEMA WD 6 - Wiring Devices - Dimensional Specifications.

E. NFPA 70 - National Electrical Code.

F. UL 20 - General-Use Snap Switches.

G. UL 498 - Attachment Plugs and Receptacles.

H. UL 514D - Cover Plates for Flush-Mounted Wiring Devices.

I. UL 943 - Ground-Fault Circuit-Interrupters.

J. UL 1472 - Solid-State Dimming Controls.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the placement of outlet boxes with millwork, furniture, equipment, etc. installed under other sections or by others.
2. Coordinate wiring device ratings and configurations with the electrical requirements of actual equipment to be installed.
3. Coordinate the installation and preparation of uneven surfaces, such as split face block, to provide suitable surface for installation of wiring devices.
4. Coordinate the core drilling of holes for poke-through assemblies with the work covered under other sections.

5. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

B. Sequencing:
   1. Do not install wiring devices until final surface finishes and painting are complete.

1.05 SUBMITTALS

A. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.

B. Field Quality Control Test Reports.

C. Project Record Documents: Record actual installed locations of wiring devices.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Products: Listed, classified, and labeled as suitable for the purpose intended.

1.07 DELIVERY, STORAGE, AND PROTECTION

A. Store in a clean, dry space in original manufacturer's packaging until ready for installation.

PART 2 PRODUCTS

2.01 WIRING DEVICE APPLICATIONS

A. Provide wiring devices suitable for intended use and with ratings adequate for load served.

B. For single receptacles installed on an individual branch circuit, provide receptacle with ampere rating not less than that of the branch circuit.

C. Provide weather resistant GFCI receptacles with specified weatherproof covers for receptacles installed outdoors or in damp or wet locations.

D. Provide GFCI protection for receptacles installed within 6 feet of sinks.

E. Provide GFCI protection for receptacles serving electric drinking fountains.

F. For flush floor service fittings, use tile rings for installations in tile floors.

G. For flush floor service fittings, use carpet flanges for installations in carpeted floors.

2.02 WIRING DEVICE FINISHES

A. Provide wiring device finishes as per Architect.

2.03 WALL SWITCHES

A. Wall Switches - General Requirements: AC only, quiet operating, general-use snap switches with silver alloy contacts, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 20; types as indicated on the drawings.
   1. Wiring Provisions: Terminal screws for side wiring and screw actuated binding clamp for back wiring with separate ground terminal screw.

B. Standard Wall Switches: Commercial specification grade, 20 A, 120/277 V with standard toggle type switch actuator and maintained contacts; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.

2.04 WALL DIMMERS

A. Wall Dimmers - General Requirements: Solid-state with continuous full-range even control following square law dimming curve, integral radio frequency interference filtering, power failure preset memory, air gap switch accessible without removing wall plate, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 1472; types and ratings suitable for load controlled as indicated on the drawings.

B. Provide locator light, illuminated with load off.

2.05 RECEPTACLES

A. Receptacles - General Requirements: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498; types as indicated on the drawings.
   1. Wiring Provisions: Terminal screws for side wiring or screw actuated binding clamp for back wiring with separate ground terminal screw.
   2. NEMA configurations specified are according to NEMA WD 6.

B. Convenience Receptacles:
   1. Standard Convenience Receptacles: Commercial specification grade, 20A, 125V, NEMA 5-20R; single or duplex as indicated on the drawings.
   2. Weather Resistant Convenience Receptacles: Commercial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations; single or duplex as indicated on the drawings.

C. GFCI Receptacles:
   1. GFCI Receptacles - General Requirements: Self-testing, with feed-through protection and light to indicate ground fault tripped condition and loss of protection; listed as complying with UL 943, class A.
      a. Provide test and reset buttons of same color as device.
   2. Standard GFCI Receptacles: Commercial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style.
   3. Weather Resistant GFCI Receptacles: Commercial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations.

2.06 WALL PLATES

A. Wall Plates: Comply with UL 514D.
   1. Configuration: One piece cover as required for quantity and types of corresponding wiring devices.
   2. Size: Standard.
   3. Screws: Metal with slotted heads finished to match wall plate finish.

B. Stainless Steel Wall Plates: Brushed satin finish, Type 302 stainless steel.

C. Weatherproof Covers for Wet or Damp Locations: Gasketed, thermoplastic, with hinged lockable cover and corrosion-resistant screws; listed as suitable for use in wet locations while in use with attachment plugs connected and identified as extra-duty type.

2.07 FLOOR BOX SERVICE FITTINGS

A. Provide service fittings compatible with floor boxes provided under Section 260533.16 with components, adapters, and trims required for complete installation. See drawings for additional information.

2.08 POKE-THROUGH ASSEMBLIES

A. Provide assembly comprising floor service fitting, poke-through component, fire stops and smoke barriers, and junction box for conduit termination; fire rating listed to match fire rating of floor and suitable for floor thickness where installed. See drawings for additional information.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.

C. Verify that wall openings are neatly cut and will be completely covered by wall plates.

D. Verify that final surface finishes are complete, including painting.

E. Verify that floor boxes are adjusted properly.

F. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

G. Verify that core drilled holes for poke-through assemblies are in proper locations.

H. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.

B. Coordinate locations of outlet boxes provided under Section 260533.16 as required for installation of wiring devices provided under this section.

1. Where multiple receptacles, wall switches, or wall dimmers are installed at the same location and at the same mounting height, gang devices together under a common wall plate.
2. Locate wall switches on strike side of door with edge of wall plate 3 inches from edge of door frame. Where locations are indicated otherwise, notify Architect to obtain direction prior to proceeding with work.
3. Locate receptacles for electric drinking fountains concealed behind drinking fountain according to manufacturer's instructions.

C. Install wiring devices in accordance with manufacturer's instructions.

D. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

E. Where required, connect wiring devices using pigtails not less than 6 inches long. Do not connect more than one conductor to wiring device terminals.

F. Connect wiring devices by wrapping conductor clockwise 3/4 turn around screw terminal and tightening to proper torque specified by the manufacturer. Where present, do not use push-in pressure terminals that do not rely on screw-actuated binding.

G. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

H. Provide GFCI receptacles with integral GFCI protection at each location indicated. Do not use feed-through wiring to protect downstream devices.

I. Install wiring devices plumb and level with mounting yoke held rigidly in place.

J. Install wall switches with OFF position down.

K. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.

L. Do not share neutral conductor on branch circuits utilizing wall dimmers.

M. Install vertically mounted receptacles with grounding pole on top and horizontally mounted receptacles with grounding pole on left.

N. Install wall plates to fit completely flush to wall with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.

O. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.

P. Identify wiring devices in accordance with Section 260553.

Q. Install poke-through closure plugs in each unused core holes to maintain fire rating of floor.

3.04 FIELD QUALITY CONTROL

A. Inspect each wiring device for damage and defects.

B. Operate each wall switch, wall dimmer, and fan speed controller with circuit energized to verify proper operation.

C. Test each receptacle to verify operation and proper polarity.

D. Test each GFCI receptacle for proper tripping operation according to manufacturer's instructions.

E. Correct wiring deficiencies and replace damaged or defective wiring devices.

3.05 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

B. Adjust presets for wall dimmers according to manufacturer's instructions as directed by Architect.

3.06 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

END OF SECTION

SECTION 262813
FUSES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fuses.

1.02 RELATED REQUIREMENTS

A. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

B. Section 260573 - Power System Studies: Additional criteria for the selection of protective devices specified in this section.

C. Section 262816.16 - Enclosed Switches: Fusible switches.

D. Section 262913 - Enclosed Controllers: Fusible switches.

1.03 REFERENCE STANDARDS

A. NEMA FU 1 - Low Voltage Cartridge Fuses.

B. NFPA 70 - National Electrical Code.

C. UL 248-1 - Low-Voltage Fuses - Part 1: General Requirements.

D. UL 248-12 - Low-Voltage Fuses - Part 12: Class R Fuses.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate fuse clips furnished in equipment provided under other sections for compatibility with indicated fuses.
      a. Fusible Enclosed Switches: See Section 262816.16.
      b. Fusible Switches for Enclosed Motor Controllers: See Section 262913.
   2. Coordinate fuse requirements according to manufacturer's recommendations and nameplate data for actual equipment to be installed.
   3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. Product Data: Provide manufacturer's standard data sheets including voltage and current ratings, interrupting ratings, time-current curves, and current limitation curves.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

PART 2 PRODUCTS

2.01 APPLICATIONS

A. Feeders:
   1. Fusible Switches up to 600 Amperes: Class RK1, time-delay.

B. General Purpose Branch Circuits: Class RK1, time-delay.

C. Individual Motor Branch Circuits: Class RK1, time-delay.

2.02 FUSES

A. Provide products listed, classified, and labeled as suitable for the purpose intended.

B. Unless specifically indicated to be excluded, provide fuses for all fusible equipment as required for a complete operating system.

C. Provide fuses of the same type, rating, and manufacturer within the same switch.

D. Comply with UL 248-1.

E. Unless otherwise indicated, provide cartridge type fuses complying with NEMA FU 1, Class and ratings as indicated.

F. Voltage Rating: Suitable for circuit voltage.

G. Class R Fuses: Comply with UL 248-12.

H. Selectivity: Where the requirement for selectivity is indicated, furnish products as required to achieve selective coordination.

I. Provide the following accessories where indicated or where required to complete installation:
   1. Fuseholders: Compatible with indicated fuses.
   2. Fuse Reducers: For adapting indicated fuses to permit installation in switch designed for fuses with larger ampere ratings.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that fuse ratings are consistent with circuit voltage and manufacturer's recommendations and nameplate data for equipment.

B. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Do not install fuses until circuits are ready to be energized.

B. Install fuses with label oriented such that manufacturer, type, and size are easily read.

END OF SECTION

SECTION 262816.16
ENCLOSED SWITCHES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Enclosed safety switches.

1.02 RELATED REQUIREMENTS

A. Section 260526 - Grounding and Bonding for Electrical Systems.

B. Section 260529 - Hangers and Supports for Electrical Systems.

C. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

D. Section 260573 - Power System Studies: Additional criteria for the selection of equipment and associated protective devices specified in this section.

E. Section 262813 - Fuses.

F. Section 262913 - Enclosed Controllers: Manual motor controllers.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction.

B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

C. NEMA KS 1 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum).

D. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems.

E. NFPA 70 - National Electrical Code.

F. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations.

G. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations.

H. UL 98 - Enclosed and Dead-Front Switches.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work with other trades. Avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and within working clearances for electrical equipment required by NFPA 70.
2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
4. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for enclosed switches and other installed components and accessories.

B. Shop Drawings: Indicate outline and support point dimensions, voltage and current ratings, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.

1. Include dimensioned plan and elevation views of enclosed switches and adjacent equipment with all required clearances indicated.
2. Include wiring diagrams showing all factory and field connections.

C. Field Quality Control Test Reports.

D. Project Record Documents: Record actual locations of enclosed switches.

E. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to enclosed switch internal components, enclosure, and finish.

1.08 FIELD CONDITIONS

A. Maintain ambient temperature between -22 degrees F and 104 degrees F during and after installation of enclosed switches.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Source Limitations: Furnish enclosed switches and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

2.02 ENCLOSED SAFETY SWITCHES

A. Description: Quick-make, quick-break enclosed safety switches listed and labeled as complying with UL 98; heavy duty; ratings, configurations, and features as indicated on the drawings.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
   1. Altitude: Less than 6,600 feet.
   2. Ambient Temperature: Between -22 degrees F and 104 degrees F.

D. Horsepower Rating: Suitable for connected load.

E. Voltage Rating: Suitable for circuit voltage.

F. Short Circuit Current Rating:
   1. Provide enclosed safety switches, when protected by the fuses or supply side overcurrent protective devices to be installed, with listed short circuit current rating not less than the available fault current at the installed location as determined by short circuit study performed in accordance with Section 260573.

G. Provide with switch blade contact position that is visible when the cover is open.

H. Fuse Clips for Fusible Switches: As required to accept fuses indicated.

I. Conductor Terminations: Suitable for use with the conductors to be installed.

J. Provide insulated, groundable fully rated solid neutral assembly where a neutral connection is required, with a suitable lug for terminating each neutral conductor.

K. Provide solidly bonded equipment ground bus in each enclosed safety switch, with a suitable lug for terminating each equipment grounding conductor.

L. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
   1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
      a. Indoor Clean, Dry Locations: Type 1.
      b. Outdoor Locations: Type 3R.

M. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.

N. Heavy Duty Switches:
   1. Comply with NEMA KS 1.
   2. Conductor Terminations:
      a. Provide mechanical lugs unless otherwise indicated.
      b. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
   3. Provide externally operable handle with means for locking in the OFF position, capable of accepting three padlocks.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings of the enclosed switches are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive enclosed safety switches.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide required support and attachment in accordance with Section 260529.

