SECTION 05 52 00 - ALUMINUM RAILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Division 01 - General Requirements, and other applicable specification sections in the Project Manual apply to the work specified in this Section.

1.2 SUMMARY

A. Scope: Provide design and engineering, labor, material, equipment, related services, and supervision required, including, but not limited to, manufacturing, fabrication, erection, and installation for aluminum railings as required for the complete performance of the work, and as shown on the Drawings and as herein specified.

B. Section Includes: The work specified in this Section includes, but shall not be limited to, the following:

1. Aluminum railings.

1.3 REFERENCES

A. General: The publications listed below form a part of this Specification to the extent referenced. The publications are referred to in the text by the basic designation only. The edition/revision of the referenced publications shall be the latest date as of the date of the Contract Documents, unless otherwise specified.

B. Aluminum Association, Inc. (AA):

1. AA SAS-30, "Specifications for Aluminum Structures."

C. American Architectural Manufacturers Association (AAMA):

1. AAMA 611, "Voluntary Specifications for Anodized Architectural Aluminum (Revised)."
2. AAMA 2604, "Voluntary Specification, Performance Requirements, and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels."
3. AAMA 2605, "Voluntary Specification, Performance Requirements, and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels."
4. AAMA Aluminum Curtain Wall Series No. 12, "Structural Properties of Glass."

D. American Iron and Steel Institute (AISI):

1. AISI SG-673, Part I, "Specification for the Design of Cold-Formed Steel Structural Members."

E. American Welding Society (AWS):

1. AWS D1.2, "Structural Welding Code – Aluminum."

F. ASTM International (ASTM):

1. ASTM B26/B26M,"Standard Specification for Aluminum-Alloy Sand Castings."
2. ASTM B209/B209M,"Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate."
3. ASTM B210/B210M, "Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes."
4. ASTM B221/B221M, "Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes."
5. ASTM B247/B247M, "Standard Specification for Aluminum and Aluminum-Alloy Die Forgings, Hand Forgings, and Rolled Ring Forgings."
6. ASTM B429/B429M, "Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube."
7. ASTM C1048, "Standard Specification for Heat-Treated Flat Glass - Kind HS, Kind FT Coated and Uncoated Glass."
8. ASTM C1107, "Standard Specification for Packaged Dry, Hydraulic Cement Grout (Non-Shrink)."
9. ASTM E488, "Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements."
10. ASTM E985, "Standard Specification for Permanent Metal Railing Systems and Rails for Buildings."

G. Code of Federal Regulation (CFR):

1. 16 CFR Part 1201, "Safety Standard for Architectural Glazing Material" (Consumer Products Safety Commission).

H. National Association of Architectural Metal Manufacturers (NAAMM):

1. NAAMM MFM, "Metal Finishes Manual."

1.4 DEFINITIONS

A. See definitions in ASTM E985 for railing-related terms that apply to this Section.

1.5 PERFORMANCE REQUIREMENTS

A. General: Railings shall withstand structural loading as determined by allowable design working stresses of materials based on the following standards.

1. Aluminum: AA SAS-30.

B. Structural Performance: Provide railings capable of withstanding the following structural loads without exceeding allowable design working stress of materials for railings, anchors, and connections:
1. Top Rail: Shall withstand the following loads:

a. Concentrated load of 200 lbf (890 N) applied at any point and in any direction.
b. Uniform load of 50 lbf per foot (730 N/m) applied horizontally or vertically downward.
c. Concentrated and uniform loads above need not be assumed to act concurrently.

C. Thermal Movements: Railings shall allow for movements resulting from 120 degree F (49 degree C) changes in ambient and 180 degree F (82 degree C) surface temperatures. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

D. Corrosion Resistance: Separate incompatible materials to prevent galvanic corrosion.

1.6 SUBMITTALS

A. General: Submit under provisions of Section 01 33 00 - Submittal Procedures.

B. Product Data:

1. Submit manufacturer’s data sheets on each product to be used, including, but not limited to, the following:

   a. Preparation instructions and recommendations.
   b. Storage and handling requirements and recommendations.
   c. Installation methods.

2. Submit product data for manufacturers product lines of railings assembled from standard components, including, but not limited to, the following:

   a. Grout, anchoring cements and paint products.

C. Shop Drawings: Submit shop drawings showing fabrication and installation of railings. Include plans, elevations, sections, details, and attachments to other work.

D. Samples:

1. Color Selection: Submit manufacturer's color charts showing the full range of colors available for products with factory-applied color finishes.
2. Finish Selection: Provide sections of railing or flat sheet metal which depict available mechanical surface finishes.
3. Verification Samples: For each type of exposed finish required, prepared on components indicated below and of same thickness and metal indicated for the work. If finishes involve normal color and texture variations, include sample sets showing the full range of variations expected.

   a. 6 inch (152 mm) long sections of each different linear railing member, including top rails.

E. Quality Control Submittals:

1. Design Data: For installed railing systems indicated to comply with certain design loadings, include structural analysis data signed and sealed by the professional engineer who was responsible for their preparation.
2. Qualification Data: Submit documentation demonstrating capability and experience in performing installations of the same type and scope as specified by this Section. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

3. Certificates: Submit certification by the manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOC's).

1.7 QUALITY ASSURANCE

A. Qualifications:

1. Manufacturer Qualifications: Manufacturer shall be a firm engaged in the manufacture of aluminum railings of types and sizes required, and whose products have been in satisfactory use in similar service for a minimum of 15 years.
2. Installer Qualifications: Installer shall be a firm that shall have a minimum of five years of successful installation experience with projects utilizing aluminum railings similar in type and scope to that required for this Project.

B. Regulatory Requirements: Comply with applicable requirements of the laws, codes, ordinances, and regulations of Federal, State, and local authorities having jurisdiction. Obtain necessary approvals from such authorities.

C. Mock-Ups: Prior to installation 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. Locate mock-ups on site in location and of size indicated or, if not indicated, as directed by the Architect. Demonstrate the proposed range of aesthetic effects and workmanship to be expected in the completed work. Obtain the Architect’s acceptance of mock-ups before start of final unit of work. Retain and maintain mock-ups during construction in undisturbed condition as a standard for judging completed unit of work.

1. When directed, demolish and remove mock-ups from the Project site.
2. Accepted mock-ups in undisturbed condition at time of Substantial Completion may become part of completed unit of work.

D. Single Source Responsibility: Obtain aluminum railings from a single source with resources to produce products of consistent quality in appearance and physical properties without delaying the work.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.9 PROJECT CONDITIONS

A. Environmental Requirements: Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.10 WARRANTY

A. General: See Section 01 77 00 - Closeout Procedures.

B. Warranty: Provide manufacturer's standard form outlining the terms and conditions of their Standard Limited Warranty:
   1. Surface Finish Warranty: One-year limited warranty.
   2. Material Integrity Warranty: One year limited warranty.

C. Additional Owner Rights: The warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to and run concurrent with other warranties made by the Contractor under requirements of the Contract Documents.

1.11 EXTRA MATERIALS

A. All supplemental materials not expressly specified in this section shall be approved by the Architect prior to installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: Items specified are to establish a standard of quality for design, function, materials, and appearance. Equivalent products by other manufacturers are acceptable. The Architect will be the sole judge of the basis of what is equivalent.

2.2 MATERIALS

A. Application/Scope of Work:

   1. Architectural railing.
   2. Pedestrian gate.

B. Basis of Design: Hansen Architectural Systems, Inc.; 5500 SE Alexander Street, Hillsboro, OR 97123; Toll Free Tel: 800-599-2965, Fax: 503-356-8478; Email: info@aluminumrailing.com; Web: www.aluminumrailing.com.

C. Metals: Provide metal free from pitting, seam marks, roller marks, stains, discolorations, and other imperfections where exposed to view on finished units.

   1. Aluminum: Provide alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than strength and durability properties of alloy and temper designated below for each aluminum form required.

      a. Extruded Bar and Tube: ASTM B221/B221M, Alloy 6063-T5/T52.
      b. Extruded Structural Pipe and Tube: ASTM B429/B429M, Alloy 6063-T832.
      c. Drawn Seamless Tube: ASTM B210/B210M, Alloy 6063-T832.
      d. Plate and Sheet: ASTM B209/B209M, Alloy 6061-T6.
      e. Die and Hand Forgings: ASTM B247/B247M, Alloy 6061-T6.

f. Castings: ASTM B26/B26M, Alloy A356-T6.

2. Brackets, Flanges, and Anchors: Provide cast or formed metal of same type of material and finish as supported rails, unless otherwise indicated.

a. Provide cast brackets with flange tapped for concealed anchorage to threaded hanger bolt.
b. Provide formed or cast brackets with predrilled hole for exposed bolt anchorage.
c. Provide formed steel brackets with predrilled hole for bolted anchorage and with snap-on cover that matches rail finish and conceals bracket base and bolt head.
d. Provide brackets with interlocking pieces that conceal anchorage. Locate set screws on bottom of bracket.

D. Railing Components:

1. Extruded Aluminum Components: Provide manufacturer's standard extruded aluminum components as follows:

a. Standard Post: 2.376 inches (60.35 mm) by 2.376 inches (60.35 mm) with radiused corner, 0.100 inch (2.54 mm) wall thickness.
b. Bottom Rail: 1.6926 inches (42.99 mm) high by 1.676 inches (43.57 mm) wide with a 0.765 inch (19.43 mm) wide pocket on the top and an open bottom.
c. Picket: 0.750 inches (19.05 mm) by 0.750 inches (19.05 mm), 0.062 inch (1.57 mm) wall thickness.
d. Top Rail: Circular cross section, radius as indicated on the Drawings or, if not indicated, as selected by the Architect from the manufacturer's standards with an open bottom, 0.0866 inch (2.20 mm) wall thickness.

2. Condensation Insert: Provide rigid plastic post insert to evacuate entrapped water in hollow sections of railing members, 2-3/8 inches (60 mm) by 2-3/8 inches (60 mm) by 4-1/8 inches (105 mm) high.

a. Basis of Design: "Trim-Line Picket Railing System," Hansen Architectural Systems, Inc.

E. Fasteners:

1. Railing Component Anchors: Use fasteners fabricated from same basic metal, unless otherwise indicated. Do not use metals that are corrosive or incompatible with materials joined.

a. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless exposed fasteners are unavoidable or are standard fastening method for handrail and railing indicated.
b. Provide Phillips flat-head machine screws for exposed fasteners, unless otherwise indicated.

2. Cast-in-Place and Post Installed Anchors: Provide anchors of type indicated below, fabricated from corrosion-resistant materials with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four items the load imposed when installed in concrete, as determined by testing per ASTM E488 conducted by a qualified independent testing agency.

a. Cast-in-place anchors.

F. Grout and Anchoring Cement:

1. Non-Shrink, Non-Metallic Grout: Provide factory-packaged, non-staining, non-corrosive, non-gaseous grout complying with ASTM C1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.3 FABRICATION

A. Assemble railings in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

B. Form changes in direction of railing members as shown on the Drawings.

C. Fabricate railings by connecting members with railing manufacturer's standard concealed mechanical fasteners and fittings, unless otherwise indicated. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.