E. Install enclosed switches plumb.

F. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed switches such that the highest position of the operating handle does not exceed 79 inches above the floor or working platform.

G. Provide grounding and bonding in accordance with Section 260526.

H. Provide fuses complying with Section 262813 for fusible switches as indicated or as required by equipment manufacturer's recommendations.

I. Identify enclosed switches in accordance with Section 260553.

3.03 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA ATS, except Section 4.

B. Perform inspections and tests listed in NETA ATS, Section 7.5.1.1.

C. Correct deficiencies and replace damaged or defective enclosed safety switches or associated components.

3.04 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.05 CLEANING

A. Clean dirt and debris from switch enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

SECTION 262913
ENCLOSED CONTROLLERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Enclosed NEMA controllers for low-voltage (600 V and less) applications:
   1. Magnetic motor starters.
   2. Manual motor starters.
   3. Motor-starting switches without overload protection.

B. Overcurrent protective devices for motor controllers, including overload relays.

1.02 RELATED REQUIREMENTS

A. Section 260526 - Grounding and Bonding for Electrical Systems.

B. Section 260529 - Hangers and Supports for Electrical Systems.

C. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

D. Section 260573 - Power System Studies: Additional criteria for the selection and adjustment of equipment and associated protective devices specified in this section.

E. Section 262813 - Fuses: Fuses for fusible switches.

1.03 REFERENCE STANDARDS

A. IEEE C57.13 - IEEE Standard Requirements for Instrument Transformers.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction.

C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

D. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts.

E. NEMA ICS 5 - Industrial Control and Systems: Control Circuit and Pilot Devices.

F. NEMA ICS 6 - Industrial Control and Systems: Enclosures.

G. NEMA KS 1 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum).

H. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems.

I. NFPA 70 - National Electrical Code.

J. UL 98 - Enclosed and Dead-Front Switches.

K. UL 60947-1 - Low-Voltage Switchgear and Controlgear - Part 1: General Rules.

L. UL 60947-4-1 - Low-Voltage Switchgear and Controlgear - Part 4-1: Contactors and Motor-starters - Electromechanical Contactors and Motor-starters.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances required by NFPA 70.
   2. Coordinate the work to provide motor controllers and associated overload relays suitable for use with the actual motors to be installed.
   3. Coordinate the work to provide controllers and associated wiring suitable for interface with control devices to be installed.

4. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
5. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
6. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for motor controllers, enclosures, overcurrent protective devices, and other installed components and accessories.

B. Shop Drawings: Indicate dimensions, voltage, controller sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
1. Include dimensioned plan and elevation views of enclosed controllers and adjacent equipment with all required clearances indicated.
2. Include wiring diagrams showing all factory and field connections.

C. Field Quality Control Test Reports.

D. Project Record Documents: Record actual installed locations of controllers and final equipment settings.
1. Include nameplate data of actual installed motors and associated overload relay selections and settings.

E. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to internal components, enclosure, and finish.

1.08 FIELD CONDITIONS

A. Maintain field conditions within required service conditions during and after installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Source Limitations: Furnish enclosed motor controllers and associated components produced by a single manufacturer and obtained from a single supplier.
1. Motor-starting switches without overload protection may be produced by the same manufacturer as the wiring devices used for this project.

2.02 ENCLOSED CONTROLLERS

A. Provide enclosed controller assemblies consisting of all required components, control power transformers, instrumentation and control wiring, accessories, etc. as necessary for a complete operating system.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Description: Enclosed controllers complying with NEMA ICS 2, and listed and labeled as complying with UL 60947-1 and UL 60947-4-1; ratings, configurations and features as indicated

on the drawings.

D. Service Conditions:
   1. Provide controllers and associated components suitable for operation under the following service conditions without derating:
      a. Altitude:
         1) Class 1 Km Equipment (devices utilizing power semiconductors, e.g. variable frequency controllers): Less than 3,300 feet.
         2) Class 2 Km Equipment (electromagnetic and manual devices): Less than 6,600 feet.
      b. Ambient Temperature: Between 32 degrees F and 104 degrees F.
   2. Provide controllers and associated components suitable for operation at indicated ratings under the service conditions at the installed location.

E. Short Circuit Current Rating:
   1. Provide controllers with listed short circuit current rating not less than the available fault current at the installed location as determined by short circuit study performed in accordance with Section 260573.

F. Selectivity: Where the requirement for selectivity is indicated, furnish products as required to achieve selective coordination.

G. Conductor Terminations: Suitable for use with the conductors to be installed.

H. Enclosures:
   1. Comply with NEMA ICS 6.
   2. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
      a. Indoor Clean, Dry Locations: Type 1 or Type 12.
      b. Outdoor Locations: Type 3R or Type 4.
   3. Finish: Manufacturer's standard unless otherwise indicated.

I. Instrument Transformers:
   1. Comply with IEEE C57.13.
   2. Select suitable ratio, burden, and accuracy as required for connected devices.
   3. Current Transformers: Connect secondaries to shorting terminal blocks.
   4. Potential Transformers: Include primary and secondary fuses with disconnecting means.

J. Magnetic Motor Starters: Combination type unless otherwise indicated.
   1. Combination Magnetic Motor Starters: NEMA ICS 2, Class A combination motor controllers with magnetic contactor(s), externally operable disconnect and overload relay(s).
   2. Noncombination Magnetic Motor Starters: NEMA ICS 2, Class A noncombination motor controllers with magnetic contactor(s) and overload relay(s).
   3. Configuration: Full-voltage non-reversing unless otherwise indicated.
   4. Disconnects: Disconnect switch type.
      a. Disconnect Switches: Fusible type unless otherwise indicated.
      b. Provide externally operable handle with means for locking in the OFF position. Provide safety interlock to prevent opening the cover with the disconnect in the ON position with capability of overriding interlock for testing purposes.
      c. Provide auxiliary interlock for disconnection of external control power sources where applicable.
   5. Overload Relays: Bimetallic thermal type unless otherwise indicated.
   6. Pilot Devices Required:

a. Furnish local pilot devices for each unit as specified below unless otherwise indicated on drawings.
b. Single-Speed, Non-Reversing Starters:
1) Pushbuttons: START-STOP.
2) Selector Switches: HAND/OFF/AUTO.
3) Indicating Lights: Red ON, Green OFF.

K. Manual Motor Starters:
1. Description: NEMA ICS 2, Class A manually-operated motor controllers with overload relay(s).
2. Configuration: Non-reversing unless otherwise indicated.
3. Fractional-Horsepower Manual Motor Starters:
a. Furnish with toggle operator.
b. Overload Relays: Bimetallic or melting alloy thermal type.
c. Provide means for locking operator in the OFF position.
d. Furnish Red ON indicating light.
4. Integral-Horsepower Manual Motor Starters:
a. Furnish with toggle operator.
b. Overload Relays: Bimetallic or melting alloy thermal type.
c. Provide means for locking operator in the OFF position.
d. Furnish Red ON indicating light.

L. Motor-Starting Switches: Horsepower-rated switches without overload protection; toggle operator.

2.03 OVERCURRENT PROTECTIVE DEVICES

A. Overload Relays:
1. Provide overload relays and, where applicable, associated current elements/heaters, selected according to actual installed motor nameplate data, in accordance with manufacturer's recommendations and NFPA 70; include consideration for motor service factor and ambient temperature correction, where applicable.
2. Inverse-Time Trip Class Rating: Class 20 unless otherwise indicated or required.
3. Trip-free operation.
4. Visible trip indication.
5. Resettable.
a. Employ manual reset unless otherwise indicated.
b. Do not employ automatic reset with two-wire control.
6. Bimetallic Thermal Overload Relays:
a. Interchangeable current elements/heaters.
b. Adjustable trip; plus/minus 10 percent of nominal, minimum.
c. Trip test function.
7. Melting Alloy Thermal Overload Relays:
a. Interchangeable current elements/heaters.

B. Fusible Disconnect Switches:
1. Description: Quick-make, quick-break, dead-front fusible switch units complying with NEMA KS 1, and listed and labeled as complying with UL 98; ratings, configurations, and features as indicated on the drawings.
2. Fuse Clips: As required to accept indicated fuses.
3. Provide externally operable handle with means for locking in the OFF position. Provide means for locking switch cover in the closed position. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock

for testing purposes.

2.04 CONTROL ACCESSORIES

A. Auxiliary Contacts:
   1. Comply with NEMA ICS 5.
   2. Provide number and type of contacts indicated or required to perform necessary functions, including holding (seal-in) circuit and interlocking, plus one normally open (NO) and one normally closed (NC) spare contact for each magnetic motor starter, minimum.

B. Pilot Devices:
   1. Comply with NEMA ICS 5; heavy-duty type.
   2. Pushbuttons: Unless otherwise indicated, provide momentary, non-illuminated type with flush button operator; normally open or normally closed as indicated or as required.
   3. Selector Switches: Unless otherwise indicated, provide maintained, non-illuminated type with knob operator; number of switch positions as indicated or as required.
   4. Indicating Lights: Push-to-test type unless otherwise indicated.
   5. Provide LED lamp source for indicating lights and illuminated devices.

C. Control and Timing Relays:
   1. Comply with NEMA ICS 5.
   2. Provide number and type of relays indicated or required to perform necessary functions.

D. Control Power Transformers:
   1. Size to accommodate burden of contactor coil(s) and all connected auxiliary devices, plus 50 VA spare capacity.
   2. Include primary and secondary fuses.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that ratings of enclosed controllers are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive enclosed controllers.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install controllers in accordance with NECA 1 (general workmanship).

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide required support and attachment in accordance with Section 260529.

E. Install enclosed controllers plumb and level.

F. Provide grounding and bonding in accordance with Section 260526.

G. Install all field-installed devices, components, and accessories.

H. Provide fuses complying with Section 262813 for fusible switches as indicated.

I. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.

J. Set field-adjustable controllers and associated components according to installed motor requirements, in accordance with manufacturer's recommendations and NFPA 70.

K. Set field-adjustable circuit breaker tripping function settings as determined by overcurrent protective device coordination study performed in accordance with Section 260573.

L. Identify enclosed controllers in accordance with Section 260553.

3.03 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA ATS, except Section 4.

B. Motor Starters: Perform inspections and tests listed in NETA ATS, Section 7.16.1.1. Tests listed as optional are not required.

C. Fusible Switches: Perform inspections and tests listed in NETA ATS, Section 7.5.1.1.

D. Correct deficiencies and replace damaged or defective enclosed controllers or associated components.

3.04 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.05 CLEANING

A. Clean dirt and debris from controller enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

3.06 CLOSEOUT ACTIVITIES

A. Demonstration: Demonstrate proper operation of controllers to Owner, and correct deficiencies or make adjustments as directed.

B. Training: Train Owner's personnel on operation, adjustment, and maintenance of enclosed controllers and associated devices.

1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.

3.07 PROTECTION

A. Protect installed enclosed controllers from subsequent construction operations.

END OF SECTION

SECTION 264300
SURGE PROTECTIVE DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surge protective devices for service entrance locations.

1.02 RELATED REQUIREMENTS

A. Section 260526 - Grounding and Bonding for Electrical Systems.

B. Section 262413 - Switchboards.

1.03 ABBREVIATIONS AND ACRONYMS

A. SPD: Surge Protective Device.

1.04 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction.

B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

C. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems.

D. NFPA 70 - National Electrical Code.

E. UL 1449 - Standard for Surge Protective Devices.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate size and location of overcurrent device compatible with the actual surge protective device and location to be installed. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to ordering equipment.

1.06 SUBMITTALS

A. Product Data: Include detailed component information, voltage, surge current ratings, repetitive surge current capacity, voltage protection rating (VPR) for all protection modes, maximum continuous operating voltage (MCOV), nominal discharge current (I-n), short circuit current rating (SCCR), connection means including any required external overcurrent protection, enclosure ratings, outline and support point dimensions, weight, service condition requirements, and installed features.

B. Shop Drawings: Include wiring diagrams showing all factory and field connections with wire and circuit breaker/fuse sizes.

C. Field Quality Control Test Reports.

D. Operation and Maintenance Data: Include information on status indicators and recommended maintenance procedures and intervals.

E. Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty completed in Owner's name and registered with manufacturer.

F. Project Record Documents: Record actual connections and locations of surge protective devices.

1.07 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

1.08 DELIVERY, STORAGE, AND PROTECTION

A. Store in a clean, dry space in accordance with manufacturer's written instructions.

1.09 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Factory-installed, Internally Mounted Surge Protective Devices:
   1. Same as manufacturer of equipment containing surge protective device, to provide a complete listed assembly including SPD.

2.02 SURGE PROTECTIVE DEVICES - GENERAL REQUIREMENTS

A. Description: Factory-assembled surge protective devices (SPDs) for 60 Hz service; listed, classified, and labeled as suitable for the purpose intended; system voltage as indicated on the drawings.

B. Unless otherwise indicated, provide factory-installed, internally-mounted SPDs.

C. List and label as complying with UL 1449, Type 1 when connected on line side of service disconnect overcurrent device and Type 1 or 2 when connected on load side of service disconnect overcurrent device.

D. Protected Modes:
   1. Wye Systems: L-N, L-G, N-G, L-L.

E. UL 1449 Voltage Protection Ratings (VPRs):
   1. 208Y/120V System Voltage: Not more than 1,000 V for L-N, L-G, and N-G modes and 1,200 V for L-L mode.
   2. 480Y/277V System Voltage: Not more than 1,500 V for L-N, L-G, and N-G modes and 2,000 V for L-L mode.

F. UL 1449 Maximum Continuous Operating Voltage (MCOV): Not less than 115% of nominal system voltage.

G. Enclosure Environment Type per NEMA 250: As indicated on the drawings.

H. Equipment Containing Factory-installed, Internally Mounted SPDs: Listed and labeled as a complete assembly including SPD.
   1. Switchboards: See Section 262413.

2.03 SURGE PROTECTIVE DEVICES FOR SERVICE ENTRANCE LOCATIONS

A. Surge Protective Device:
   1. Protection Circuits: Field-replaceable modular.
   2. Surge Current Rating: Not less than 120 kA per mode/240 kA per phase.
   3. UL 1449 Nominal Discharge Current (I-n): 20 kA.
   4. UL 1449 Short Circuit Current Rating (SCCR): Not less than the available fault current at the installed location as indicated on the drawings.
   5. Diagnostics:
      a. Protection Status Monitoring: Provide indicator lights to report the protection for each phase.
      b. Alarm Notification: Provide indicator light and audible alarm to report alarm condition. Provide button to manually silence audible alarm.
      c. Surge Counter: Provide surge event counter with manual reset button, surge count retention upon power loss, and six digit LCD display that indicates quantity of surge events.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the service voltage and configuration marked on the SPD are consistent with the service voltage and configuration at the location to be installed.

C. Verify system grounding and bonding is in accordance with Section 260526, including bonding of neutral and ground for service entrance and separately derived systems where applicable. Do not energize SPD until deficiencies have been corrected.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).

B. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

C. Do not energize SPD until bonding of neutral and ground for service entrance and separately derived systems is complete in accordance with Section 260526 where applicable. Replace SPDs damaged by improper or missing neutral-ground bond.

3.03 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA ATS, except Section 4.

B. Perform inspections and tests listed in NETA ATS Section 7.19.1.

C. Procure services of a qualified manufacturer's representative to observe installation and assist in inspection, testing, and adjusting. Include manufacturer's reports with field quality control submittals.

3.04 CLEANING

A. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

SECTION 265100
INTERIOR LIGHTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Interior luminaires.

B. Emergency lighting units.

C. Exit signs.

D. Ballasts and drivers.

E. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 260529 - Hangers and Supports for Electrical Systems.

B. Section 260533.16 - Boxes for Electrical Systems.

C. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

D. Section 262726 - Wiring Devices: Manual wall switches and wall dimmers.

E. Section 265600 - Exterior Lighting.

1.03 REFERENCE STANDARDS

A. IES LM-63 - IESNA Standard File Format for Electronic Transfer of Photometric Data and Related Information.

B. IES LM-79 - Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products.

C. IES LM-80 - Approved Method: Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays, and Modules.

D. NECA 1 - Standard for Good Workmanship in Electrical Construction.

E. NECA/IESNA 500 - Standard for Installing Indoor Commercial Lighting Systems.

F. NECA/IESNA 502 - Standard for Installing Industrial Lighting Systems.

G. NEMA 410 - Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts.

H. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility.

I. NFPA 70 - National Electrical Code.

J. NFPA 101 - Life Safety Code.

K. UL 924 - Emergency Lighting and Power Equipment.

L. UL 1598 - Luminaires.

M. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the installation of luminaires with mounting surfaces installed under other sections or by others. Coordinate the work with placement of supports, anchors, etc. required for mounting. Coordinate compatibility of luminaires and associated trims with mounting surfaces at installed locations.

2. Coordinate the placement of luminaires with structural members, ductwork, piping, equipment, diffusers, fire suppression system components, and other potential conflicts installed under other sections or by others.
3. Coordinate the placement of exit signs with furniture, equipment, signage or other potential obstructions to visibility installed under other sections or by others.
4. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

1.05 SUBMITTALS

A. Shop Drawings:
1. Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
2. Provide photometric calculations where luminaires are proposed for substitution upon request.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, installed accessories, and ceiling compatibility; include model number nomenclature clearly marked with all proposed features.
1. LED Luminaires:
a. Include estimated useful life, calculated based on IES LM-80 test data.
b. Include IES LM-79 test report upon request.
2. Provide electronic files of photometric data in IES LM-63 standard format upon request.

C. Field quality control reports.

D. Operation and Maintenance Data: Instructions for each product including information on replacement parts.

E. Project Record Documents: Record actual connections and locations of luminaires and any associated remote components.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

1.07 DELIVERY, STORAGE, AND PROTECTION

A. Receive, handle, and store products according to NECA/IESNA 500 (commercial lighting), NECA/IESNA 502 (industrial lighting), and manufacturer's written instructions.

B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

1.08 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.09 WARRANTY

A. Provide three year manufacturer warranty for LED luminaires, including drivers.

B. Provide five year pro-rata warranty for batteries for emergency lighting units.

C. Provide ten year pro-rata warranty for batteries for self-powered exit signs.

PART 2 PRODUCTS

2.01 LUMINAIRE TYPES

A. Furnish products as indicated in luminaire schedule included on the drawings.

202 LUMINAIRES

A. Provide products that comply with requirements of NFPA 70.

B. Provide products that are listed and labeled as complying with UL 1598, where applicable.

C. Provide products listed, classified, and labeled as suitable for the purpose intended.

D. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.

E. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, supports, trims, accessories, etc. as necessary for a complete operating system.

F. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

G. Recessed Luminaires:
   1. Ceiling Compatibility: Comply with NEMA LE 4.
   2. Luminaires Recessed in Insulated Ceilings: Listed and labeled as IC-rated, suitable for direct contact with insulation and combustible materials.

H. LED Luminaires:
   1. Components: UL 8750 recognized or listed as applicable.
   2. Tested in accordance with IES LM-79 and IES LM-80.
   3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.

I. Luminaires Mounted in Continuous Rows: Provide quantity of units required for length indicated, with all accessories required for joining and aligning.

203 EMERGENCY LIGHTING UNITS

A. Description: Emergency lighting units complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.

B. Operation: Upon interruption of normal power source or brownout condition exceeding 20 percent voltage drop from nominal, solid-state control automatically switches connected lamps to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.

C. Battery:
   1. Size battery to supply all connected lamps, including emergency remote heads where indicated.

D. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.

E. Provide low-voltage disconnect to prevent battery damage from deep discharge.

F. Self-Diagnostics: Provide units that self-monitor functionality and automatically perform testing required by NFPA 101 where indicated; provide indicator light(s) to report test and diagnostic status.

204 EXIT SIGNS

A. Description: Internally illuminated exit signs with LEDs unless otherwise indicated; complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.
   1. Number of Faces: Single or double as indicated or as required for the installed location.

2. Directional Arrows: As indicated or as required for the installed location.

B. Self-Powered Exit Signs:
1. Operation: Upon interruption of normal power source or brownout condition exceeding 20 percent voltage drop from nominal, solid-state control automatically switches connected lamps to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.
2. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.
3. Provide low-voltage disconnect to prevent battery damage from deep discharge.
4. Self-Diagnostics: Provide units that self-monitor functionality and automatically perform testing required by NFPA 101 where indicated; provide indicator light(s) to report test and diagnostic status.

2.05 BALLASTS AND DRIVERS

A. Ballasts/Drivers - General Requirements:
1. Provide ballasts containing no polychlorinated biphenyls (PCBs).
2. Minimum Efficiency/Efficacy: Provide ballasts complying with all current applicable federal and state ballast efficiency/efficacy standards.
3. Electronic Ballasts/Drivers: Inrush currents not exceeding peak currents specified in NEMA 410.

B. Dimmable LED Drivers:
1. Dimming Range: Continuous dimming from 100 percent to one percent relative light output unless dimming capability to lower level is indicated, without flicker.
2. Control Compatibility: Fully compatible with the dimming controls to be installed.

2.06 ACCESSORIES

A. Stems for Suspended Luminaires: Steel tubing, minimum 1/2" size, factory finished to match luminaire or field-painted as directed.

B. Threaded Rods for Suspended Luminaires: Zinc-plated steel, minimum 1/4" size, field-painted as directed.

C. Provide accessory plaster frames for luminaires recessed in plaster ceilings.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.

C. Verify that suitable support frames are installed where required.

D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

A. Coordinate locations of outlet boxes provided under Section 260533.16 as required for installation of luminaires provided under this section.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Install products in accordance with manufacturer's instructions.

D. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 500 (commercial lighting) and NECA 502 (industrial lighting).

E. Provide required support and attachment in accordance with Section 260529.

F. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.

G. Suspended Ceiling Mounted Luminaires:
   1. Do not use ceiling tiles to bear weight of luminaires.
   2. Do not use ceiling support system to bear weight of luminaires unless ceiling support system is certified as suitable to do so.
   3. Secure surface-mounted and recessed luminaires to ceiling support channels or framing members or to building structure.
   4. Secure pendant-mounted luminaires to building structure.
   5. Secure lay-in luminaires to ceiling support channels using listed safety clips at four corners.
   6. In addition to ceiling support wires, provide two galvanized steel safety wire(s), minimum 12 gage, connected from opposing corners of each recessed luminaire to building structure.
   7. See appropriate Division 9 section where suspended grid ceiling is specified for additional requirements.

H. Recessed Luminaires:
   1. Install trims tight to mounting surface with no visible light leakage.
   2. Non-IC Rated Luminaires: Maintain required separation from insulation and combustible materials according to listing.

I. Suspended Luminaires:
   1. Install using the suspension method indicated, with support lengths and accessories as required for specified mounting height.
   2. Provide minimum of two supports for each luminaire equal to or exceeding 4 feet nominal length, with no more than 4 feet between supports.
   3. Install canopies tight to mounting surface.
   4. Unless otherwise indicated, support pendants from swivel hangers.

J. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire.

K. Install accessories furnished with each luminaire.

L. Bond products and metal accessories to branch circuit equipment grounding conductor.

M. Emergency Lighting Units:
   1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.
   2. Install lock-on device on branch circuit breaker serving units.

N. Exit Signs:
   1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.
   2. Install lock-on device on branch circuit breaker serving units.

O. Install lamps in each luminaire.

3.04 FIELD QUALITY CONTROL

A. Inspect each product for damage and defects.

B. Operate each luminaire after installation and connection to verify proper operation.

C. Test self-powered exit signs and emergency lighting units to verify proper operation upon loss of normal power supply.

D. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Architect.

3.05 ADJUSTING

A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Architect. Secure locking fittings in place.

B. Aim and position adjustable emergency lighting unit lamps to achieve optimum illumination of egress path as required or as directed by Architect or authority having jurisdiction.

C. Exit Signs with Field-Selectable Directional Arrows: Set as indicated or as required to properly designate egress path as directed by Architect or authority having jurisdiction.

3.06 CLEANING

A. Clean surfaces according to NECA 500 (commercial lighting), NECA 502 (industrial lighting), and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

3.07 CLOSEOUT ACTIVITIES

A. Demonstration: Demonstrate proper operation of luminaires to Architect, and correct deficiencies or make adjustments as directed.

3.08 PROTECTION

A. Protect installed luminaires from subsequent construction operations.

END OF SECTION

SECTION 265600
EXTERIOR LIGHTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Exterior luminaires.

B. Ballasts.

1.02 RELATED REQUIREMENTS

A. Section 260526 - Grounding and Bonding for Electrical Systems.

B. Section 260529 - Hangers and Supports for Electrical Systems.

C. Section 260533.16 - Boxes for Electrical Systems.

D. Section 262726 - Wiring Devices: Receptacles for installation in poles.

E. Section 265100 - Interior Lighting.

1.03 REFERENCE STANDARDS

A. IES LM-63 - IESNA Standard File Format for Electronic Transfer of Photometric Data and Related Information.

B. IES LM-79 - Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products.

C. IES LM-80 - Approved Method: Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays, and Modules.

D. NECA 1 - Standard for Good Workmanship in Electrical Construction.

E. NECA/IESNA 501 - Standard for Installing Exterior Lighting Systems.

F. NEMA 410 - Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts.

G. NFPA 70 - National Electrical Code.

H. UL 1598 - Luminaires.

I. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

1.05 SUBMITTALS

A. Shop Drawings:
   1. Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
   2. Provide photometric calculations where luminaires are proposed for substitution upon request.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, weight, effective projected area (EPA), and installed accessories; include model number nomenclature clearly marked with all proposed features.
   1. LED Luminaires:

a. Include estimated useful life, calculated based on IES LM-80 test data.
b. Include IES LM-79 test report upon request.