D. Provide manufacturer's standard wall brackets, flanges, miscellaneous fittings, and anchors to connect railing members to other construction.

E. Provide inserts and other anchorage devices to connect railings to concrete or masonry. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.

F. Shear and punch metals cleanly and accurately. Remove burrs from exposed cut edges.

G. Cut, reinforce, drill, and tap components as indicated on the Drawings to receive finish hardware, screws, and similar items.

H. Close exposed ends of railing members with prefabricated end fittings.

2.4 FINISHES

A. General: Comply with NAAMM MFM for recommendations for applying and designating finishes.

1. Appearance of Finished Work:

a. Variations in appearance of abutting or adjacent units are acceptable if they are within one-half of the range of final samples. Noticeable variations in the same unit are not acceptable.
b. Variations in appearance of other components are acceptable if they are within the range of final samples and are assembled or installed to minimize contrast.

B. Aluminum Finish: Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

1. Powder Coat Finish: AA-C12-C42-R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid chromate-fluoride-phosphate conversion coating; Organic Coating: as

specified below). Prepare, pretreat, and apply manufacturer's standard baked powder coat finish. Comply with coating manufacturer's written instructions for cleaning, surface preparation, pretreatment, and application.

a. Material: Polyester powder coating, 3.0 mil (0.076 mm). Comply with AAMA 2605, including, but not limited to, average film thickness. Subject to compliance with requirements, provide one of the following products:

1) "1PC-440 Series," Forrest Paint Co.
2) "Series 75," TIGER Drylac U.S.A., Inc.

b. Color: Black.
c. Gloss: To be determined.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions: Examine areas and conditions under which the work is to be installed, 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. Examine substrates to receive anchors verifying that locations of concealed reinforcements have been clearly marked for the Installer. Locate reinforcements and mark locations if not already done.
2. Beginning of the work shall indicate acceptance of the areas and conditions as satisfactory by the Installer.

3.2 PREPARATION

A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installing anchors, such as sleeves, concrete inserts, anchor bolts, and miscellaneous items having integral anchors, that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to the Project site.

3.3 INSTALLATION

A. General:

1. Fitting: Fit exposed connections together to form tight, hairline joints.
2. Cutting and Placement: Set railings accurately in location, alignment, and elevation measured from established lines and levels and free from rack.
   a. Do not weld, cut, or abrade coated or finished surfaces of railing components that are intended for field connection by mechanical or other means without further cutting or fitting.
   b. Align rails so variations from level or parallel alignment do not exceed 1/4 inch in 12 feet (1.6 mm per m).
   c. Provide manufacturer's proprietary system to evacuate entrapped water in hollow sections of railing members that are exposed to exterior or to moisture from

condensation or other sources, in order to prevent water from entering the concrete slab. In lieu of the manufacturer's proprietary system, if acceptable to the Architect, provide another means to evacuate the entrapped water, i.e., a weephole and epoxy fill system ("drill-and-fill").

d. Anchor posts in concrete by forming or core drilling holes not less than 5 inches (127 mm) deep and 3/4 inch (19 mm) greater than outside diameter of post. Clean holes of loose material, insert posts, and fill annular space between post and concrete with non-metallic, non-shrink grout, mixed and placed to comply with anchoring material manufacturer's directions.

1) Cover anchorage joint with a round steel flange attached to post by set screws.

3. Corrosion Protection: Provide separation as recommended by manufacturer on concealed surfaces of aluminum that will be in contact with grout, concrete, masonry, wood, or dissimilar metals.
4. Adjusting: Adjust railings before anchoring to ensure alignment at abutting joint's space posts at interval indicated, but not less than required to achieve structural loads.
5. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

B. Non-Welded Railings Connections: Use mechanical joints for permanently connecting railing components. Use wood blocks and padding to prevent damage to railing members and fittings.

3.4 ADJUSTING AND CLEANING

A. Touch-Up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and appoint exposed areas with same material.

B. Cleaning: Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in field to shop; make required alterations and refinish entire unit, or provide new units.

3.5 PROTECTION

A. Provide final protection and maintain conditions in a manner acceptable to the Installer, that shall ensure that the aluminum railings shall be without damage at time of Substantial Completion.

B. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at the time of Substantial Completion.

END OF SECTION 05 52 00

PAGE

INTENTIONALLY

LEFT

BLANK

SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Mechanical door hardware for the following:
   a. Swinging doors.
2. Cylinders for door hardware specified in other Sections.
3. Electrified door hardware.

B. Related Requirements:

1. Section 081113 "Hollow Metal Doors and Frames".
2. Section 081216 "Interior Aluminum Doors and Frames" for interior aluminum frame doors.
3. Section 081416 "Flush Wood Doors".
4. Section 084113 "Aluminum-Framed Entrances and Storefronts" for exterior entrance doors.
5. Section 087100.01 "Door Hardware Sets".
6. Section 283100 "Intrusion Detection" for detection devices installed at door openings and provided as part of an intrusion-detection system.
7. Section 284621.13 "Conventional Fire-Alarm Systems" for connections to building fire-alarm system.

1.3 COORDINATION

A. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

B. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.

C. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.

D. Existing Openings: Where hardware components are scheduled for application to existing construction or where modifications to existing door hardware are required, field verify existing conditions and coordinate installation of door hardware to suit opening conditions and to provide proper door operation.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Conference participants shall include Installer's Architectural Hardware Consultant.

B. Keying Conference: Conduct conference at Project site.

1. Conference participants shall include the representative of the lock and cylinder manufacturer.
2. Incorporate conference decisions into keying schedule after reviewing door hardware keying system including, but not limited to, the following:
   a. Flow of traffic and degree of security required.
   b. Preliminary key system schematic diagram.
   c. Requirements for key control system.
   d. Requirements for access control.
   e. Address for delivery of keys.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For electrified door hardware.

1. Include diagrams for power, signal, and control wiring.
2. Include Point to Point wiring diagrams.
3. Include details of interface of electrified door hardware and building safety and security systems.

C. Samples: For each exposed product in each finish specified, in manufacturer's standard size.

1. Tag Samples with full product description to coordinate Samples with door hardware schedule.

D. Samples for Initial Selection: For each type of exposed finish.

E. Samples for Verification: For each type of exposed product, in each finish specified.

1. Sample Size: Full-size units or minimum 2-by-4-inch Samples for sheet and 4-inch long Samples for other products.
   a. Full-size Samples will be returned to Contractor. Units that are acceptable and remain undamaged through submittal, review, and field comparison process may, after final check of operation, be incorporated into the Work, within limitations of keying requirements.
2. Tag Samples with full product description to coordinate Samples with door hardware schedule.

F. Door Hardware Schedule: Prepared by or under the supervision of Installer's Architectural Hardware Consultant. Coordinate door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Submittal Sequence: Submit door hardware schedule concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate the fabrication of other work that is critical in Project construction schedule.
2. Format: Use Door & hardware Institute’s scheduling sequence and format as in door hardware schedule in the Contract Documents.
3. Content: Include the following information:
   a. Identification number, location, hand, fire rating, size, and material of each door and frame.
   b. Locations of each door hardware set cross-referenced to Drawings on floor plans and to door and frame schedule.

c. Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.
d. Description of electrified door hardware sequences of operation and interfaces with other building control systems.
e. Fastenings and other installation information.
f. Explanation of abbreviations, symbols, and designations contained in door hardware schedule.
g. Mounting locations for door hardware.
h. List of related door devices specified in other Sections for each door and frame.

G. Keying Schedule: Prepared by or under the supervision of Installer's Architectural Hardware Consultant, detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations that are coordinated with the Contract Documents.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Hardware Supplier an Architectural Hardware Consultant, (AHC).

B. Product Certificates: For each type of electrified door hardware.

1. Certify that door hardware for use on each type and size of labeled fire-rated doors complies with listed fire-rated door assemblies.

C. Product Test Reports: For compliance with accessibility requirements, for tests performed by manufacturer and witnessed by a qualified testing agency, for door hardware on doors located in accessible routes.

D. Field quality-control reports.

E. Sample Warranty: For special warranty.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of door hardware to include in maintenance manuals.

B. Schedules: Final Door Hardware and keying schedule.

1.8 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Door Hardware: As listed in the Hardware Sets .

1.9 QUALITY ASSURANCE

A. Installer Qualifications: Supplier of products and an employer of workers trained and approved by product manufacturers and of an Architectural Hardware Consultant who is available during the course of the Work to consult Contractor, Architect, and Owner about door hardware and keying.

1. Warehousing Facilities: In Project's vicinity.
2. Scheduling Responsibility: Preparation of door hardware and keying schedule.
3. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

B. Architectural Hardware Consultant Qualifications: A person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and who is currently certified by DHI as an Architectural Hardware Consultant (AHC) and an Architectural Openings Consultant (AOC).

1.10 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.

B. Tag each item or package separately with identification coordinated with the final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.

C. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.

D. Deliver keys and permanent cores to Owner by registered mail or overnight package service.

1.11 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Structural failures including excessive deflection, cracking, or breakage.
   b. Faulty operation of doors and door hardware.
   c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.
2. Warranty Period: 10 years from date of Substantial Completion unless otherwise indicated below:
   a. Exit Devices: 5 years from date of Substantial Completion.
   b. Manual Closers: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain each type of door hardware from single manufacturer.

1. Provide electrified door hardware from same manufacturer as mechanical door hardware unless otherwise indicated. Manufacturers that perform electrical modifications and that are listed by a testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.
2. The following manufacturers were used in the hardware sets.

1.	Butt Hinges	Stanley	STN
2.	Continuous Hinges	ABH Man.	STN
3.	Locks and Latchsets	Best	BST
4.	Cylinders and Cores	Best	BST
5.	Surface Closers	Dorma	DOR
6.	Exit Devices	Precision	PRE
7.	Overhead Stop/Holders	Dorma	DOR
8.	Door Pulls	Trimco	TRM
9.	Flushbolts	Trimco	TRM
10.	Protection Plates	Trimco	TRM
11.	Wall/Floor Stops	Trimco	TRM
12.	Thresholds and Gasketing	National Guard	NGP
13.	Silencers	Trimco	TRM

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Rated Door Assemblies: Where fire-rated doors are indicated, provide door hardware complying with NFPA 80 that is listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.

B. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that complies with requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.

1. Air Leakage Rate: Maximum air leakage of 0.3 cfm/sq. ft. at the tested pressure differential of 0.3-inch wg of water.

C. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Means of Egress Doors: Latches do not require more than 15 lbf to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.

E. Accessibility Requirements: For door hardware on doors in an accessible route, comply with A117.1

1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf.
2. Comply with the following maximum opening-force requirements:
   a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf applied perpendicular to door.
   b. Sliding or Folding Doors: 5 lbf applied parallel to door at latch.
   c. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.
3. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch high.
4. Adjust door closer sweep periods so that, from an open position of 90 degrees, the door will take at least 5 seconds to move to a position of 12 degrees from the latch.
5. Adjust spring hinges so that, from an open position of 70 degrees, the door will take at least 1.5 seconds to move to the closed position.