2. Provide electronic files of photometric data in IES LM-63 standard format upon request.

C. Field Quality Control Reports.

D. Operation and Maintenance Data: Instructions for each product including information on replacement parts.

E. Project Record Documents: Record actual connections and locations of luminaires and any pull or junction boxes.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, handle, and store products according to NECA/IESNA 501 and manufacturer's written instructions.

B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

1.08 WARRANTY

A. Provide three year manufacturer warranty for all LED luminaires, including drivers.

PART 2 PRODUCTS

2.01 LUMINAIRE TYPES

A. Furnish products as indicated in luminaire schedule included on the drawings.

2.02 LUMINAIRES

A. Provide products that comply with requirements of NFPA 70.

B. Provide products that are listed and labeled as complying with UL 1598, where applicable.

C. Provide products listed, classified, and labeled as suitable for the purpose intended.

D. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.

E. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, supports, trims, accessories, etc. as necessary for a complete operating system.

F. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

G. Provide luminaires listed and labeled as suitable for wet locations unless otherwise indicated.

H. LED Luminaires:
1. Components: UL 8750 recognized or listed as applicable.
2. Tested in accordance with IES LM-79 and IES LM-80.
3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.

2.03 BALLASTS AND DRIVERS

A. Ballasts/Drivers - General Requirements:
1. Provide ballasts containing no polychlorinated biphenyls (PCBs).

2. Minimum Efficiency/Efficacy: Provide ballasts complying with all current applicable federal and state ballast efficiency/efficacy standards.
3. Electronic Ballasts/Drivers: Inrush currents not exceeding peak currents specified in NEMA 410.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.

C. Verify that suitable support frames are installed where required.

D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

A. Coordinate locations of outlet boxes provided under Section 260533.16 as required for installation of luminaires provided under this section.

B. Install products in accordance with manufacturer's instructions.

C. Install luminaires in accordance with NECA/IESNA 501.

D. Provide required support and attachment in accordance with Section 260529.

E. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.

F. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire.

G. Install accessories furnished with each luminaire.

H. Bond products and metal accessories to branch circuit equipment grounding conductor.

I. Install lamps in each luminaire.

3.04 FIELD QUALITY CONTROL

A. Inspect each product for damage and defects.

B. Operate each luminaire after installation and connection to verify proper operation.

C. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Architect.

3.05 ADJUSTING

A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Architect. Secure locking fittings in place.

3.06 CLEANING

A. Clean surfaces according to NECA/IESNA 501 and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

3.07 CLOSEOUT ACTIVITIES

A. Demonstration: Demonstrate proper operation of luminaires to Architect, and correct deficiencies or make adjustments as directed.

3.08 PROTECTION

A. Protect installed luminaires from subsequent construction operations.

END OF SECTION

SECTION 271000
STRUCTURED CABLING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Communications system design requirements.

B. Copper cable and terminations.

C. Communications outlets.

D. Communications grounding and bonding.

E. Communications identification.

1.02 RELATED REQUIREMENTS

A. Section 078400 - Firestopping.

B. Section 260526 - Grounding and Bonding for Electrical Systems.
   1. Includes intersystem bonding termination.

C. Section 260533.13 - Conduit for Electrical Systems.

D. Section 260533.16 - Boxes for Electrical Systems.

E. Section 262726 - Wiring Devices.

1.03 REFERENCE STANDARDS

A. NECA/BICSI 568 - Standard for Installing Commercial Building Telecommunications Cabling.

B. NFPA 70 - National Electrical Code.

C. TIA-568 (SET) - Commercial Building Telecommunications Cabling Standard Set.

D. TIA-568.2 - Balanced Twisted-Pair Telecommunications Cabling and Components Standards.

E. TIA-569 - Telecommunications Pathways and Spaces.

F. TIA-606 - Administration Standard for Telecommunications Infrastructure.

G. TIA-607 - Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises.

H. UL 444 - Communications Cables.

I. UL 514C - Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers.

J. UL 1863 - Communications-Circuit Accessories.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the work with other trades to avoid placement of other utilities or obstructions within the spaces dedicated for communications equipment.
   2. Coordinate arrangement of communications equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.

B. Evidence of qualifications for installer.

C. Field Test Reports.

D. Project Record Documents: Prepared and approved by BICSI Registered Communications Distribution Designer (RCDD).
   1. Record actual locations of outlet boxes and distribution frames.
   2. Show as-installed color coding, pair assignment, polarization, and cross-connect layout.
   3. Identify distribution frames and equipment rooms by room number on drawings.

E. Operation and Maintenance Data: List of all components with part numbers, sources of supply, and operation and maintenance instructions; include copy of project record documents.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: A company having at least 3 years experience in the installation and testing of the type of system specified, and:
   1. Employing a BICSI Registered Communications Distribution Designer (RCDD).
   2. Supervisors and installers factory certified by manufacturers of products to be installed.

B. Products: Listed, classified, and labeled as suitable for the purpose intended.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Keep stored products clean and dry.

1.08 WARRANTY

A. Furnish guarantee covering all work in this section for a period of one (1) year after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 SYSTEM DESIGN

A. Provide a complete permanent system of cabling and pathways for voice and data communications, including cables, conduits and wireways, pull wires, support structures, enclosures and cabinets, and outlets.
   1. Comply with TIA-568 (SET) (cabling) and TIA-569 (pathways) (commercial standards).
   2. Provide fixed cables and pathways that comply with NFPA 70 and TIA-607 and are UL listed or third party independent testing laboratory certified.
   3. Provide connection devices that are rated for operation under conditions of 32 to 140 degrees F at relative humidity of 0 to 95 percent, noncondensing.
   4. In this project, the term plenum is defined as return air spaces above ceilings, inside ducts, under raised floors, and other air-handling spaces.

B. Main Distribution Frame (MDF): Centrally located support structure for terminating horizontal cables that extend to telecommunications outlets, functioning as point of presence to external service provider. See drawings for location of MDFs.

C. Intermediate Distribution Frames (IDF): Support structures for terminating horizontal cables that extend to telecommunications outlets. See drawings for location of IDFs.

D. Cabling to Outlets: Specified horizontal cabling, wired in star topology to distribution frame located at center hub of star; also referred to as "links".

2.02 COPPER CABLE AND TERMINATIONS

A. Copper Horizontal Cable:
   1. Description: 100 ohm, balanced twisted pair cable complying with TIA-568.2 and listed and labeled as complying with UL 444.

2. Cable Type - Voice and Data: TIA-568.2 Category 6 UTP (unshielded twisted pair); 23 AWG.
3. Cable Capacity: 4-pair.
4. Cable Applications: Use listed NFPA 70 Type CMP plenum cable unless otherwise indicated.
5. Cable Jacket Color - Voice and Data Cable: Blue.

B. Copper Cable Terminations: Insulation displacement connection (IDC) type using appropriate tool; use screw connections only where specifically indicated.

C. Jacks and Connectors: Modular RJ-45, non-keyed, terminated with 110-style insulation displacement connectors (IDC); high impact thermoplastic housing; suitable for and complying with same standard as specified horizontal cable; UL 1863 listed.
1. Performance: 500 mating cycles.
2. Voice and Data Jacks: 8-position modular jack, color-coded for both T568A and T568B wiring configurations.

D. Copper Patch Cords:
1. Description: Factory-fabricated 4-pair cable assemblies with 8-position modular connectors terminated at each end.
2. Patch Cords for Patch Panels:
a. Quantity: One for each pair of patch panel ports.
b. Length: 3'-0".
3. Patch Cords for Work Areas:
a. Quantity: One for each work area outlet port.
b. Length: 10'-0" feet.

203 COMMUNICATIONS OUTLETS

A. Outlet Boxes: Comply with Section 260533.16.
1. Provide depth as required to accommodate cable manufacturer's recommended minimum conductor bend radius.
2. Minimum Size, Unless Otherwise Indicated:
a. Voice Only Outlets: 4 inch by 2 inch by 2-1/8 inch deep (100 by 50 by 54 mm)trade size.
b. Data or Combination Voice/Data Outlets: 4 inch square by 2-1/8 inch deep (100 by 54 mm) trade size.

B. Wall Plates:
1. Comply with system design standards and UL 514C.
2. Accepts modular jacks/inserts.
3. Wall Plate Material/Finish - Flush-Mounted Outlets: High impact thermoplastic, color to be selected by Architect.

204 GROUNDING AND BONDING COMPONENTS

A. Comply with TIA-607.

205 IDENTIFICATION PRODUCTS

A. Comply with TIA-606.

206 SOURCE QUALITY CONTROL

A. Factory test cables according to TIA-568 (SET).

PART 3 EXECUTION

3.01 INSTALLATION - GENERAL

A. Comply with latest editions and addenda of TIA-568 (SET) (cabling), TIA-569 (pathways), TIA-607 (grounding and bonding), NECA/BICSI 568, NFPA 70, and as specified in PART2.

B. Grounding and Bonding: Perform in accordance with TIA-607 and NFPA 70.

C. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 078400.

3.02 INSTALLATION OF PATHWAYS

A. Install pathways with the following minimum clearances:
   1. 48 inches from motors, generators, frequency converters, transformers, x-ray equipment, and uninterruptible power systems.
   2. 12 inches from power conduits and cables and panelboards.
   3. 5 inches from fluorescent and high frequency lighting fixtures.
   4. 6 inches from flues, hot water pipes, and steam pipes.

B. Conduit, in Addition to Requirements of Section 260533.13:
   1. Arrange conduit to provide no more than the equivalent of two 90 degree bend(s) between pull points.
   2. Conduit Bends: Inside radius not less than 10 times conduit internal diameter.
   3. Arrange conduit to provide no more than 100 feet between pull points.
   4. Do not use conduit bodies.

C. Outlet Boxes:
   1. Coordinate locations of outlet boxes provided under Section 260533.16 as required for installation of telecommunications outlets provided under this section.
      a. Mounting Heights: Unless otherwise indicated, as follows:
         1) Telephone and Data Outlets: 18 inches above finished floor.
         2) Telephone Outlets for Forward-Reach Wall-Mounted Telephones: 48 inches above finished floor to top of telephone.
      b. Orient outlet boxes for vertical installation of wiring devices unless otherwise indicated.

3.03 INSTALLATION OF EQUIPMENT AND CABLING

A. Cabling:
   1. Do not bend cable at radius less than manufacturer's recommended bend radius; for unshielded twisted pair use bend radius of not less than 4 times cable diameter.
   2. Do not over-cinch or crush cables.
   3. Do not exceed manufacturer's recommended cable pull tension.
   4. When installing in conduit, use only lubricants approved by cable manufacturer and do not chafe or damage outer jacket.

B. Service Loops (Slack or Excess Length): Provide the following minimum extra length of cable, looped neatly:
   1. At Distribution Frames: 120 inches.
   2. At Outlets - Copper: 12 inches.

C. Copper Cabling:
   1. Category 5e and Above: Maintain cable geometry; do not untwist more than 1/2 inch from point of termination.
   2. For 4-pair cables in conduit, do not exceed 25 pounds pull tension.

3. Use T568B wiring configuration.

D. Identification:
   1. Use wire and cable markers to identify cables at each end.
   2. Use manufacturer-furnished label inserts to identify each jack at communications outlets with unique identifier.

3.04 FIELD QUALITY CONTROL

A. Comply with inspection and testing requirements of specified installation standards.

B. Visual Inspection:
   1. Inspect cable jackets for certification markings.
   2. Inspect cable terminations for color coded labels of proper type.
   3. Inspect outlet plates and patch panels for complete labels.
   4. Inspect patch cords for complete labels.

C. Testing - Copper Cabling and Associated Equipment:
   1. Category 5e and Above Links: Perform tests for wire map, length, attenuation, NEXT, and propagation delay.

D. Final Testing: After all work is complete, including installation of telecommunications outlets, and telephone dial tone service is active, test each voice jack for dial tone.

END OF SECTION

SECTION 281000
ACCESS CONTROL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Integrated security management system.