2.3 HINGES

A. Hinges: BHMA A156.1,

B. ANSI A8111 Heavy Weight Concealed Bearing.

C. Acceptable manufacturers: Basis of Design*

Type	Stanley	Hager
Heavy Weight	*CB168	CB1168
Heavy Weight	*CB199	CB1199
Electrified Hinges	*CECB168-16	CB1168EMN

2.4 CONTINUOUS HINGES

A. Continuous Hinges: BHMA A156.26; minimum 0.120-inch- thick, hinge leaves with minimum overall width of 4 inches; fabricated to full height of door and frame and to template screw locations; with components finished after milling and drilling are complete.

B. Continuous, Gear-Type Hinges: Extruded-aluminum, pinless, geared hinge leaves joined by a continuous extruded-aluminum channel cap; with concealed, self-lubricating thrust bearings.

C. Acceptable manufacturers: Basis of Design*

Type	ABH	Bommer	Stanley
Heavy Duty	*110 HD series	FM83HD series	661 HDHD series
*Indicates Basis of Design			

2.5 MECHANICAL LOCKS AND LATCHES

A. Lock Functions: As indicated in door hardware schedule.

B. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:

1. Mortise Locks: Minimum 3/4-inch latchbolt throw.
2. Deadbolts: Minimum 1-inch bolt throw.

C. Lock Backset: 2-3/4 inches unless otherwise indicated.

D. Lock Trim:

1. Description: Best Locking Systems
2. Levers: Forged or Cast.
   Lever Design: 16
3. Roses: Forged or Cast.
   Rose Design: H
4. Dummy Trim: Match lever lock trim and escutcheons.

E. Strikes: Provide manufacturer's standard strike for each lock bolt or latchbolt complying with requirements indicated for applicable lock or latch and with strike box and curved lip extended to protect frame; finished to match lock or latch.

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: Manufacturer's special strike box fabricated for aluminum framing.
4. Rabbet Front and Strike: Provide on locksets for rabbeted meeting stiles.

F. Mortise Locks: BHMA A156.13; Operational Grade 1, Security Grade 2; stamped steel case with steel or brass parts; Series 1000.

1. Acceptable Manufacturers and Models: Basis of Design*

Best	Sargent	Schlage
*45H Series	8200 Series	L9000 Series

*Indicates Basis of Design

Note: Acceptable Manufacturers must match the Design of the specified Lever and Rose listed above.

2.6 AUXILIARY LOCKS

A. Mortise Auxiliary Locks: BHMA A156.36; Grade 1; with strike that suits frame.

1. Acceptable Manufacturers:

Best	Sargent	Schlage
*48H Series	4870 Series	L400 Series
*Indicates Basis of Design		

2.7 EXIT LOCKS

A. Exit Locks and Alarms: BHMA A156.29, Grade 1.

B. Acceptable Manufacturers:

Precision	Sargent	Von Duprin
*Apex 2000 Series	19-GL-80 Series	98 series
*Indicates Basis of Design		

2.8 MANUAL FLUSH BOLTS

A. Manual Flush Bolts: BHMA A156.16; minimum 3/4-inch throw; designed for mortising into door edge.

B. Acceptable Manufacturers:

Bolt/Door Type	Trimco	Burns	ABH
Manual	*3917	590	1855
*Indicates Basis of Design			

2.9 LOCK CYLINDERS

A. High-Security Lock Cylinders: BHMA A156.30; Grade 1 permanent cores that are removable; face finished to match lockset.

1. Type: Best Locking Systems, (No Substitutions)

B. Construction Master Keys: Provide cylinders with feature that permits voiding of construction keys without cylinder removal. Provide 10 construction master keys.

C. Construction Cores: Provide construction cores that are replaceable by permanent cores. Provide 10 construction master keys.

2.10 KEYING

A. Keying System: Factory registered, complying with guidelines in BHMA A156.28, appendix. Provide one extra key blank for each lock. Incorporate decisions made in keying conference.

B. Keys: Nickel silver.

1. Stamping: Permanently inscribe each key with a visual key control number and include the following notation:
   a. Notation: "DO NOT DUPLICATE."

2.11 KEY CONTROL SYSTEM

A. Key Control Cabinet: BHMA A156.28; metal cabinet with baked-enamel finish; containing key-holding hooks, labels, two sets of key tags with self-locking key holders, key-gathering envelopes, and temporary and permanent markers; with key capacity of 150 percent of the number of locks.

1. Wall-Mounted Cabinet: Grade 1 cabinet with hinged-panel door equipped with key-holding panels and pin-tumbler cylinder door lock.

B. Key Control System Software: Multiple-index system for recording and reporting key-holder listings, tracking keys and lock and key history, and printing receipts for transactions. Include instruction manual.

1. Best Locking Systems: KEYSTONE

2.12 OPERATING TRIM

A. Operating Trim: BHMA A156.6; Stainless Steel unless otherwise indicated.

B. Acceptable Manufacturers:

Type	Trimco
Push/Pull bars	AP436-36 series (No Substitutions)

2.13 PROTECTION PLATES

Material: Plastic plates with four beveled sides. Counter screw heads. Width: 2-inch less door width on stop (push) side and 1-inch less door width on face (pull) side.

Provide Kickplates for doors with door closer.

Provide Kick Plates and/or Mop Plates to match the sill height of openings with side lite frames.

Provide Kick Plates and/or Mop Plates .050 thickness, beveled 4 edges.

Acceptable Manufacturers:

Trimco	Burns	Rockwood
*KO050	EQUAL	EQUAL
*M050	EQUAL	EQUAL
*Indicates Basis of Design		

2.14 ACCESSORIES FOR PAIRS OF DOORS

A. Coordinators: BHMA A156.3; consisting of active-leaf, hold-open lever and inactive-leaf release trigger; fabricated from steel with nylon-coated strike plates; with built-in, adjustable safety release.

B. Carry-Open Bars: BHMA A156.3; prevent the inactive leaf from opening before the active leaf; provide polished brass or bronze carry-open bars with strike plate for inactive leaves of pairs of doors unless automatic or self-latching bolts are used.

C. Astragals: BHMA A156.22.

2.15 SURFACE CLOSERS

A. Surface Closers: BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves and forged-steel main arm. Comply with manufacturer's written instructions for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

B. Acceptable Manufacturers:

Dorma	Sargent	LCN
*8916FC Series	350 Series	4040XP Series
*Indicates Basis of Design		

2.16 OVERHEAD STOPS AND HOLDERS

A. Overhead Stops and Holders: BHMA A156.8.

B. Acceptable Manufacturers:

Dorma	ABH	Glynn Johnson
*900 Series	9020 Series	90S Series
*Indicates Basis of Design		

2.17 MECHCANICAL STOPS AND HOLDERS

A. Floor and Wall Stops: BHMA A156.16

B. Acceptable Manufacturers:

Type	Trimco	Burns	Rockwood
Wall Stop	*1270CVSV		
Floor Stop	*1211	521	441H
*Indicates Basis of Design			

2.18 DOOR GASKETING

A. Door Gasketing: BHMA A156.22; with resilient or flexible seal strips that are easily replaceable and readily available from stocks maintained by manufacturer.

B. Acceptable Manufacturers:

1. Model as listed in Hardware Sets.

2. Acceptable Manufacturers:

National Guard Products	Pemko	Reece	Legacy

C. Maximum Air Leakage: When tested according to ASTM E283 with tested pressure differential of 0.3-inch wg, as follows:

1. Smoke-Rated Gasketing: 0.3 cfm/sq. ft. of door opening.

2. Gasketing on Single Doors: 0.3 cfm/sq. ft. of door opening.
3. Gasketing on Double Doors: 0.50 cfm per foot of door opening.

2.19 THRESHOLDS

A. Thresholds: BHMA A156.21; fabricated to full width of opening indicated.

B. Acceptable Manufacturers:

C. "SIA" designates Non-Slip Finish

2.20 FABRICATION

A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location except in conjunction with required fire-rating labels and as otherwise approved by Architect.

1. Manufacturer's identification is permitted on rim of lock cylinders only.

B. Base Metals: Produce door hardware units of base metal indicated, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18.

C. Fasteners: Provide door hardware manufactured to comply with published templates prepared for machine, wood, and sheet metal screws. Provide screws that comply with commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware unless otherwise indicated.

1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.
2. Fire-Rated Applications:
   a. Wood or Machine Screws: For the following:
      1) Hinges mortised to doors or frames; use threaded-to-the-head wood screws for wood doors and frames.
      2) Strike plates to frames.
      3) Closers to doors and frames.
   b. Steel Through Bolts: For the following unless door blocking is provided:
      1) Surface hinges to doors.
      2) Closers to doors and frames.
      3) Surface-mounted exit devices.
3. Spacers or Sex Bolts: For through bolting of hollow-metal doors.
4. Gasketing Fasteners: Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

2.21 FINISHES

A. Provide finishes complying with BHMA A156.18 as indicated in door hardware schedule.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance of the Work.

B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

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

3.2 PREPARATION

A. Steel Doors and Frames: For surface-applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.

B. Wood Doors: Comply with door and hardware manufacturers' written instructions.

3.3 INSTALLATION

A. Mounting Heights: Mount door hardware units at heights unless otherwise indicated or required to comply with governing regulations.

1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
2. Custom Steel Doors and Frames: HMMA 831.
3. Wood Doors: DHI's "Recommended Locations for Architectural Hardware for Wood Flush Doors."

B. Install each door hardware item to comply with manufacturer's 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. Do not install surface-mounted items until finishes have been completed on substrates involved.

1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

C. Hinges: Install types and in quantities indicated in door hardware schedule, but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.

D. Intermediate Offset Pivots: Where offset pivots are indicated, provide intermediate offset pivots in quantities indicated in door hardware schedule, but not fewer than one intermediate offset pivot per door and one additional intermediate offset pivot for every 30 inches of door height greater than 90 inches.

E. Lock Cylinders: Install construction cores to secure building and areas during construction period.

1. Replace construction cores with permanent cores as directed by Owner.
2. Furnish permanent cores to Owner for installation.

F. Key Control System:

1. Key Control Cabinet: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.
2. Key Lock Boxes: Install where indicated or approved by Architect to provide controlled access for fire and medical emergency personnel.
3. Key Control System Software: Set up multiple-index system based on final keying schedule.

G. Boxed Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings. Verify location with Architect.

1. Configuration: Provide least number of power supplies required to adequately serve doors with electrified door hardware.

H. Thresholds: Set thresholds for exterior doors and other doors indicated in full bed of sealant complying with requirements specified in Section 079200 "Joint Sealants."

I. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they will impede traffic.

J. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

1. Do not notch perimeter gasketing to install other surface-applied hardware.

K. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.

L. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

3.4 FIELD QUALITY CONTROL

A. Independent Architectural Hardware Consultant: Engage a qualified independent Architectural Hardware Consultant to perform inspections and to prepare inspection reports.