1.02 REFERENCES

A. Electronic Industries Alliance (EIA):
   1. RS232C - Interface between Data Terminal Equipment and Data Communications Equipment Employing Serial Binary Data Interchange.
   2. RS485 - Electrical Characteristics of Generators and Receivers for use in Balanced Digital Multi-Point Systems.

B. Federal Communications Commission (FCC):
   1. FCC Part 15 - Radio Frequency Device.
   2. FCC Part 68 - Connection of Terminal Equipment to the Telephone Network.

C. Federal Information Processing Standards (FIPS):
   1. Advanced Encryption Standard (AES) (FIPS 197).
   2. FIPS 201: Personal Identity Verification (PIV) of Federal Employees and Contractors.

D. National Fire Protection Association (NFPA):
   1. NFPA70 - National Electrical Code.

E. Homeland Security Presidential Directive 12 (HSPD-12).

F. Underwriters Laboratories (UL):
   1. UL294 - Access Control System Units.
   2. UL1076 - Proprietary Burglar Alarm Units and Systems.

1.03 SECURITY MANAGEMENT SYSTEM DESCRIPTION

A. The Integrated Security Management System (ISMS) shall function as an electronic access control system and shall integrate the alarm monitoring, CCTV, digital video, ID badging and database management into a single platform. ISMS shall function as a one-stop gateway for all the access control needs. A modular and network-enabled architecture shall allow maximum versatility for tailoring secure and dependable access and alarm monitoring solutions. The following definitions are applicable for the system:
   1. Access Card: A coded employee card, usually the size of a credit card, recognizable to the access control system and read by a reader to allow access. It can be used for photo identification of the cardholder and for other data collection purposes. Card technologies include magnetic strips, wiegand-effect, proximity (active/passive), barium ferrite, and smart/intelligent cards.
   2. Abstract Device: An Abstract Device (ADV) is a logical representation of a physical device. The ADVs can be associated with any hardware device, including communication interfaces, panels, alarm points, entrances, and CCTV equipment. The ADVs help in monitoring the device status and controlling the actions of a physical device through the Control Map, Floor Plan, or Alarm View.
   3. Access Control System: An interconnected set of controllers, managing the entrance and exit of people through secure areas.
   4. Access Level: The door or combination of doors and/or barriers an individual is authorized to pass through.
   5. Anti-Pass back (Anti-Tailgating): This feature protects against more than one person using the same card or number. It defines each system card reader and card ID number as IN,

OUT or other. Once a card is granted access to an IN reader, it must be presented to an OUT reader before another IN reader access is granted. Cards will continue to have access to all authorized OTHER readers.

6. Alarm: A signal that indicates a problem.
7. Alarm input: A device that is monitored by the access control panel. An alarm signal will be generated if the device is activated.
8. Badge: Badge is a template or a design for creating a card. The system includes a full-featured badge layout utility for designing, creating, and printing badges. Badge design includes magnetic stripe encoding, bar coding, signatures, and so on.
9. Bar Code: A method of encoding information using lines and blank spaces of varying size and thickness to represent alphanumeric characters.
10. Biometrics: A general term for the verification of individuals using unique biological characteristics (i.e. fingerprints, hand geometry, voice analysis, the retinal pattern in the eye).
11. Card and Card Holder: A card is an identity proof of a person and a card holder is a person who holds the card. Multiple cards can be assigned to a single card holder to provide different access.
12. Controller: A microprocessor based circuit board that manages access to a secure area. The controller receives information that it uses to determine through which doors and at what times cardholders are granted access to secure areas. Based on that information, the controller can lock/unlock doors, sound alarms, and communicate status to a host computer.
13. Communication Port: A hardware device that allows a computer to communicate with external devices.
14. Card Reader: A device that retrieves information stored on an access card and transmits that information to a controller.
15. Network or Digital Video Recorder (DVR): A security system device that records the video from the surveillance cameras (IP and/or Analog) on a hard disk.
16. Door: A generic term for a securable entry way. In many access control applications a "door" may actually be a gate, turnstile, elevator door, or similar device.
17. Duress: Forcing a person to provide access to a secure area against that person's wishes.
18. Guard Tour: A defined route of a security guard.
19. Host Computer: The central controlling computer from which access control software applications are run.
20. Input: An electronic sensor on a controller that detects a change of state in a device outside the controller
21. Keypad: An alphanumeric grid which allows a user to enter an identification code. A flat device which has buttons that may be pressed in a sequence to send data to a controller, and which differs from a typewriter-like computer board.
22. Online Help: A reference program within most software programs that provides basic descriptions and instructions on how to use that software program.
23. Output Relay: A device that changes its state upon receiving a signal from a controller. Typically the state change prompts an action outside of the controller such as activating or inactivating a device. The auxiliary relays found in access control panels or NODES that control external devices.
24. Reader: A device that "receives" an identification code from a card, key tag, magnetic stripe card, bar code card, or related item. Refers to the "front end" that a user must interact with to allow access. Readers can be keypads, card readers, proximity readers, and so on.
25. RS232: A serial communication protocol used for connecting data terminal devices. RS-232 is the most commonly used communication protocol.

26. Server: The host computer, which has the ISMS functions.
27. Shunt Time: The length of time a door open alarm is suppressed (shunted) after a valid card access or free egress request. This time should be just enough to allow a card user to open a door or gate, pass through, and then close it.
28. Time zones: "Schedules" that allow cards to function or not function depending on the time of day. This is used to limit access to the facility. The schedule may include not only time but which days of the week a card is valid.
29. Wiegand Card: An access control card based on the Wiegand effect. Small bits of specially processed wire are embedded in the card in a pattern that uniquely identifies the card. This identification information can then be decoded by a Wiegand reader.
30. Wiegand Reader: A reader capable of reading the information encoded on a Wiegand card.
31. Video Management System (VMS): An enterprise-class video management and storage solution.

1.04 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. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) square representing actual product, color, and patterns.

C. Manufacturer's Product Data: Submit manufacturer's data sheets indicating systems and components proposed for use.

D. Shop Drawings: Submit complete shop drawings indicating system components, wiring diagrams and load calculations.

E. Record Drawings: During construction maintain record drawings indicating location of equipment and wiring. Submit an electronic version of record drawings for the Security Management System not later than Substantial Completion of the project.

F. Operation and Maintenance Data: Submit manufacturer's operation and maintenance data, customized to the Security Management System installed. Include system and operator manuals.

G. Maintenance Service Agreement: Submit a sample copy of the manufacturer's maintenance service agreement, including cost and services for a two year period for Owner's review.

1.05 QUALITY ASSURANCE

A. Manufacturer: Minimum ten years experience in manufacturing and maintaining Security Management Systems. Manufacturer shall be Microsoft Silver Certified.

B. Installer must be certified by Honeywell Integrated Security Dealer Service Certification Program (DSCP).

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

1.07 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 recommended limits.

1.08 WARRANTY

A. Manufacturer's Warranty: Submit manufacturer's standard warranty for the security management system.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Approved manufacturers:
   1. Honeywell Commercial Security. All product models listed in this specification are products of this manufacturer.
   2. Or equal.

2.02 INTEGRATED SECURITY MANAGEMENT SYSTEM

A. Product: WIN-PAK Access System as manufactured by the Honeywell Security Group.

B. The Integrated Security Management System (ISMS) shall function as an electronic access control system and shall integrate the alarm monitoring, CCTV, digital and network video, ID badging and database management into a single platform. ISMS shall function as a one-stop gateway for all the access control needs. A modular and network-enabled architecture shall allow maximum versatility for tailoring secure and dependable access and alarm monitoring solutions. The ISMS shall offer a security management software suite that includes all the features bundled in the following three editions:
   1. Professional Edition (PE): Shall include all the features of Standard Edition plus the following additional features: Unrestricted concurrent users, multiple communication servers, 255 IP connections per communication server, 100,000 card holders and PRO3200, PRO2200, NetAXS-123, NetAXS-4, N1000/PW2000, NS2 and NS2+ panel support.

C. ISMS Components:
   1. The ISMS shall be divided into three components: Database Server, Communication Server, and User Interface. These components shall run on a single computer or on multiple computers, allowing flexibility in configuring a networked system.
      a. Database Server: The database server is used for storing the database tables. This data is accessible to communication server and user interface for retrieving and generating the reports. The database server shall be installed on the client computer or any other computer connected to the network.
      b. Communication Server: The communication server routes user interface requests as well as the access transactions to the panel. The panel in-turn processes the transactions and sends the information to the database server as well as responses to the user interface through the communication server. When the communication server is sending information to the database server, it can also receive a request from the user interface. In this scenario, the communication server considers the user request as a higher priority and stops the panel-database server communication until the user request is processed. The communication server shall be installed on the client computer or any other computer connected to the network.
      c. User Interface (ISMS Client): The user interface helps ISMS operators to communicate with the access control system. The user interface shall be installed on the computer where the database server or the communication server is installed or any other computer connected to the network. Several client computers can be run simultaneously and can access the single database server simultaneously. The number of client computers varies based on the licensing information of ISMS.
   2. The ISMS includes the Command File Server: A command file server provides text files containing device instructions that shall be stored in the command files database. The

commands in the command files can be sent to the devices automatically on receiving, acknowledging, or clearing an alarm. Also, the command files can be manually executed.

a. Guard Tour server: A guard tour is a defined series of check points a guard must activate within a given amount of time. The check points are readers or input points where the guard presents the card or presses the button.
b. Tracking and Muster Server: A muster server is enabled in the event of an emergency and allows the card holders to swipe the readers. Muster areas are logical areas that contain readers to be used by the card holders, only if there is a call for muster (in the event of a disaster, for example).
c. Schedule Server: A schedule server schedules the list of events to be performed at a predetermined time and intervals such as hourly, daily, or monthly.
d. Video Management Server: A video management server provides interface to connect to various DVR's/NVR's. In addition, it also provides CCTV control with live monitor display, PTZ control of cameras and video playback operations.

D. Integrated Security Management System Operational Requirements:
1. The ISMS shall be a modular and network-enabled access control system capable of controlling multiple remote sites, alarm monitoring, video imaging, ID badging, paging, digital video and CCTV switching and control that allows for easy expansion or modification of inputs and remote control stations. The ISMS control at a central computer location shall be under the control of a single software program and shall provide full integration of all components. It shall be alterable at any time depending upon facility requirements. The ISMS reconfiguration shall be accomplished online through system programming.
2. The ISMS application shall have the major functional capabilities (considered essential for the system) categorized as follows:
a. General:
1) All the databases shall have the ability to add, delete, report, view, and edit information.
2) All the system transactions shall be saved in a retrievable file.
3) All the events shall be logged by date and time.
4) All the system transactions or selected system transactions shall be saved in a disk file.
5) The end-user shall have the provision to make any system configuration changes such as, but not limited to door open time, door contact shunt time, point and reader names, when and where a cardholder is valid, and the ability to add or modify card databases at any time.
6) Shall support "Global Anti-pass back", feature allowing cardholder to enter/exit any such defined card reader on the same intelligent control panel or RS-485 drop-line consisting of 2 and 4 door controllers.
7) Anti-pass back modes shall include: hard (no forgiveness), soft (allows access but generates an alarm event) and timed for all readers on the intelligent controller, on specified reader or card for a definable period of time up to 32,000 seconds.
8) Shall support the "Duress" feature, where a PIN is used in conjunction with a card read; the numbers of digits are selected using the keypad where the PIN number is a value different from the normal PIN.
9) Shall support the "Two card holder" rule, where two valid, non-identical "cards" must be used within a 20 second period to grant access.
10) Shall have the option to display the time when a card holder using a reader has accessed (opened) the door or the card was used, but the door was not opened.