1. Independent Architectural Hardware Consultant will inspect door hardware and state in each report whether installed work complies with or deviates from requirements, including whether door hardware is properly installed and adjusted.

3.5 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

1. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.

2. Spring Hinges: Adjust to achieve positive latching when door is allowed to close freely from an open position of 70 degrees and so that closing time complies with accessibility requirements of authorities having jurisdiction.
3. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.

B. Occupancy Adjustment: Approximately six months after date of Substantial Completion, Installer's Architectural Hardware Consultant shall examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors, door hardware, and electrified door hardware.

3.6 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items as necessary to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

3.7 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

B. Maintenance Service: Beginning at Substantial Completion, maintenance service shall include six months' full maintenance by skilled employees of door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door and door hardware operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

3.8 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain door hardware.

Manufacturer List

Code	Name
AB	ABH Manufacturing Inc.
BE	Best Access Systems
BY	By Others
DM	Dorma Door Controls
NA	National Guard
PR	Precision
RC	RCI
ST	Stanley
TR	Trimco

Option List

Code	Description
G	Back-to-Back Mounted
CD	CYLINDER DOGGING
FC	Full Plastic Cover
CSK	COUNTER SINKING OF KICK and MOP PLATES
MCS	Mullion Cap Spacer
SIA	ABRASIVE COATING
VIN	Visual Indicator
VIT	Visual Indictor Thumb-Turn
7/8"LTC	7/8" Lip-To-Center Strike

Finish List

Code	Description
689	Aluminum Anodized (Clear)
626	Satin Chromium Plated
630	Satin Stainless Steel
GRY	Grey

Hardware Sets

Hardware Group:01				
Doors: 001, 037				
each to have:				
Qty	Product	Model	Fin	Man
3ea.	Hinges	CB168 4 ½" x 4 ½"	652	STN
1ea.	Classroom	45H7R16H	630	BST
1ea.	Core	I/C	626	BST
1ea.	Door Closer	8916FC IS	689	DRM
1ea.	Kickplate	KO050 8" x 2" LDW	630	TRM
Set	Gasketing	5020C	GRY	NGP

Hardware Group: 02				
Doors: 002, 003, 102, 103				
each to have:				
Qty	Product	Model	Fin	Man
3ea.	Hinges	CB168 4 ½" x 4 ½"	630	STN
1ea.	Deadlock	48H7R	626	BST
1ea.	Core	I/C	626	BST
1set.	Door Push/Pull Set	1035-1 4x16	710CU	TRM
1ea.	Door Closer	8916FC IS	689	DRM
1ea.	Kick Plate	KO050 8" x 2" LDW	630	TRM
1ea.	Mop Plate	M050 4" x 1" LDW	630	TRM
Set	Gasketing	5020C	GRY	NGP

Hardware Group: 03				
Doors: 004, 005, 104, 105, 124				
each to have:				
Qty	Product	Model	Fin	Man
3ea.	Hinges	CB179 4 ½" x 4 ½"	652	STN
1ea.	Privacy Set	45H0L16H VIN x VIT	630	BST
1ea.	Kick Plate	KO050 8" x 2" LDW	630	TRM
1ea.	Mop Plate	M050 4" x 2" LDW	630	TRM
1ea.	Wall Stop	1270CVSV	626	TRM
Set	Gasketing	5020C	GRY	NGP

Hardware Group: 04				
Doors: 010				
pair to have:				
Qty	Product	Model	Fin	Man
6ea.	Hinges	CB168 4 ½" x 4 ½" NRP	652	STN
1ea.	Key Removeable Mullion	KR822 x MCS822	PT	PRE
1ea	Mullion Cylinder	Rim Type	626	BST
1ea.	Core	I/C	626	BST
1ea.	Mullion Storage Kit	KMCB822SK	689	PRE
1ea.	Kit Cylinder	Rim Type	626	BST
1ea.	Core	I/C	626	BST
1ea.	Panic Device	2108CD x 4908B	630	PRE
1ea.	Trim Cylinder	Rim Type	626	BST
1ea.	Dogging Cylinder	Mortise Type	626	BST
1ea.	Cores	I/C	626	BST
1ea.	Panic Device	2102CD x V4902B	630	PRE
1ea.	Dogging Cylinder	Mortise Type	626	BST
1ea.	Core	I/C	626	BST
2ea	Door Closers w/ Stop	8916FC DS	689	DOR
2ea.	Kick Plates	KO050 8" x 2" LDW	630	TRM
2ea.	Mop Plates	M050 4" x 1" LDW	630	TRM
Set	Gasketing	5020C	GRY	NGP

Hardware Group:05				
Doors: 027A, 134				
each to have:				
Qty	Product	Model	Fin	Man
3ea.	Hinges	CB179 4 ½" x 4 ½"	652	STN
1ea.	Storeroom	45H7D16H	630	BST
1ea.	Core	I/C	626	BST
1ea.	Kick Plate	KO050 8" x 2" LDW	630	TRM
1ea.	Wall Stop	1270CVSV	626	TRM
3ea.	Silencers	1229A	GRY	TRM

Hardware Group: 06				
Doors: 012,012A, 014, 027A, 039, 131, 146				
each to have:				
Qty	Product	Model	Fin	Man
3ea.	Hinges	CB179 4 ½" x 4 ½"	652	STN
1ea.	Storeroom	45H7D16H	630	BST
1ea.	Core	I/C	626	BST
1ea.	Door Closer	8916FC	689	Dor
1ea.	Kick Plate	KO050 8" x 2" LDW	630	TRM
1ea.	Wall Stop	1270CVSV	626	TRM
Set.	Gasketing	5020C	GRY	NGP

Hardware Group: 07 NOT USED				
Doors:				
each to have:				
Qty	Product	Model	Fin	Man
3ea.	Hinges	CB179 4 ½" x 4 ½"	652	STN
1ea.	Passage Set	45H0N16H	630	BST
1ea.	Kick Plate	KO050 8" x 2" LDW	630	TRM
1ea.	Wall Stop	1270CVSV	626	TRM
Set.	Gasketing	5020C	GRY	NGP

Hardware Group: 08				
Doors: 027				
pair to have:				
Qty	Product	Model	Fin	Man
6ea.	Hinges	CB168 5" x 4 ½" NRP	652	STN
2ea.	Flush Bolts	3917	626	TRM
1ea.	DP Strike	3910	626	TRM
1ea.	Deadlock	48HL	630	BST
2ea.	Cores	I/C	626	BST
4ea.	Door Pull/Push Bars	AP436-G-36	710	TRM
2ea.	Door Closers w/Stop/HO	8916FC SDS HO	689	DOR
2ea.	Kick Plates	KO050 8" x 1" LDW	630	TRM
2ea.	Mop Plates	M050 4" x 1" LDW	630	TRM
2ea.	Silencers	1229A	GRY	NGP

Hardware Group: 09				
Doors: 033				
each to have:				
Qty	Product	Model	Fin	Man
3ea.	Hinges	CB168 5" x 4 ½" NRP	652	STN
1ea	Panic Device	FL2108 x V4908B	630	PRE

1ea.	Cylinder	Rim Type	626	BST
1ea.	Core	I/C	626	BST
1ea.	Door Closer w/Stop	8916FC SDS	689	DOR
1ea.	Kick Plate	KO050 8” x 2” LDW	630	TRM
1ea.	Mop Plate	M050 4” x 1” LDW	630	TRM
Set	Gasketing	5020C	GRY	NGP

Hardware Group: 10				
Doors: 001-1				
Qty	Product	Model	Fin	Man
3ea.	Hinges	CB179 4 ½” x 4 ½” NRP	652	STN
1ea.	Storeroom	45H7D16H	630	BST
1ea.	Core	I/C	626	BST
1ea.	Kick Plate	KO050 4” x 2” LDW	630	TRM
1ea.	Overhead Stop	900S series	626	DOR
3ea.	Silencers	1229A	GRY	TRM

Hardware Group: 11				
Doors: 100E, 153C				
each to have:				
Qty	Product	Model	Fin	Man
3ea.	Hinges	CB179 4 ½” x 4 ½” NRP	652	STN
1ea.	Storeroom	45H7D16H	630	BST
1ea.	Core	I/C	626	BST
1ea.	Door Closer w/Stop	8916FC DS	689	DOR
1ea.	Kick Plate	KO050 8” x 2” LDW	630	TRM
1ea.	Mop Plate	M050 4” x 1” LDW	630	TRM
3ea.	Silencers	1229A	GRY	TRM

Hardware Group: 12				
Doors: 100C, 100CA, 100F, 153B				
pair to have:				
Qty	Product	Model	Fin	Man
6ea.	Hinges	CB179 4 ½” x 4 ½” NRP	652	STN
2ea.	Flush bolts	3917	626	TRM
1ea.	DP Strike	3910	626	TRM
1ea.	Storeroom	45H7D16H	630	BST
1ea.	Core	I/C	626	BST
1ea.	Door Closer w/Stop/Holder	8916FC DST	689	DOR
1ea.	OH Stop/Holder	900H	626	DOR
2ea.	Mop Plates	M050 4” x 1” LDW	630	TRM
2ea.	Silencers	1229A	GRY	TRM

Hardware Group:13

Doors: 011, 013, 110, 120, 140, 153, 165				
each to have:				
Qty	Product	Model	Fin	Man
2ea.	Hinges	CB168 4 ½" x 4 ½" NRP	652	STN
1ea.	Electrified Hinge	CECB168-12C 4 ½" x 4 ½"	652	STN
1ea.	Electrified Lock	45HW7DEU16H RQE	630	BST
1ea.	Core	I/C	626	BST
1ea.	Low Voltage Power Supply	PS615RF BB24-7	PTD	BST
1ea.	Wiring Harness	WH-192P		BST
1ea.	Wiring Harness	WH-XXP (Length Req'd)		BST
1ea.	Wiring Harness	WH-6E		BST
1ea.	Wiring Diagram	Point to Point		
1ea.	Door Closer	8916FC		DOR
1ea.	Kick Plate	KO050 8" x 2" LDW	630	TRM
1ea.	Mop Plate	M050 4" x 1" LDW	630	TRM
1ea.	Wall Stop	1270CVSV	626	TRM
3ea.	Silencers	1229A	GRY	NGP
1ea.	Card Reader	By Security Contractor		
Operational Description: Access via authorized card at card reader or via mechanical key. Free egress always via inside lever of lockset.				

Hardware Group: 14				
Doors: 023, 035, 041, 100D, 151				
each to have:				
Qty	Product	Model	Fin	Man
3ea.	Hinges	CB168 4 ½" x 4 ½"	652	STN
1ea.	Classroom	45H7R16H	630	BST
1ea.	Core	I/C	626	BST
1ea.	Door Closer	8916FC	689	DOR
1ea.	Kick Plate	KO050 8" x 2" LDW	630	TRM
1ea.	Mop Plate	M050 4" x 1" LDW	630	TRM
1ea.	Wall Stop	1270CVSV	626	TRM
Set	Gasketing	5020C	GRY	NGP

Hardware Group: 15				
Doors: 012A, 022, 027B, 038, 111, 122, 123, 132, 133, 143, 144, 150A, 152, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 171, 300, 301, 302				
each to have:				
Qty	Product	Model	Fin	Man
3ea.	Hinges	CB179 4 ½" x 4 ½"	652	STN
1ea.	Classroom	45H7R16H	630	BST
1ea.	Core	I/C	626	BST
1ea.	Kick Plate	KO050 4" x 2" LDW	630	TRM
1ea.	Mop Plate	M050 8" x 1" LDW	630	TRM
1ea.	Wall Stop	1270CVSV	626	TRM
Set	Gasketing	5020C	GRY	NGP

Hardware Group: 16				
Doors: 121, 164				
each to have:				
Qty	Product	Model	Fin	Man
3ea.	Hinges	CB179 4 ½" x 4 ½"	652	STN
1ea.	Storeroom	45H7D16H	630	BST
1ea.	Core	I/C	626	BST
1ea.	Kick Plate	KO050 8" x 2" LDW	630	TRM
1ea.	Wall Stop	1270CVSV	626	TRM
3ea.	Silencers	1229A	GRY	TRM

Hardware Group: 17				
Doors: 027-1, 201, 202				
each to have:				
Qty	Product	Model	Fin	Man
3ea.	Hinges	CB168 4 ½" x 4 ½" NRP	652	STN
1ea.	Panic Device	2108CD x V4908B	630	PRE
1ea.	Trim Cylinder	Rim Type	626	BST
1ea.	Core	I/C	626	BST
1ea.	Dogging Cylinder	Mortise Type	626	BST
1ea.	Core	I/C	626	BST
1ea.	Door Closer/Stop	8916FC SDS	689	DOR
1ea.	Kick Plate	KO050 8" x 2" LDW	630	TRM
Set	Gasketing	5020C	GRY	NGP

Hardware Group: 17A				
Doors: 141				
each to have:				
Qty	Product	Model	Fin	Man
3ea.	Hinges	CB168 4 ½" x 4 ½" NRP	652	STN
1ea.	Electrified Hinge	CECB168-16 4 ½" x 4 ½"	652	STN
1ea.	Panic Device	C-E2103CD x V4908B FSE	630	PRE
1ea.	Power Supply	PS161-6 BB	PTD	PRE
1ea.	Wiring Harness	WH-192P		BST
1ea.	Wiring Harness	WH-XXP (Length Req'd)		BST
1ea.	Wiring Harness	WH-6E		BST
1ea.	Wiring Diagram	Point to Point		
1ea.	Trim Cylinder	Rim Type	626	BST
1ea.	Core	I/C	626	BST
1ea.	Dogging Cylinder	Mortise Type	626	BST
1ea.	Core	I/C	626	BST

1ea.	Door Closer/Stop	8916FC SDS	689	DOR
1ea.	Kick Plate	KO050 8" x 2" LDW	630	TRM
Set	Gasketing	5020C	GRY	NGP
1ea.	Card Reader	By Security Contractor		
Operational Description: Access via authorized card at card reader which unlocks outside lever trim or via mechanical key. Free egress always via panic device touch bar.				

Hardware Group: 18				
Doors: 150,				
pair to have:				
Qty	Product	Model	Fin	Man
6ea.	Hinges	CB179 4 ½" x 4 ½" NRP	652	STN
2ea.	Flush Bolts	3917	626	TRM
1ea.	DP Strike	3910	626	TRM
1ea.	Deadlock	48H7L	626	BST
1ea.	Core	I/C	626	BST
4ea.	Door Pull/Push Bars	AP436-G-36	710	TRM
2ea.	Door Closers w/Stop	8916FC SIS	689	DOR
2ea.	Mop Plates	M050 4" x 1" LDW	630	TRM
2ea.	Silencers	1229A	GRY	TRM

Hardware Group: 19				
Doors: 010A, 010B, 015, 016, 018, 019, 021, 022, 030, 031, 040				
each to have:				
Qty	Product	Model	Fin	Man
1ea.	Cylinder	Mortise Type	626	BST
1ea.	Core	I/C	626	BST
Note: Door Hardware by Door manufacturer				

Hardware Group: 20				
Doors: 170				
each to have:				
Qty	Product	Model	Fin	Man
6ea.	Hinges	CB168 4 ½" x 4 ½" NRP	652	STN
Set	Flush Bolts	3917	626	TRM
1ea.	DP Strike	3910	626	TRM
1ea.	Deadlock	48H7M	626	BST
2ea.	Cores	I/C	626	BST
4ea.	Door Pull/Push Bars	AP436-G-36	710	TRM
2ea.	Door Closers w/Stop	8916FC IS	689	DOR
2ea.	Kick Plates	KO050 8" x 2" LDW	630	TRM
2ea.	Mop Plates	M050 4" x 1" LDW	630	TRM

Set	Gasketing	5020C	GRY	NGP

Hardware Group: 21				
Doors: 017				
each to have:				
Qty	Product	Model	Fin	Man
3ea.	Hinges	CB179 4 ½" x 4 ½"	652	STN
1ea.	Storeroom	45H7D16H	630	BST
1ea.	Core	I/C	626	BST
1ea.	Door Closer w/Stop	8916FC IS	689	Dor
1ea.	Kick Plate	KO050 8" x 2" LDW	630	TRM
Set.	Gasketing	5020C	GRY	NGP

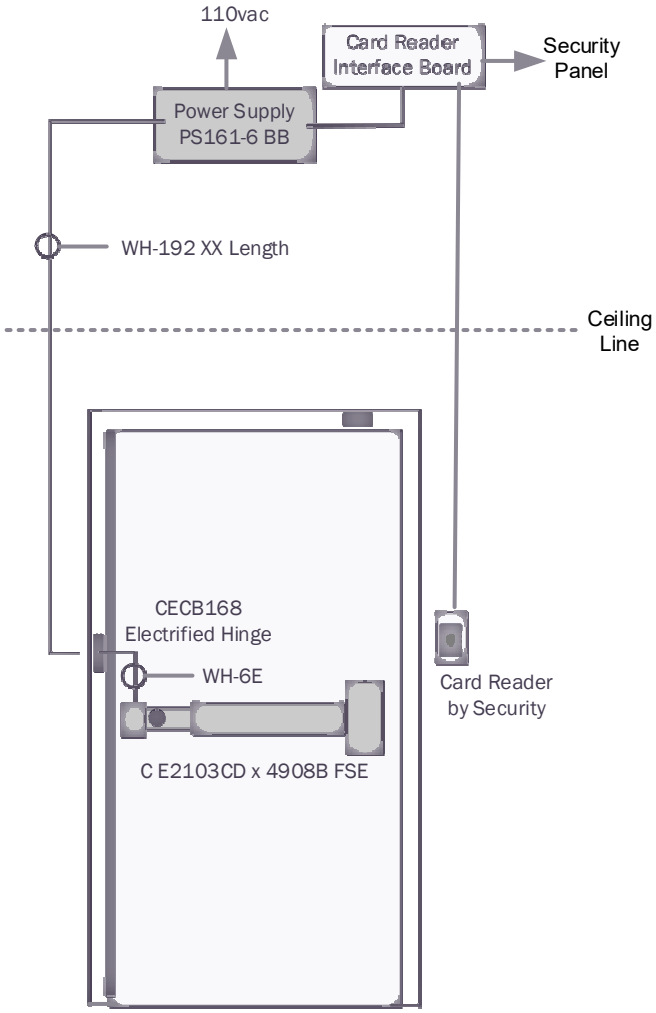
Hardware Group: 22				
Doors: 034A, 153A				
each to have:				
Qty	Product	Model	Fin	Man
3ea.	Hinges	CB168 4 ½" x 4 ½" NRP	652	STN
1ea	Panic Device	FL2108 x V4908B	630	PRE
1ea.	Cylinder	Rim Type	626	BST
1ea.	Core	I/C	626	BST
1ea.	Door Closer w/Stop	8916FC SDS	689	DOR
1ea.	Kick Plate	KO050 8" x 2" LDW	630	TRM
1ea.	Mop Plate	M050 4" x 1" LDW	630	TRM
Set	Gasketing	5020C	GRY	NGP

Hardware Group: 23				
Doors: ST12, ST13, ST14, ST22, ST24				
each to have:				
Qty	Product	Model	Fin	Man
4ea.	Hinges	CB168 4 ½" x 4 ½" NRP	652	STN
1ea	Panic Device	FL2114 x V4914B	630	PRE
1ea.	Door Closer w/Stop	8916FC SDS	689	DOR
1ea.	Kick Plate	KO050 8" x 2" LDW	630	TRM
1ea.	Mop Plate	M050 4" x 1" LDW	630	TRM
Set	Gasketing	5020C	GRY	NGP

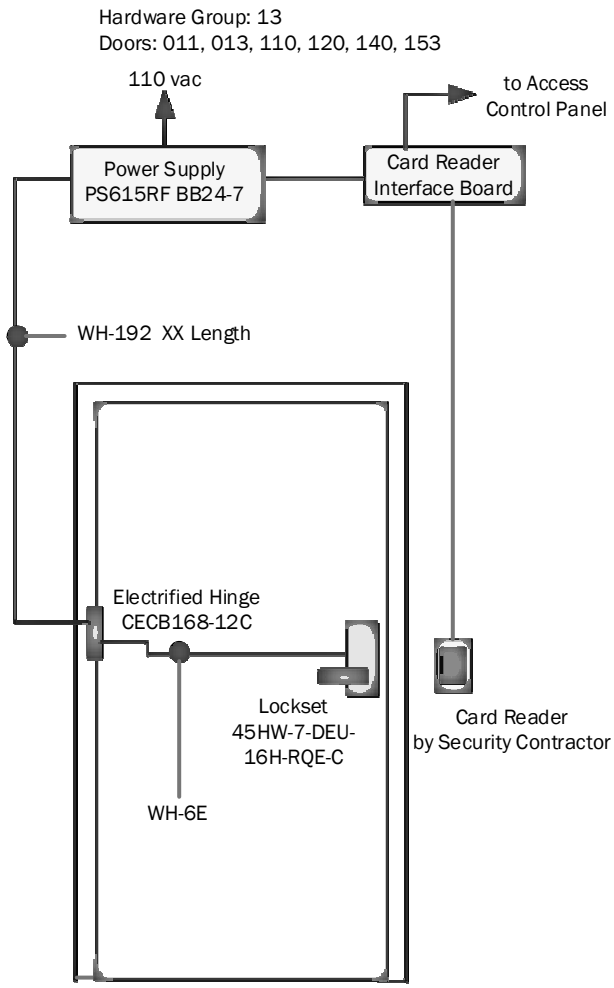
Hardware Group: 24				
Doors: ST01, ST02, ST03, ST04				
each to have:				
Qty	Product	Model	Fin	Man

3ea.	Hinges	CB168 5” x 4 ½” NRP	652	STN
1ea	Panic Device	FL2114 x V4914B	630	PRE
1ea.	Door Closer w/Stop	8916FC SDS	689	DOR
1ea.	Kick Plate	KO050 8” x 2” LDW	630	TRM
1ea.	Mop Plate	M050 4” x 1” LDW	630	TRM
Set	Gasketing	5020C	GRY	NGP

Hardware Group: 25				
Doors: MISC.				
each to have:				
Qty	Product	Model	Fin	Man
12ea.	Cores	I/C Keyed Existing System	626	BST
1 box	Key Blanks	Existing System Keyway		BST
1ea.	Key Cabinet	1201	PTD	LUND
3ea.	Classroom	45H7R16H	630	BST
3ea.	Door Closer	8916FC	689	DOR
3ea.	Wall Stop	1270CVSV	626	TRM



Operational Description: Access via authorized card at card reader which unlocks outside lever trim or via mechanical key. Free egress always via panic device touch bar.
Note: all wire to be stranded.