11) Shall support the "Latch mode" operation where the first card read unlocks the door and the second card read locks it.
12) Shall provide a mode of system operation that stores system commands not accepted by the hardware.
13) Shall provide a mode of system operation that requires the operator to enter a response to an event when acknowledging it from the alarm view window.
14) Shall provide a mode of system operation that allows acknowledged alarms to be automatically cleared.
15) Shall provide a mode of system operation where when an acknowledged, but not cleared event will be reissued requiring acknowledgement when the event changes to an alarm or trouble state.
16) Shall provide a mode of system operation that does not allow the operator to clear an alarm before prior to it being restored to normal.
17) Shall provide the ability for manual operator control of system output relays. The manual functions shall include the ability to energize, de-energize, return to time zone, or pulse the output relay. The pulse time shall be a programmable setting.
18) Shall provide the ability for manual operator control of system doors. The manual functions shall include the ability to Lock, Un-Lock, Disable, Card only, Card-Pin only, Pin only, exit only and site code only.
19) Shall provide the ability to automatically display stored "video image" of cardholder, and switch real-time camera from CCTV or digital video server to card reader location for specific card usage.
20) The cardholder "video image" pop-up shall be activated based on a priority level set to the cardholder or reader. Information in the pop-up shall include, but not be limited to the card holder's primary image a live video pop-up showing the person who initiated the pop-up, entrance name, time, date, cardholder name, and status. User shall be able to display up to 40 note fields. The size of the pop-ups shall be adjustable by the operator.
21) Shall support multiple card reader technology including: Proximity, Wiegand effect, Biometrics, Magnetic stripe, Bar Code, Keypad, Card/keypad (PIN), High-speed long range Vehicle ID, and Smart Card.
22) Shall provide an option for taking scheduled automatic backups of any or all database system files. A means to restore these files from a simple menu shall exist.
23) Shall provide the ability to address up to 255 serial communication ports per communication server, where each port can be configured for either hardwired, or dial-up. When configured for dial-up, any one port can support multiple dial-up locations.
24) Communication from the access control communication server to the remote intelligent control panels shall be selectable. Communication options shall be RS-232 directly to the intelligent control, via RS-485 converter, dial-up, leased line from a defined communication port or by LAN/WAN using an IP address for direct connection to the intelligent controller via network interface card. When using IP addressing it shall be un-acceptable to use a communication port converter device on the communication server side of the transmission. A minimum of 255 such IP connections shall be allowed per communication server.
25) All commands and updates to the panels shall be verified and shall automatically retry if communications fail.
26) Shall provide a system scheduler that shall automatically: Call remote locations to retrieve history transactions and update panel information, including time and

date, Activate or deactivate cards locally or at remote dial-up sites, Initiate a pre-programmed command event/action, Synchronize system to intelligent controller time, Run a pre-defined (template) History report, Run a pre-defined (template) Card Holder report, Card frequency report defined by reader(s), over a defined period of time with disposition options to automatically report or report and de-activate card or change the access level of the card, Frequency shall be defined as Never, Now, Once, Hourly, Daily, and Weekly, Once per 2 weeks, and Monthly.

27) Shall provide drop boxes for all system-required information that the user has previously entered.

28) Shall provide the ability to initiate an email (via SMTP) or page to a paging system based on a transaction state. A transaction state shall be defined as but not limited to Normal, Alarm, Trouble, Ajar, Trace, Not Found, Anti-Pass back Violation, PIN Violation, Time Zone Violation, Site Code Violation, Door Used, Duress, No Second Card Presented, Trace Card or Expired Card, and System Alarms including, Panel Com, Panel Power Failure, Modem Pool, Guard Tour, and Tamper. Intrusion partition events including but not limited to: Alarm, Alarm Cancel, Aram Away, Arm Stay, Auto Arm, Auto Disarm, Bypass, Disarm, Early Arm, Early Disarm, Fail to Arm, Fail to Disarm, Normal, Not Ready, Part Arm, Quick Arm, Recent Close, Remote Arm, Remote Disarm, Unbypass, User Code Added, User Code Deleted, user Code Edited. Intrusion zone events including but not limited to: Alarm, Alarm Restore, Bypass, Fault, Fault Restore, Normal, Trouble, Trouble Restore, and Unbypass. Intrusion output events including but not limited to: Alarm, Communication Loss, Normal, Tamper, and Tamper Restore. Intrusion panel events including but not limited to: Access Denied, Automatic Test, Comm Fail, Comm Restore, Faults, Faults Restore, Line Restore, Line Trouble, Manual Test, Pager Restore, Pager Trouble, AC Restore, AC Trouble, Alarm, Battery Low, Battery Low Restore, Disarm, Normal, Recent Close, Reset, Panic Alarm, Power Up, Program begin, Program Changed, Program End, System Shutdown, System Shutdown Restore, Tamper Alarm, Tamper Restore, Test End, Test Start, Time/Date changed.

29) Shall include a "host grant" mode of operation that requires the host computer to grant accesses to "valid" cards. An alternate host grant mode shall allow the card access information to be downloaded along with unlocking the door for "valid" cards.

b. Cards: Shall provide a simple card and card holder database import utility. The utility shall be password protected and accessible only to administrators of the access control system. Information that can be imported shall include but not be limited to: First Name, Last Name, Card Number, Activation Date, De-activation Date, Status, up to 40 note fields and Photo Images. A simple CSV (comma separated value) file shall be used for the importing of data and image file names.

c. Access Levels: Shall provide an option to define specific access times and specific readers for access. Shall provide a template of a defined access level detail, where changes can be made to the template and saved as a new access level detail.

d. Video Management Server: Shall support the following Recorders: MAXPRO NVR, MAXPRO NVR HYBRID, RapidEye, HRDP, and Fusion from Honeywell.

e. Camera Control:

f. Alarm Monitoring - Alarms Only View:

g. Alarm Monitoring/System Control - Tree View: Shall provide the ability for dynamic alarm monitoring of alarm points in real time on the system computer's video display terminal.

h. Operator Database: Shall allow the assignment of operator levels to define the system components that each operator has access to view, operate, change, or delete.
i. Access Control Panels: Shall provide ability to program Action Messages and assign an alarm event priority. .
j. Reports: Shall provide Card holder report capability with filter options to define door(s) that a card holder has access to, reporting card holder name, Card(s), Access Level/schedules, Activation/Expiration.
k. Tracking/Muster Report: A tracking feature shall allow the system operator to identify an area and the person(s) in that area.
l. Time Zones: Time zone definitions shall include Starting time, Ending time, Days of the week, and Holiday override.
m. Floor Plan Graphic: Shall provide the ability to import floor plan graphics stored in a WMF format.
n. Remote Locations: Shall provide the ability to place remote control panels in an offline mode. In the offline mode, the remote control panels shall retain all panel history events. The amount of historical events shall be limited to the panels' buffer capacity.
o. Guard Tour: Guard Tour shall allow the operator to program a series of guard check points that must be activated to accomplish the task of a Guard Tour.
p. ID Badging System/Video Image System: Shall allow any card data fields to be assigned to a badge.
q. Networking: Shall provide networking capabilities (LAN or WAN) as allowed by the computer's operating system license.

E. ISMS Hardware and Software Requirements:
1. The ISMS shall be installed in a computer that supports 1 to 100 readers, 5,000 cards, and 8 communication ports. The recommended hardware requirements to fulfill this installation are:
a. Processor: Quad Core Intel Xeon® .
b. CPU: 2.4 GHz.
c. RAM: 4 Gigabytes (GB).
d. Hard Disk: 250 GB SATA or SCSI.
e. Serial Communication Ports: 2.
f. Secondary Storage: Tape or DVD burner.
g. Printer port: 1 (2 if badging).
h. Monitor Display: Size: 17 Inches SVGA, Resolution: 1024 x 768, Colors: True color.
i. Pointing Device: Mouse (USB preferred).
j. Operating System: Microsoft Windows 7 SP1.
k. Database: Microsoft SQL Server2012 Express Edition.

F. Hardware Requirements:
1. Intelligent Controllers:
a. Distributed architecture shall allow controllers to operate independently of the host. The architecture shall place key access decisions, event/action processing, and alarm monitoring functions within the controllers, eliminating degraded mode operation.
b. Flash memory management shall support firmware updates and revisions to be downloaded to the system. Upgrades to the hardware and software shall occur seamlessly without the loss of database, configurations, or historical report data.

c. Manufacturers: Subject to compliance with requirements, provide Field Controllers or comparable product by one of the following:
    1) Honeywell NetAXS Controller (NetAXS-123 and NetAXS-4 are the two types of NetAXS controllers).
    2) Honeywell P-Series Controller (PRO-2200 (Legacy), PRO-3200 are the types of P-Series controllers).
    3) Intelligent Controller Board: Honeywell Security PRO32IC
    4) Honeywell N-1000 or PW-2000 Controller (Legacy only).
    5) Honeywell Security NS2 or NS2+ (Legacy only).

2. Field Hardware:
    a. The security management system shall be equipped with access control field hardware required to receive alarms and administer all access granted/denied decisions. All field hardware shall meet UL requirements.
    b. Intelligent Controller Board: Honeywell Security PRO32IC
    c. Dual Reader Module (DRM): Honeywell Security PRO32R2
    d. Alarm Input Module (AIM): Honeywell Security PRO32IN. 16 Inputs 2 Outputs.
    e. Relay Output Module (ROM): Honeywell Security PRO32OUT. 16 Outputs 2 Inputs.

G. System Integrations:
1. Network and Digital Video Recording Systems:
    a. The Security Management System shall provide fully integrated support for a powerful network and digital video recording and transmission system. The Security Management System shall record, search and transmit video, and shall provide users with live, pre and post- event assessment capabilities. The NVRs/DVRs shall be seamlessly integrated with existing video equipment and incorporated into any TCP/IP network. The NVRs/DVRs shall provide multiple levels of integration with the Security Management System software, providing control of the network or digital video system from the access control application.
    b. WIN-PAK shall support the following Network (NVRs) and Digital Video Recorders (DVRs).
        1) MAXPRO NVR.
        2) MAXPRO NVR HYBRID.
        3) Rapid Eye (Legacy only).
        4) Fusion (Legacy only).
2. Access Control Panels(Controllers):
    a. Honeywell P-Series Controller (PRO-2200 (Legacy), PRO-3200 are the types of P-Series controllers), Honeywell NetAXS Controller (NetAXS-123 and NetAXS-4 are the two types of NetAXS controllers). Honeywell N-1000, PW-2000, NS2, and NS2+ Controller are legacy controllers and are listed for reference to existing systems only.
    b. P Series Panels shall have the following capabilities:
        1) Supports ABA and WIEGAND card formats.
        2) Types of P-Series panels are: PRO-2200, PRO-3200.
        3) Eight SIO Boards are included in the PRO-2000 panel. A maximum of 16 SIO boards are supported by the PRO-3200 panel. SIO boards enable extended input and output capabilities to the panel.
        4) Readers, inputs, and outputs that can be connected to the panel are based on the type of SIO Board that is added to the panel. The SIO Board types include 16-Zone Input/Output (16 inputs, 2 outputs, and 0 readers), 16-Relay Output (0 inputs, 16 outputs, and o readers), 2-Reader I/O (2 inputs, 8 outputs, and 6 readers), and 1-Reader I/O (1 input, 2 outputs, and 2 readers).
    c. NetAXS Panels shall have the following capabilities:

1) Types of NetAXS panels available are: NetAXS-4 panel and NetAXS-123 panel.
2) Panels (NetAXS-123 and NetAXS-4) are called as Gateway panels when added directly to the communication server.
3) NetAXS-4 Gateway panel supports the downstream devices feature. This feature shall extend the input and output capabilities of the NetAXS-4 panels.
4) NX4IN and NX4OUT
   (a) NX4IN is a 32 input and 0 output downstream add on device
   (b) NX4OUT is a 2 input and 16 output downstream add on device
5) Supports only the WIEGAND card format. The NetAXS panel allows multiple sets of card numbers and site codes embedded in a card format. These multiple embedded sets will be represented as A, B, C, and D sets of card numbers and site codes. The A set shall be used as the default / primary card and site code numbers. The resulting maximum length of the card number will be 64-bits in length (20-digit card number). This is the reason that the system defaults will incorporate the ability to select a 20-digit card number size in addition to the existing 5, 12 and 16 digit
6) Supports 128 time slots and 256 holidays (per holiday group). Holidays shall be definable in two different holiday types thus allowing for different operational time definitions for each holiday type. The NetAXS panels shall have a provision to add a new time zone while within the panel database. After creating the new time zone, it shall be added to the Time Zones database and applied to the panel's database.
7) Panel options such as Anti-passback, Groups, Forgiveness, Continuous Card Reads, Reverse Read LEDs, Host Grant, Site Codes, and Command File can be set for providing access to the readers, input points, and output points attached to the NetAXS panels.
8) NetAXS-4 panel shall allow configuring of 14 inputs with default values. NetAXS-123 panel shall allow configuring 17 inputs with default values.
9) NetAXS-4 panel shall allow configuring of 16 inputs with default values. NetAXS-123 panel shall allow configuring 14 inputs with default values.
10) NetAXS-4 panel shall support 4 readers. NetAXS-123 shall support 6 readers controlling 3 doors where the "A" reader is the primary reader for the door and the "B" reader is the Out reader for the door when so used. The B Reader can be programmed separately regarding name, Advanced Options, Anti-Passback configuration, and Intrusion support. The B Reader cannot work alone as a Reader only. When used, the B reader will be tied to the A reader in terms of the interlock relationships pertaining to Door operation. The Advanced Options selection shall provide several advance features not normally used in the typical system and thus the reason they are accessed separately to reduce confusion for typical installations. For the NetAXS-123, Reader A and Reader B shall support their own settings.
11) The Groups option shall be supported only by the NetAXS-4 panels. A maximum of 64 groups shall be defined with a maximum of 76 relays.

d. N-1000 Series Panels (Legacy) shall have the following capabilities:
   1) Stores 5,000 cards/key codes, expandable to 25,000 with memory upgrade.
   2) Supports ABA and WIEGAND card formats.
   3) Stores eight format (software) commands, allowing use of cards with various bit structures and encoding schemes.
   4) Supports an option to define 63 time zones. Each time zone shall include a start time, end time, day of week specification and holiday specification. Time zones may be assigned to cards via access levels to define when the card is allowed

access. Time zones may be assigned to input points, to define when the input points are shunted (de-activated). Time zones may be assigned to output points (relays), to define when the output points are energized, for timed control of doors or devices.