Operational Description: Access via authorized card at card reader or via mechanical key. Free egress always via inside lever of lockset.
Note: All wire to be stranded.

END OF SECTION

SECTION 23 09 50 - BUILDING AUTOMATION SYSTEM (BAS) GENERAL (BASE BID)

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. General Requirements

B. Description of Work

C. Quality Assurance

D. System Architecture

E. Distributed Processing Units/Quantity and Location

F. Demolition and Reuse of Existing Materials and Equipment

G. Sequence of Work

1.02 RELATED DOCUMENTS

A. Section 23 09 69 - Variable Frequency Controllers

B. Section 23 09 51 - Building Automation System (BAS) Basic Materials, Interface Devices, and Sensors

C. Section 23 09 53 - BAS Field Panels

D. Section 23 09 54 - BAS Communication Devices

E. Section 23 09 55 - BAS Software and Programming

F. Section 23 09 58 - Sequences of Operation

G. Section 23 09 59 - BAS Commissioning

1.03 DESCRIPTION OF WORK

A. The building automation system (BAS) defined in this specification shall interface with the Delaware Technical Community College (DTCC) Network , and shall utilize the BACnet communication requirements as defined by ASHRAE/ANSI 135 (current version and addendum) for all communication.

B. Contractor shall furnish and install a update to the existing building automation system (BAS). The new BAS shall utilize electronic sensing, microprocessor-based digital control, and electronic actuation of dampers and valves to perform control sequences and functions specified. The BAS for this project will generally consist of monitoring and control of systems listed below. Reference also control drawings, sequences of operation, and points lists.

C. The systems to be controlled under work of this section basically comprise New VAV Boxes with Re-heat coils, and maintaining existing, to remain pneumatic systems.

D. In addition, the following work will be provided:

1. A combination temperature / humidity sensor will be installed on the 3rd and 4th floors for each AHU. The location will be determined by the owner. These sensors will provide indication only to the BAS.
2. Install a duct static pressure sensor in each AHU supply duct between the 1st and 2nd floors. This will include programming to control the AHU's supply fan and return fan VFDs. As these fan VFDs are not currently linked, additional TAB will be required to create an algorithm to correlate the corresponding VFDs.
3. Install a high static pressure sensor in each AHU supply duct. This will shut down the AHU VFDs on high static pressure.
4. Provide programming, and equipment if required, to install supply air temperature reset based on outside air temperature. It shall be as follows:

    a. A floating reset algorithm shall be used which increments the secondary variable, supply air temperature setpoint on a periodic basis to maintain primary variable space temperature setpoint. The reset increment shall be determined by the quantity of "need heat" or "need cool" requests from individual SCU's. A SCU's "need heat" virtual point shall activate whenever the zone's space temperature falls below the currently applicable occupied or unoccupied heating setpoint throttling range. A SCU's "need cool" virtual point shall activate whenever the zone's space temperature rises above the currently applicable occupied or unoccupied cooling setpoint throttling range. The recalculation time and reset increment shall be chosen to maintain the primary variable within the specified maximum allowable variance while minimizing overshoot and settling time. Reset range maximum and minimum values shall limit the setpoint range.

1.04 APPLICATION OF OPEN PROTOCOLS

A. Subject to the detailed requirements provided throughout the specifications, the BAS and digital control and communications components installed, as work of this contract shall be an integrated distributed processing system utilizing BACnet. System components shall communicate using native BACnet in accordance with ASHRAE Standard 135 and current addenda and annexes, including all workstations, all building controllers, and all application specific controllers. Gateways to other communication protocols are not acceptable

1.05 QUALITY ASSURANCE

A. Product Line Demonstrated History: The product line being proposed for the project must have an installed history of demonstrated satisfactory operation for a length of 2 years since date of final completion in at least 10 installations of comparative size and complexity. Submittals shall document this requirement with references.

The following requirement relates to the actual installing contractor.

B. Installer's Qualifications: Firms specializing and experienced in control system installations for not less than 5 years. Firms with experience in BAS installation projects with point counts equal to this project and systems of the same character as this project. If installer is a Value Added Reseller (VAR) of a manufacturer's product, installer must demonstrate at least three years prior experience with that manufacturer's products. Experience starts with awarded Final Completion of previous projects. Submittals must document this experience with references.

C. Installer's Experience with Proposed Product Line: Firms shall have specialized in and be experienced with the installation of the proposed product line for not less than one year from date of final completion on at least 3 projects of similar size and complexity. Submittals shall document this experience with references.

D. Installer's Field Coordinator and Sequence Programmer Qualifications: Individual(s) shall specialize in and be experienced with control system installation for not less than 5 years. Proposed field coordinator shall have experience with the installation of the proposed product line for not less than 2 projects of similar size and complexity. Installer shall submit the names of the proposed individual and at least one alternate for each duty. Submittals shall document this experience with references. The proposed individuals must show proof of the following training:

1. Product Line Training: Individuals overseeing the installation and configuration of the proposed product line must provide evidence of the most advanced training offered by the Manufacturer on that product line for installation and configuration
2. Programming Training: Individuals involved with programming the site-specific sequences shall provide evidence of the most advanced programming training offered by the vendor of the programming application offered by the Manufacturer.

E. Installer's Service Qualifications: The installer must be experienced in control system operation, maintenance and service. Installer must document a minimum 5 year history of servicing installations of similar size and complexity. Installer must also document at least a one year history of servicing the proposed product line.

F. Installer's Response Time and Proximity

1. Installer must maintain a fully capable service facility within a 45 mile radius of the project site. Service facility shall manage the emergency service dispatches and maintain the inventory of spare parts.
2. Emergency response times are listed below in this section. Installer must demonstrate the ability to meet the response times.

1.06 CODES AND STANDARDS

A. American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
1. ASHRAE 135: BACnet - A Data Communication Protocol for Building Automation and Control Networks. American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. current edition including all related addenda shall apply.

B. Electronics Industries Alliance
1. EIA-709.1-A-99: Control Network Protocol Specification
2. EIA-709.3-99: Free-Topology Twisted-Pair Channel Specification
3. EIA-232: Interface between Data Terminal Equipment and Data Circuit-Terminating Equipment Employing Serial Binary Data Interchange.
4. EIA-458: Standard Optical Fiber Material Classes and Preferred Sizes
5. EIA-485: Standard for Electrical Characteristics of Generator and Receivers for use in Balanced Digital Multipoint Systems.
6. EIA-472: General and Sectional Specifications for Fiber Optic Cable

7. EIA-475: Generic and Sectional Specifications for Fiber Optic Connectors and all Sectional Specifications
8. EIA-573: Generic and Sectional Specifications for Field Portable Polishing Device for Preparation Optical Fiber and all Sectional Specifications
9. EIA-590: Standard for Physical Location and Protection of Below-Ground Fiber Optic Cable Plant and all Sectional Specifications

C. Underwriters Laboratories
1. UL 916: Energy Management Systems.
The following rating is required only for devices used for smoke control purposes. If these are not intended, delete.
2. UUKL 864: UL Supervised Smoke Control

D. NEMA Compliance
1. NEMA 250: Enclosure for Electrical Equipment
2. NEMA ICS 1: General Standards for Industrial Controls.

E. NFPA Compliance
1. NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems" where applicable to controls and control sequences.
2. NFPA 70 National Electrical Code (NEC)

F. Institute of Electrical and Electronics Engineers (IEEE)
1. IEEE 142: Recommended Practice for Grounding of Industrial and Commercial Power Systems
2. IEEE 802.3: CSMA/CD (Ethernet - Based) LAN
3. IEEE 802.4: Token Bus Working Group (ARCNET - Based) LAN

1.07 DEFINITIONS

A. Advanced Application Controller (AAC): A device with limited resources relative to the Building Controller (BC). It may support a level of programming and may also be intended for application specific applications.

B. Application Protocol Data Unit (APDU): A unit of data specified in an application protocol and consisting of application protocol control information and possible application user data (ISO 9545).

C. Application Specific Controller (ASC): A device with limited resources relative to the Advanced Application Controller (AAC). It may support a level of programming and may also be intended for application-specific applications. .

D. BACnet/BACnet Standard: BACnet communication requirements as defined by ASHRAE/ANSI 135 (Current edition and addendum).

E. BACnet Interoperability Building Blocks (BIBB): A BIBB defines a small portion of BACnet functionality that is needed to perform a particular task. BIBBS are combined to build the BACnet functional requirements for a device in a specification.

F. Binding: In the general sense, binding refers to the associations or mappings of the sources network variable and their intended opr required destinations.

G. Building Automation System (BAS): The entire integrated management and control system

H. Building Controller (BC): A fully programmable device capable of carrying out a number of tasks including control and monitoring via direct digital control (DDC) of specific systems, acting as a communications router between the controlled devices / equipment and the CSS, and temporary data storage for trend information, time schedules, and alarm data.

I. Change of Value (COV): An event that occurs when a measured or calculated analog value changes by a predefined amount (ASHRAE/ANSI 135 (current version and addendum)).

J. Client: A device that is the requestor of services from a server. A client device makes requests of and receives responses from a server device.

K. Continuous Monitoring: A sampling and recording of a variable based on time or change of state (e.g. trending an analog value, monitoring a binary change of state).

L. Controller or Control Unit (CU): Intelligent stand-alone control device. Controller is a generic reference and shall include BCs, AACs, and ASCs as appropriate.

M. Control Systems Server (CSS): A server class computer(s) that maintains the systems configuration and programming database. This server is located at DTCC data center in a virtual environment and serves as an access point to BAS.

N. Controlling LAN: High speed, peer-to-peer controller LAN connecting BCs, AACs and ASCs. Refer to System Architecture below.

O. Direct Digital Control (DDC): Microprocessor-based control including Analog/Digital conversion and program logic

P. Functional Profile: A collection of variables required to define a the key parameters for a standard application. As this applies to the HVAC industry, this would include applications like VAV terminal, fan coil units, and the like.

Q. Gateway (GTWY): A device, which contains two or more dissimilar networks/protocols, permitting information exchange between them.

R. Hand Held Device (HHD): Manufacturer's microprocessor based device for direct connection to a Controller.

S. LAN Interface Device (LANID): Device or function used to facilitate communication and sharing of data throughout the BAS

T. Local Area Network (LAN): General term for a network segment within the architecture. Various types and functions of LANs are defined herein.

U. Local Supervisory LAN: Also known as the State's Network: Ethernet-based network connecting Primary Controlling LANs with each other and OWSs and CSSs. See System Architecture below.

V. Master-Slave/Token Passing (MS/TP): Data link protocol as defined by the BACnet standard.

W. Open Database Connectivity (ODBC): An open standard application-programming interface

(API) for accessing a database developed. ODBC compliant systems make it possible to access any data from any application, regardless of which database management system (DBMS) is handling the data.

X. Operator Interface (OI): A device used by the operator to manage the BAS including OWSs, POTs, and HHDs.

Y. Operator Workstation (OWS): The user's interface with the BAS system. As the BAS network devices are stand-alone, dedicated OWS is not required for communications to occur. The OWS can be any computer on the State's Network that has a compatible Web browser.

Z. Point-to-Point (PTP): Serial communication as defined in the BACnet standard.

AA. Portable Operators Terminal (POT): Mobile computer used both for direct connection to a controller as well as network connection.

AB. Protocol Implementation Conformance Statement (PICS): A written document, created by the manufacturer of a device, which identifies the particular options specified by BACnet that are implemented in the device (ASHRAE/ANSI 135 (current version and addendum)).

AC. Router: A device that connects two or more networks at the network layer.

AD. Secondary Controlling LAN: LAN connecting AACs and ASCs, generally lower speed and less reliable than the Controlling LAN. Refer to System Architecture below.

AE. Server : A device that is a provider of services to a client. A client device makes requests of and receives responses from a server device.

AF. Standardized Query Language (SQL): A database computer language designed for managing data in relational database management system (RDBMS). Its scope includes data insert, query, update and delete, schema creation and modification, and data access control.

AG. Smart Device: A control I/O device such as a sensor or actuator that can directly communicate with a controller through the network. This differs from an ASC in that it typically deals only with one variable.

AH. Extensible Markup Language (XML): A specification developed by the World Wide Web Consortium. XML is a pared-down version of SGML, designed especially for Web documents. It is a set of rules for encoding documents in machine-readable form that allows designers to create their own customized tags, enabling the definition, transmission, validation, and interpretation of data between applications and between organizations.

1.08 FUNCTIONAL INTENT

A. Throughout Sections 23 09 50 through 23 09 55, the Sequences of Operation, and Section 23 09 59 detailed requirements are specified, some of which indicate a means, method or configuration acceptable to meet that requirement. Contractor may submit products that utilize alternate means, methods, and configurations that meet the functional intent.

However these will only be allowed with prior approval.

1.09 SUBMITTALS

A. Submit under provisions of Section 01 30 00 .

B. Electronic Submittals: While all requirements for hard copy submittal apply, control submittals and O&M information shall also be provided in electronic format as follows.
   1. Drawings and Diagrams: Shop drawings shall be provided on electronic media as an AutoCAD (current version) and/or Adobe Portable Document Format file. All 'X reference' and font files must be provided with AutoCAD files.
   2. Other Submittals: All other submittals shall be provided in Adobe Portable Document Format (PDF).

C. Qualifications: Manufacturer, Installer, and Key personnel qualifications as indicated for the appropriate item above.

D. Product Data: Submit manufacturer's technical product data for each control device, panel, and accessory furnished, indicating dimensions, capacities, performance and electrical characteristics, and material finishes. Also include installation and start-up instructions.

E. Shop Drawings: Submit shop drawings for each control system, including a complete drawing for each air handling unit, system, pump, device, etc. with all point descriptors, addresses and point names indicated. Each shop drawing shall contain the following information:
   1. System Architecture and System Layout:
      a. One-line diagram indicating schematic locations of all control units, workstations, LAN interface devices, gateways, etc. Indicate network number, device ID, , instance number, MAC address, drawing reference number, and controller type for each control unit. Indicate media, protocol, baud rate, and type of each LAN. Indicate media, protocol, baud rate, and type of each LAN. All optical isolators, repeaters, end-of-line resistors, junctions, ground locations etc. shall be located on the diagram.
      b. Provide electronic floor plans locating all control units, workstations, LAN interface devices, gateways, etc. Include all network communication wiring routing, power wiring, power originating sources, and low voltage power wiring. Indicate network number, device ID, instance number, MAC address, drawing reference number, and controller type for each control unit. Indicate media, protocol, baud rate, and type of each LAN. All optical isolators, repeaters, end-of-line resistors, junctions, ground locations etc. shall be located on the floor plans. Wiring routing as-built conditions shall be maintained accurately throughout the construction period and the drawing shall be updated to accurately reflect accurate, actual installed conditions.
   2. Schematic flow diagram of each air and water system showing fans, coils, dampers, valves, pumps, heat exchange equipment and control devices. Include verbal description of sequence of operation.
   3. All physical points on the schematic flow diagram shall be indicated with names, descriptors, and point addresses identified as listed in the point

summary table.

4. With each schematic, provide a point summary table listing building number and abbreviation, system type, equipment type, full point name, point description, Ethernet backbone network number, network number, device ID, object ID (object type, instance number). See Section 23 09 55 - Part III for additional requirements.
5. Label each control device with setting or adjustable range of control.
6. Label each input and output with the appropriate range.
7. Provide a Bill of Materials with each schematic. Indicate device identification to match schematic and actual field labeling, quantity, actual product ordering number, manufacturer, description, size, voltage range, pressure range, temperature range, etc. as applicable.
8. With each schematic, provide valve and actuator information including size, Cv, design flow, design pressure drop, manufacturer, model number, close off rating, etc. Indicate normal positions of spring return valves and dampers.
9. Indicate all required electrical wiring. Electrical wiring diagrams shall include both ladder logic type diagram for motor starter, control, and safety circuits and detailed digital interface panel point termination diagrams with all wire numbers and terminal block numbers identified. Provide panel termination drawings on separate drawings. Ladder diagrams shall appear on system schematic. Clearly differentiate between portions of wiring, which are existing, factory-installed and portions to be field-installed.
10. Details of control panels, including controls, instruments, and labeling shown in plan or elevation indicating the installed locations.
11. Sheets shall be consecutively numbered.
12. Each sheet shall have a title indicating the type of information included and the HVAC system controlled.
13. Table of Contents listing sheet titles and sheet numbers.
14. Legend and list of abbreviations.
15. Memory allocation projections.
16. Submit along with shop drawings but under separate cover calculated and guaranteed system response times of the most heavily loaded LAN in the system.

F. Open Protocol Information
   1. BACnet Systems:
      a. BACnet object description, object ID, and device ID, for each I/O point.
      b. Documentation for any non-standard BACnet objects, properties, or enumerations used detailing their structure, data types, and any associated lists of enumerated values.
      c. Submit PICS indicating the BACnet functionality and configuration of each controller.

G. Framed Control Drawings: Laminated control drawings including system control schematics, sequences of operation and panel termination drawings, shall be provided in panels for major pieces of equipment. Terminal unit drawings shall be located in the central plant equipment panel or mechanical room panel.

H. Control Logic Documentation
   1. Submit control logic program listings (for graphical programming) and logic flow charts (for line type programs) to document the control software of all control units.
   2. Control logic shall be annotated to describe how it accomplishes the sequence of operation. Annotations shall be sufficient to allow an operator to relate each program component (block or line) to corresponding portions of the specified Sequence of Operation.
   3. Include written description of each control sequence.
   4. Include control response, settings, setpoints, throttling ranges, gains, reset schedules, adjustable parameters and limits.
   5. Sheets shall be consecutively numbered.
   6. Each sheet shall have a title indicating the controller designations and the HVAC system controlled.
   7. Include Table of Contents listing sheet titles and sheet numbers
   8. Submit one complete set of programming and operating manuals for all digital controllers concurrently with control logic documentation. This set will count toward the required number of Operation and Maintenance materials specified below and in Section 01 30 00.

I. Operation and Maintenance Materials:
   1. Submit documents under provisions of Section 01 03 00. One copy of the materials shall be delivered directly to DTCC facilities operation staff, in addition to the copies required by other Sections.
   2. Submit maintenance instructions and spare parts lists for each type of control device, control unit, and accessory.
   3. Submit BAS User's Guides (Operating Manuals) for each controller type .
   4. Submit BAS advanced Programming Manuals for each controller type.
   5. Include all submittals (product data, shop drawings, control logic documentation, hardware manuals, software manuals, installation guides or manuals, maintenance instructions and spare parts lists) in maintenance manual; in accordance with requirements of Division 1.

J. Controls contractor shall provide DTCC with all product line technical manuals and technical bulletins, to include new and upgraded products, by the same distribution channel as to dealers or branches. This service will be provided for 5 years as part of the contract price, and will be offered to DTCC thereafter for the same price as to a dealer or branch.

K. Manufacturers Certificates: For all listed and/or labeled products, provide certificate of conformance.

L. Product Warranty Certificates: submit manufacturers product warranty certificates covering the hardware provided.

1.10 PROJECT RECORD DOCUMENTS

A. Submit documents under provisions of Section 01 30 00.

B. Record copies of product data and control shop drawings updated to reflect the final installed condition.

C. Record copies of approved control logic programming and database on paper and on CD's. Accurately record actual setpoints and settings of controls, final sequence of operation, including changes to programs made after submission and approval of shop drawings and including changes to programs made during specified testing.

D. Record copies of approved project specific graphic software on CDs.

E. Record copies shall include individual floor plans with controller locations with all interconnecting wiring routing including space sensors, LAN wiring, power wiring, low voltage power wiring. Indicate device instance, MAC address and drawing reference number.

F. Provide record riser diagram showing the location of all controllers.

G. Maintain project record documents throughout the warranty period and submit final documents at the end of the warranty period

1.11 SYSTEM ARCHITECTURE

A. The system provided shall incorporate hardware resources sufficient to meet the functional requirements of these Specifications. The Contractor shall include all items not specifically itemized in these Specifications that are necessary to implement, maintain, and operate the system in compliance with the functional intent of these Specifications.

B. The system shall be configured as a distributed processing network(s) capable of expansion as specified below.

C. The system architecture shall consist of the Ethernet-based Network, and Controlling LANs that support BCs, AACs, ASCs, Operator Workstations (OWS), Smart Devices (SD), and Remote Communication Devices (RCDs) as applicable. The following indicates a functional description of the BAS structure.

1. Network: Internet-based network connecting multiple facilities with a central data and application server, accessible via standard web-browser. Refer to Section 23 09 54 for requirements. This contractor shall integrate the controlling devices and the CCS together.
2. Local Supervisory LAN: The Local Supervisory LAN shall be an Ethernet-based, 100 Mbps LAN connecting Primary Control LANs and OWSs. The LAN serves as the inter-BC gateway and OWS-to-BC gateway and communications path. Contractor shall provide this as a dedicated LAN for the control system. LAN shall be IEEE 802.3 Ethernet over Fiber or Category 5 cable with switches and routers that support 100 Mbps throughput.