5) Supports setting of panel options such as anti-passback, groups, and keypads for providing access for the readers, input points, and output points attached to the panel.
6) Supports the use of card readers in conjunction with keypads, in which users are required to enter a PIN, followed by a card, to gain access.
7) Supports an option to assign shunt times to input points, from 1-63 seconds, minutes, or hours, and debounce times to input points, from 1-255 seconds.
8) Supports an option to assign pulse times to output points, from 1-63 seconds, minutes, or hours.
9) Supports the option to interlock selected input and output points, in any combination. An interlocked input or output point shall take action based upon a change of state from another input or output point.
10) Stores 32 relay group definitions. Each group may be controlled with the same options available for individual relays.
11) Supports an option to define 32 holidays, for override of normal system operation.
12) Supports the followings mechanical and electrical specifications:
    (a) Mechanical specifications: Height: 14.6 inches (370mm), Width: 12.6 inches (320mm), Depth: 3.5 inches (89mm), Weight: 5.51 lb. (2.5kg).
    (b) Electrical Specifications: 16.5VAC 50 VA or +24 VDC @ 1.25 Amps

e. NS2+ Series Panels (Legacy) shall have the following capabilities:
1) Stores 10, 000 cards/key codes. (NS2 = 2,000 cards/key codes)
2) Supports WIEGAND card format.
3) Stores eight format (software) commands, allowing use of cards with various bit structures and encoding schemes.
4) Supports an option to define 63 time zones. Each time zone shall include a start time, end time, day of week specification and holiday specification. Time zones may be assigned to cards via access levels to define when the card is allowed access. Time zones may be assigned to input points, to define when the input points are shunted (de-activated).Time zones may be assigned to output points (relays), to define when the output points are energized, for timed control of doors or devices.
5) Supports setting of panel options such as anti-passback, groups, and key pads for providing access for the readers, input points, and output points attached to the panel.
6) Supports the use of card readers in conjunction with keypads, in which users are required to enter a PIN, followed by a card, to gain access.
7) Supports an option to assign shunt times to input points, from 1-63 seconds, minutes, or hours, and debounce times to input points, from 1-255 seconds.
8) Supports an option to assign pulse times to output points, from 1-63 seconds, minutes, or hours. Output points shall also have the ability to report in change of state status in the same way an alarm point would. This provides added awareness of door operation in critical installations.
9) Supports the option to interlock selected input and output points, in any combination. An interlocked input or output point shall take action based upon a change of state from another input or output point.

10) Supports an option to define 32 holidays, for override of normal system operation. Holidays shall be definable in two different holiday types thus allowing for different operational time definitions for each holiday type.
11) Supports the followings mechanical and electrical specifications:
(a) Mechanical specifications: Height: 14.6 inches (370mm), Width: 12.6 inches (320mm), Depth: 3.5 inches (89mm), Weight: 5.51 lb. (2.5kg).
12) Electrical Specifications: 16.5VAC 50 VA or +24 VDC @ 1.25 Amps.

3. Intrusion Detection Panels:
a. Honeywell VISTA-128FBP, VISTA-250FBP Controllers, Honeywell VISTA -128BPT, and Honeywell VISTA-250BPT.
1) General Requirements: The Security Management System shall support hardwired and TCP/IP communication for the VISTA 128FBP/VISTA-250 FBP panel. Each panel shall have 8 partitions and 15 zone lists. Zones, partitions, and the top-level panel shall have an events page, with all supported events present. Features:
(a) Disarm and unlock a door on card swipe.
(b) Arm and lock a door on card swipe.
(c) Common area arm/disarm.
(d) Access denied if intrusion system is in alarm or armed.
(e) Monitor and log intrusion system events and alarms in the Security Management System.
(f) Associate intrusion system events and alarms to video surveillance integrations.
b. Honeywell Galaxy Dimension Controllers: GALAXY GD264, GALAXY_GD_48, GALAXY_GD_96 GALAXY_GD_520, Firmware 6.02 and above, Ethernet module firmware 2.08 and above controllers. Honeywell Galaxy Grade 3 Controllers: GALAXY_144, GALAXY_20, Firmware 5.04/5.50 and above, Ethernet module firmware 2.01 and above. Honeywell Classic Panel Controllers: GALAXY_60, GALAXY_128, GALAXY_500, GALAXY_504, GALAXY_512, Firmware 4.50 and above, Ethernet module firmware 2.10 and above.
1) Security Management System users are able to control and monitor Group and zone status using the Security Management System client, and control the individual zones and groups using Security Management System Access control credentials. Depending on the combined user profiles and access permissions defined in Security Management System, Security Management System cardholder is allowed or denied permission to arm/disarm zones and groups. The access control functionality of the intrusion panel is disabled when the integration is operational. Features:
(a) Disarm a zone on a card swipe.
(b) Arm a zone on consecutive card swipes. Security Management System will support definition of quantity of swipes required and the timeout time in seconds to recognize consecutive swipes.
(c) Security Management System supports linking of intrusion panel users with Security Management System cardholders.
(d) Security Management System operators may be given control permissions for intrusion input and output alarms.
(e) Security Management System can associate alarm events with video commands to look at current or historic footage.
(f) Security Management System stores and reports on intrusion events.

H. Controller for High Density Installations (PRO3200):

1. Designed for high density installations. Supporting up to 16 readers per enclosure and 32 readers per intelligent controller along with up to 100,000 card capacity provides a combination of small installation footprint and superior cost per door ratio.
2. The PRO22R1 provides I/O support for one card access reader, while the PRO32R2 supports two card access readers. Both interface with the intelligent control module (PRO32IC). In the event that communication to the intelligent control module is lost, the card access readers can be individually configured to allow entrance based on security needs. This customization allows for a door to be configured as locked, unlocked, or access only via valid facility code.
3. The PRO32OUT interfaces with the intelligent control module (PRO32IC) providing up to 12 or 16, Form C, 12 VDC, 2A relay output controls depending if the board is rack or tile-mounted and power fail and panel tamper when tile mounted. Relays may be used for elevator control, status annunciation and for general facility control, such as door monitoring.
4. The PRO32IN interfaces with the intelligent control module (PRO32IC) providing 16 supervised alarm inputs and a dedicated power fail and panel tamper when tile mounted. An analog to digital converter samples the input values and the digitized result is filtered and processed. Filter parameters are configurable for each input point, resulting in the ability to specify a custom End-Of-Line (EOL) resistance value, sensitivity range and timing parameter.
5. The PRO3200 Series of access modules are designed to accommodate various mounting options. Units can be mounted in a rack configuration (PRO22ENC1, PRO22ENC2 and PRO22ENC5) when space is limited, or in a tile-mount configuration (PRO22ENC3).
6. PRO22ENC1 is a wall-mounted enclosure rack unit.
7. PRO22ENC2 is a 19 inch rack-mounted enclosure rack unit.
8. PRO22ENC5 is a rack unit which fits inside a customer's enclosure.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine site conditions to determine site conditions are acceptable without qualifications. Notify Owner in writing if deficiencies are found. Starting work is evidence that site conditions are acceptable.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

A. System, including but not limited to access control, alarm monitoring and reporting, time management, and user identification cards shall be installed in accordance with the manufacturer's installation instructions.

B. Supervise installation to appraise ongoing progress of other trades and contracts, make allowances for all ongoing work, and coordinate the requirements of the installation of the System.

3.04 FIELD TESTING AND CERTIFICATION

A. Testing: The control, alarm monitoring and reporting, time management, and user identification cards shall be tested in accordance with the following:
   1. Conduct a complete inspection and test of all installed access control and security monitoring equipment. This includes testing and verifying connection to equipment of

other divisions such as life safety and elevators.

2. Provide staff to test all devices and all operational features of the System for witness by the Owner's representative and authorities having jurisdiction as applicable.
3. Correct deficiencies until satisfactory results are obtained.
4. Submit written copies of test results.

3.05 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 281523
INTERCOM ENTRY SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Intercom entry system and associated door/entry stations, interior stations, and accessories.

1.02 RELATED REQUIREMENTS

A. Section 078400 - Firestopping.

B. Section 087100 - Door Hardware: Electrically operated door hardware, for interface with intercom entry system.

C. Section 260526 - Grounding and Bonding for Electrical Systems.

D. Section 260533.13 - Conduit for Electrical Systems.

E. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

1.03 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction.

C. NFPA 70 - National Electrical Code.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the placement of intercom stations with millwork, furniture, equipment, etc. installed under other sections or by others.
   2. Coordinate the work with other installers to provide power for equipment at required locations.
   3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Preinstallation Meetings:
   1. Conduct meeting with facility representative to review intercom station and equipment locations.
   2. Conduct meeting with facility representative and other related equipment manufacturers to discuss intercom entry system interface requirements.

C. Sequencing:
   1. Do not install intercom stations until final surface finishes and painting are complete.

1.05 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for each system component. Include configurations, standard wiring diagrams, dimensions, finishes, service condition requirements, and installed features.

B. Shop Drawings: Include plan views indicating locations of system components and proposed size, type, and routing of conduits and/or cables. Include system interconnection schematic diagrams.

C. Field quality control test reports.

D. Project Record Documents: Record actual locations of system components and installed wiring arrangements and routing.

1.06 QUALITY ASSURANCE

A. Comply with the following:
   1. ADA Standards.
   2. NFPA 70 (National Electrical Code).
   3. Applicable TIA/EIA standards.

B. Installer Qualifications: Company with minimum three years documented experience with similar systems and providing contract maintenance service as a regular part of their business; manufacturer's authorized installer.

C. Products: Listed, classified, and labeled as suitable for the purpose intended.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

B. Store products in manufacturer's unopened packaging, keep dry and protect from damage until ready for installation.

1.08 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.09 WARRANTY

A. Provide minimum one year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Intercom Entry System - Basis of Design: Viking.
   1. Or Equal.

2.02 INTERCOM ENTRY SYSTEM

A. Provide new intercom entry system consisting of required equipment, conduit, boxes, wiring, connectors, hardware, accessories, system programming, etc. as necessary for a complete operating system that provides the functional intent indicated.

B. System Description:
   1. System Type: Audio-video, analog.
   2. System Capacity: See drawings for exact quantities of door/entry and master stations.
   3. Interface with Other Systems:
      a. Provide products compatible with other systems requiring interface with intercom entry system.
      b. Interface with electrically operated door hardware as specified in Section 087100.
         1) Capable of locking/unlocking/releasing controlled doors.
      c. Interface with facility's video surveillance system.
         1) Capable of viewing door/entry station cameras from video surveillance system.
         2) Capable of viewing designated video surveillance system cameras from intercom entry system interior stations.

C. Door/Entry Stations:
   1. Vandal resistant, with tamper proof hardware.
   2. Suitable for the environment where installed.
   3. Provide means to initiate call to designated interior station(s).
   4. Provide for hands-free two-way communication with interior station(s).

5. Audio-Video Door/Entry Station:
    a. Furnished with integral video camera for door/entry monitoring and visitor identification.
    b. Call Initiation: Single button; initiates call to pre-determined interior station(s).
    c. Finish: Painted steel or stainless steel.
    d. Mounting: As indicated on drawings.
    e. Features:
        1) LED low-light video illumination.
        2) PTZ (Pan/Tilt/Zoom) camera.

D. Interior Stations:
1. Audio-Video Master Station:
    a. Provides for hands-free and handset two-way communication with designated door/entry station(s) and other interior station(s).
    b. Provide means for unlocking/releasing door corresponding to door/entry station communication is established with.
    c. Provide means to initiate video monitoring of connected door/entry station(s).
    d. Mounting: Wall or desk.
    e. Features:
        1) Adjustable audible call notification volume.
        2) Adjustable communication volume.
        3) Adjustable LCD screen brightness.
        4) PTZ (Pan/Tilt/Zoom) camera control.

E. Accessories:
1. Provide components as indicated or as required for a complete operating system.
2. Wiring: Provide manufacturer's recommended cables as indicated or as required for connections between system components.
3. Provide accessory racks/cabinets as indicated or as required for equipment mounting.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that characteristics of system components are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive system components.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).

B. Install products in accordance with manufacturer's instructions.

C. Wiring Method for NFPA 70 Class 2/Class 3 Circuits: Unless otherwise indicated or required by NFPA 70, use wiring in conduit.
1. Conduit: Comply with Section 260533.13.

D. Provide grounding and bonding in accordance with Section 260526.

E. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 078400.

F. Identify system wiring and components in accordance with Section 260553.

3.03 FIELD QUALITY CONTROL

A. Test to verify wiring is free of shorts and grounds.

B. Prepare and start system in accordance with manufacturer's instructions.

C. Test system for proper operation.

D. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.

E. Submit detailed reports indicating inspection and testing results and corrective actions taken.

3.04 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.05 CLOSEOUT ACTIVITIES

A. Demonstration: Demonstrate proper operation of system to Owner, and correct deficiencies or make adjustments as directed.

B. Training: Train Owner's personnel on operation, adjustment, and maintenance of system.
   1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.

3.06 PROTECTION

A. Protect installed system components from subsequent construction operations.

END OF SECTION

SECTION 284600
FIRE DETECTION AND ALARM

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fire alarm system design and installation, including all components, wiring, and conduit.

B. Transmitters for communication with supervising station.

1.02 RELATED REQUIREMENTS

A. Section 078400 - Firestopping: Materials and methods for work to be performed by this installer.

B. Section 087100 - Door Hardware: Electrically operated locks and door holder devices to be monitored and released by fire alarm system.

C. Section 233300 - Air Duct Accessories: Smoke dampers monitored and controlled by fire alarm system.

1.03 REFERENCE STANDARDS

A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines.

B. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design.

C. IEEE C62.41.2 - IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits.

D. NFPA 70 - National Electrical Code.

E. NFPA 72 - National Fire Alarm and Signaling Code.

1.04 SUBMITTALS

A. Evidence of designer qualifications.

B. Design Documents: Submit all information required for plan review and permitting by authorities having jurisdiction, including but not limited to floor plans, riser diagrams, and description of operation:

1. Copy (if any) of list of data required by authority having jurisdiction.
2. NFPA 72 "Record of Completion", filled out to the extent known at the time.
3. Clear and concise description of operation, with input/output matrix similar to that shown in NFPA 72 Appendix A-7-5-2.2(9), and complete listing of software required.
4. System zone boundaries and interfaces to fire safety systems.
5. Location of all components, circuits, and raceways; mark components with identifiers used in control unit programming.
6. Circuit layouts; number, size, and type of raceways and conductors; conduit fill calculations; spare capacity calculations; notification appliance circuit voltage drop calculations.
7. List of all devices on each signaling line circuit, with spare capacity indicated.
8. Manufacturer's detailed data sheet for each component, including wiring diagrams, installation instructions, and circuit length limitations.
9. Description of power supplies; if secondary power is by battery include calculations demonstrating adequate battery power.
10. Certification by either the manufacturer of the control unit or by the manufacturer of each other component that the components are compatible with the control unit.

11. Certification by the manufacturer of the control unit that the system design complies with Contract Documents.
12. Certification by Contractor that the system design complies with Contract Documents.
13. Do not show existing components to be removed.

C. Evidence of installer qualifications.

D. Evidence of maintenance contractor qualifications, if different from installer.

E. Inspection and Test Reports:
1. Submit inspection and test plan prior to closeout demonstration.
2. Submit documentation of satisfactory inspections and tests.
3. Submit NFPA 72 "Inspection and Test Form," filled out.

F. Operating and Maintenance Data:
1. Complete set of specified design documents, as approved by authority having jurisdiction.
2. Additional printed set of project record documents and closeout documents, bound or filed in same manuals.
3. Contact information for firm that will be providing contract maintenance and trouble call-back service.
4. List of recommended spare parts, tools, and instruments for testing.
5. Replacement parts list with current prices, and source of supply.
6. Detailed troubleshooting guide and large scale input/output matrix.
7. Preventive maintenance, inspection, and testing schedule complying with NFPA 72; provide printed copy and computer format acceptable to Owner.
8. Detailed but easy to read explanation of procedures to be taken by non-technical administrative personnel in the event of system trouble, when routine testing is being conducted, for fire drills, and when entering into contracts for remodeling.

G. Project Record Documents:
1. Complete set of floor plans showing actual installed locations of components, conduit, and zones.
2. "As installed" wiring and schematic diagrams, with final terminal identifications.
3. "As programmed" operating sequences, including control events by device, updated input/output chart, and voice messages by event.

H. Closeout Documents:
1. Certification by manufacturer that the system has been installed in compliance with manufacturer's installation requirements, is complete, and is in satisfactory operating condition.
2. NFPA 72 "Record of Completion", filled out completely and signed by installer and authorized representative of authority having jurisdiction.

1.05 QUALITY ASSURANCE

A. Designer Qualifications: NICET Level III or IV (3 or 4) certified fire alarm technician or registered fire protection engineer, employed by fire alarm control panel manufacturer, Contractor, or installer , with experience designing fire alarm systems in the jurisdictional area of the authorities having jurisdiction.

B. Installer Qualifications: Firm with minimum 3 years documented experience installing fire alarm systems of the specified type and providing contract maintenance service as a regular part of their business.
1. Authorized representative of control unit manufacturer; submit manufacturer's certification that installer is authorized; include name and title of manufacturer's representative making certification.

2. Installer Personnel: At least 2 years of experience installing fire alarm systems.
3. Supervisor: NICET level III or IV (3 or 4) certified fire alarm technician; furnish name and address.

1.06 WARRANTY

A. Provide control panel manufacturer's warranty that system components other than wire and conduit are free from defects and will remain so for 1 year after date of Substantial Completion.

B. Provide installer's warranty that the installation is free from defects and will remain so for 1 year after date of Substantial Completion.

PART 2 PRODUCTS

2.01 FIRE ALARM SYSTEM

A. Fire Alarm System: Provide modifications/extensions to the existing automatic fire detection and alarm system at High School South, Washington Street Elementary and Pine Beach Elementary.
   1. Provide all components necessary, regardless of whether shown in Contract Documents or not.
   2. Protected Premises: Entire building shown on drawings.
   3. Comply with the following; where requirements conflict, order of precedence of requirements is as listed:
      a. ADA Standards.
      b. The requirements of the local authority having jurisdiction.
      c. Applicable local codes.
      d. Contract Documents (drawings and specifications).
      e. NFPA 72; where the word "should" is used consider that provision mandatory; where conflicts between requirements require deviation from NFPA 72, identify deviations clearly on design documents.
   4. Evacuation Alarm: Multiple smoke zones; allow for evacuation notification of any individual zone or combination of zones, in addition to general evacuation of entire premises.
   5. General Evacuation Zones: Each smoke zone is considered a general evacuation zone unless otherwise indicated, with alarm notification in all zones on the same floor, on the floor above, and the floor below.
   6. Fire Alarm Control Unit: See drawings for exact location.

B. Supervising Stations and Fire Department Connections:
   1. Means of Transmission to Remote Station: Digital alarm communicator transmitter (DACT), 2 telephone lines.

C. Circuits:
   1. Initiating Device Circuits (IDC): Class B, Style A.
   2. Signaling Line Circuits (SLC) Within Single Building: Class B, Style 0.5.
   3. Notification Appliance Circuits (NAC): Class B, Style W.

D. Spare Capacity:
   1. Initiating Device Circuits: Minimum 25 percent spare capacity.
   2. Notification Appliance Circuits: Minimum 25 percent spare capacity.
   3. Fire Alarm Control Units: Capable of handling all circuits utilized to capacity without requiring additional components other than plug-in control modules.

E. Power Sources:
   1. Primary: Dedicated branch circuits of the facility power distribution system.
   2. Secondary: Storage batteries.

3. Capacity: Sufficient to operate entire system for period specified by NFPA 72.
4. Each Computer System: Provide uninterruptible power supply (UPS).

202 EXISTING COMPONENTS

A. Existing Fire Alarm Systems: Remove existing components indicated and incorporate new components into existing system, under warranty as if they were new; do not take existing portions of system out of service until new portions are fully operational, tested, and connected to existing system.

B. Remove unused existing components and materials from site and dispose of properly.

203 FIRE SAFETY SYSTEMS INTERFACES

A. Supervision: Provide supervisory signals in accordance with NFPA 72 for the following:
1. Sprinkler water control valves.
2. Dry-pipe sprinkler system pressure.
3. Dry-pipe sprinkler valve room low temperature.
4. Elevator shut-down control circuits.

B. Alarm: Provide alarm initiation in accordance with NFPA 72 for the following:
1. Sprinkler water flow.
2. Kitchen hood suppression activation; also disconnect fuel source from cooking equipment.
3. Elevator lobby, elevator hoistway, and elevator machine room smoke detectors.
4. Duct smoke detectors.

C. Elevators:
1. Elevator lobby, hoistway, and machine room smoke detectors: Elevator recall for fire fighters' service.
2. Elevator Machine Room Heat Detector: Shut down elevator power prior to hoistway sprinkler activation.
3. Sprinkler pressure or waterflow: Shut down elevator power prior to hoistway sprinkler activation.

D. HVAC:
1. Duct Smoke Detectors: Close dampers indicated; shut down air handlers indicated.

E. Doors:
1. Smoke Barrier Door Magnetic Holders: Release upon activation of smoke detectors in smoke zone on either side of door, upon alarm from manual pull station on same floor, and upon sprinkler activation on same floor. Refer to Section 087100.
2. Electromagnetic Door Locks on Egress Doors: Unlock upon activation of any alarm initiating device or suppression system in smoke zone that doors serve as egress from. Refer to Section 087100.

204 COMPONENTS

A. General:
1. Provide flush mounted units where installed in finish areas; in unfinished areas, surface mounted unit are acceptable.
2. Provide legible, permanent labels for each control device, using identification used in operation and maintenance data.

B. Fire Alarm Control Units: Analog, addressable type; listed, classified, and labeled as suitable for the purpose intended.

C. Initiating Devices:
1. Addressable Systems:
a. Addressable Devices: Individually identifiable by addressable fire alarm control unit.

b. Provide suitable addressable interface modules as indicated or as required for connection to conventional (non-addressable) devices and other components that provide a dry closure output.

2. Manual Pull Stations: Quantities as indicated on the drawings.
3. Smoke Detectors: Quantities as indicated on the drawings.
4. Duct Smoke Detectors: Quantities as indicated on the drawings.
5. Heat Detectors: Quantities as indicated on the drawings.

D. Notification Appliances:
1. Strobes: Quantities as indicated on the drawings.
2. Horn/Strobes: Quantities as indicated on the drawings.
3. Speakers: Quantities as indicated on the drawings.

E. Circuit Conductors: Copper; provide 200 feet extra; color code and label.

F. Surge Protection: In accordance with IEEE C62.41.2 category B combination waveform and NFPA 70; except for optical fiber conductors.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with applicable codes, NFPA 72, NFPA 70, and Contract Documents.

B. Conceal all wiring, conduit, boxes, and supports where installed in finished areas.

C. Obtain Owner's approval of locations of devices, before installation.

D. Install instruction cards and labels.

3.02 INSPECTION AND TESTING FOR COMPLETION

A. Notify Owner 7 days prior to beginning completion inspections and tests.

B. Notify authorities having jurisdiction and comply with their requirements for scheduling inspections and tests and for observation by their personnel.

C. Provide the services of the installer's supervisor or person with equivalent qualifications to supervise inspection and testing, correction, and adjustments.

D. Prepare for testing by ensuring that all work is complete and correct; perform preliminary tests as required.

E. Provide all tools, software, and supplies required to accomplish inspection and testing.

F. Perform inspection and testing in accordance with NFPA 72 and requirements of local authorities; document each inspection and test.

G. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.

H. Diagnostic Period: After successful completion of inspections and tests, Operate system in normal mode for at least 14 days without any system or equipment malfunctions.
1. Record all system operations and malfunctions.
2. If a malfunction occurs, start diagnostic period over after correction of malfunction.
3. Owner will provide attendant operator personnel during diagnostic period; schedule training to allow Owner personnel to perform normal duties.
4. At end of successful diagnostic period, fill out and submit NFPA 72 "Inspection and Testing Form."

3.03 CLOSEOUT

A. Closeout Demonstration: Demonstrate proper operation of all functions to Owner.

1. Be prepared to conduct any of the required tests.
2. Have at least one copy of operation and maintenance data, preliminary copy of project record drawings, input/output matrix, and operator instruction chart(s) available during demonstration.
3. Have authorized technical representative of control unit manufacturer present during demonstration.
4. Demonstration may be combined with inspection and testing required by authority having jurisdiction; notify authority having jurisdiction in time to schedule demonstration.
5. Repeat demonstration until successful.

END OF SECTION