   Power-line carrier communication shall not be acceptable for communications. The physical media will be that installed for the IT infrastructure of the facility and as such network drops will be provided under that scope of work to facilitate work of this scope. This network will be 100 Mbps and therefore all network interface cards shall support that speed. The higher level layers of this network shall be BACnet as described below:

   a. BACnet Supervisory LAN: Shall be BACnet/IP as defined in the BACnet standard, and shall share a common network number for the Ethernet backbone,

as defined in the BACnet standard. Point/Object naming conventions are specified in 23 09 55 - Part III.

3. Controlling LAN: High-speed, peer-to-peer communicating LAN used to connect AACs, ASCs and Building Controllers (BCs) and communicate exclusively control information. Acceptable technologies include:
   a. Ethernet (IEEE802.3)
   b. ARCNET (IEEE802.4)
   c. Communication to/from building controller (BC) and the control system server (CSS) shall utilize standard TCP/IP, BACnet/IP ports (80and/or 47808)
4. Secondary Controlling LAN : Network used to connect AACs, ASCs or SDs. These can be Master Slave/ Token Passing or polling, in addition to those allowed for Primary Controller LANs. Network speed vs. the number of controllers on the LAN shall be dictated by the response time and trending requirements.

D. Dynamic Data Access: Any data throughout any level of the network shall be available to and accessible by all other devices, Controllers and OWS, whether directly connected or connected remotely.

E. Remote Data Access: The system shall support the following methods of remote access to the building data.
   1. Browser-based access: A remote user using a standard browser shall be able to access all control system facilities and graphics with proper authentication. DTCC shall maintain continuous network connection. The following paradigms are acceptable for browser-based access:
      a. Native Internet-based user interface (HTML, Java, XML, etc.) via a standard freely distributed web browser that does not require a Windows client software installation.

F. The communication speed between the controllers, LAN interface devices, and operator interface devices shall be sufficient to ensure fast system response time under any loading condition. Contractor shall submit guaranteed response times with shop drawings including calculations to support the guarantee. In no case shall delay times between an event, request, or command initiation and its completion be greater than those listed herein. Contractor shall recommend reconfiguring the LAN as necessary to accomplish these performance requirements.:
   1. 5 seconds between a Level 1 (critical) alarm occurrence and enunciation at operator workstation.
   2. 10 seconds between a Level 2 alarm occurrence and enunciation at operator workstation.
   3. 20 seconds between and a Level 3-5 alarm occurrence and enunciation at operator workstation.
   4. 10 seconds between an operator command via the operator interface to change a setpoint and the subsequent change in the controller.
   5. 5 seconds between an operator command via the operator interface to start/stop a device and the subsequent command to be received at the controller.
   6. 10 seconds between a change of value or state of an input and it being updated on the operator interface.

7. 10 seconds between an operator selection of a graphic and it completely painting the screen and updating at least 10 points.

G. Control Systems Server (CSS): A server class computer(s) that maintains the systems configuration and programming database. This server is located at DTCC data center in a virtual environment and serves as an access point to BAS. It shall hold the backup files of the information downloaded into the individual controllers and as such support uploading and downloading that information directly to/from the controllers. It shall also act as a control information server to non-control system based programs. It shall allow secure multiple-access to the control information. Refer to Section 23 09 52 - BAS Operator Interfaces for its requirements.

H. The Operator Interface shall provide for overall system supervision, graphical user interface, management report generation, alarm annunciation, and remote monitoring. Refer to Section 23 09 52 - BAS Operator Interfaces.

I. The BCs, AACs, ASCs, [and SDs] shall monitor, control, and provide the field interface for all points specified. Each BC, AAC, or ASC shall be capable of performing all specified energy management functions, and all DDC functions, independent of other BCs, AACs, or ASCs and operator interface devices as more fully specified in Section 23 09 53 - BAS Field Panels.

J. Systems Configuration Database: The system architecture shall support maintaining the systems configuration database on the CSS. User tools provided to DTCC shall allow configuring, updating, maintaining, etc. current configurations and settings whether they are initiated at the server or the end device.
   1. Database Schema shall be published and provided to DTCC to facilitate easy access to the data.
   2. Database shall be ODBC compliant.

K. Interruptions or fault at any point on any Primary Controller LAN shall not interrupt communications between other nodes on the network. If a LAN is severed, two separate networks shall be formed and communications within each network shall continue uninterrupted.

L. All line drivers, signal boosters, and signal conditioners etc. shall be provided as necessary for proper data communication.

M. Anytime any controller's database or program is changed in the field, the controller shall be capable of automatically uploading the new data to the CSS.

1.12 WARRANTY MAINTENANCE

A. Contractor shall warrant all products and labor for a period of 2 year after Substantial Completion.

B. DTCC reserves the right to make changes to the BAS during the warranty period. Such changes do not constitute a waiver of warranty. The Contractor shall warrant parts and installation work regardless of any such changes made by the State, unless the Contractor provides clear and convincing evidence that a specific problem is the result of such changes to the BAS.

C. At no cost to DTCC, during the warranty period, the Contractor shall provide maintenance services for software and hardware components as specified below:
   1. Maintenance services shall be provided for all devices and hardware specified in sections 23 09 51 through 23 09 59. Service all equipment per the manufacturer's recommendations. All devices shall be calibrated within the last month of the warranty period.
   2. Emergency Service: Any malfunction, failure, or defect in any hardware component or failure of any control programming that would result in property damage or loss of comfort control shall be corrected and repaired following notification by DTCC to the Contractor.
      a. Response by telephone to any request for service shall be provided within two (2) hours of the State's initial telephone request for service.
      b. In the event that the malfunction, failure, or defect is not corrected through the telephonic communication, at least one (1) hardware and software technician, trained in the system to be serviced, shall be dispatched to the State's site within eight (8) hours of DTCC initial telephone request for such services, as specified.
   3. Normal Service: Any malfunction, failure, or defect in any hardware component or failure of any control programming that would not result in property damage or loss of comfort control shall be corrected and repaired following telephonic notification by DTCC to the Contractor.
      a. Response by telephone to any request for service shall be provided within eight (8) working hours (contractor specified 40 hr per week normal working period) of DTCC initial telephone request for service.
      b. In the event that the malfunction, failure, or defect is not corrected through the telephonic communication, at least one (1) hardware and software technician, trained in the system to DTCC initial telephone request for such services, as specified.
   4. Telephonic Request for Service: Contractor shall specify a maximum of three telephone numbers for DTCC to call in the event of a need for service. At least one of the lines shall be attended at any given time at all times. Alternatively, pagers can be used for technicians trained in system to be serviced. One of the three paged technicians shall respond to every call within 15 minutes.
   5. Technical Support: Contractor shall provide technical support by telephone throughout the warranty period.
   6. Preventive maintenance shall be provided throughout the warranty period in accordance with the hardware component manufacturer's requirements.

1.13 DELIVERY, STORAGE, AND HANDLING

A. Provide factory-shipping cartons for each piece of equipment and control device. Maintain cartons during shipping, storage and handling as required to prevent equipment damage, and to eliminate dirt and moisture from equipment. Store equipment and materials inside and protect from weather.

1.14 LISTING AND LABELING

A. The BAS and components shall be listed by Underwriters Laboratories (UL 916) as an Energy Management System.

PART 2 - PRODUCTS

2.01 MANUFACTURERS (Existing System)

A. Johnson Controls by Modern Controls

B. Substitutions: See Section 01 60 00 - Product Requirements

2.02 MATERIALS AND EQUIPMENT

A. Materials shall be new, the best of their respective kinds without imperfections or blemishes and shall not be damaged in any way. Used equipment shall not used in any way for the permanent installation except where drawings or specs specifically allow existing materials to remain in place.

2.03 UNIFORMITY

A. To the extent practical, all equipment of the same type serving the same function shall be identical and from the same manufacturer.

PART 3 - EXECUTION

3.01 INSPECTION

A. Examine areas and conditions under which control systems are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.02 INSTALLATION OF CONTROL SYSTEMS

A. General: Install systems and materials in accordance with manufacturer's instructions, roughing-in drawings and details shown on drawings.

B. Network Connectivity: The BAS contractor shall provide two network connections with Cat-6 cables from the Building Controller to the State's IT network.
   1. The BAS contractor shall terminate one end of the two Cat-6 cables at or around the State's patch panel and make connections to the State's switch with green patch cables, following the instruction of the DFM's IT personnel.
   2. The BAS contractor shall terminate the other end of the two Cat-6 cables near or within the building controller cabinet with dual RJ-45 terminal box and make connection of one cable to the building controller. Note: the second connection is for on-site operator interface through a mobile computer. Exposed cable shall be protected by conduit or wire mold.
   3. The BAS contractor shall label the two network connections BAC-1 and BAC-2 on both ends.

C. Refer to additional requirements in other sections of this specification.

3.03 SURGE PROTECTION

A. The Contractor shall furnish and install any power supply surge protection, filters, etc. as necessary for proper operation and protection of all BCs, AAC/ASCS operator

interfaces, printers, routers, gateways and other hardware and interface devices. All equipment shall be capable of handling voltage variations 10% above or below measured nominal value, with no effect on hardware, software, communications, and data storage.

3.04 DEMOLITION AND REUSE OF EXISTING MATERIALS AND EQUIPMENT

A. Contractor shall assume that existing equipment that specifically is indicated to be reused is in good condition and is operable. Contractor, during the course of work, shall inspect these devices and determine if any devices are in need of replacement or repair. Contractor shall prepare an itemized list of suggested repairs/replacement. This repair/replacement will be at the discretion of DTCCand will be accomplished by expanding this contract.

B. Existing wire, conduit, and control panel cabinets may be reused at DTCC discretion, but only if such materials or equipment comply with the applicable specification for new materials and equipment. Such materials shall not be reused if visibly damaged or otherwise unsuitable for the intended service.

C. Where such materials are reused, the contractor's shop drawings shall reflect the existing wiring designation. If existing labeling is illegible or otherwise does not comply with the applicable specification for labeling, wiring runs shall be relabeled in accordance with the requirements specified elsewhere.

D. Existing valves and dampers and their operators may be reused only when preapproved by DTCC. Contractor shall lubricate all damper linkages of dampers being controlled under this project.

E. Other materials and equipment not specifically mentioned herein may be reused only if specifically allowed by indications on the drawings.

F. For HVAC systems which are indicated to receive a new BAS, all existing materials and equipment associated with the existing pneumatic controls and EMCS shall be removed Existing materials and equipment to be removed shall be removed subject to the requirements in paragraph “Sequence of Work”.

3.05 SEQUENCE OF WORK For Existing Systems Conversion

A. General: All work involving changeover of control functions from existing pneumatic control system to the new DDC BAS shall be performed in accordance with the following sequence in order to minimize the duration of equipment outages. The following descriptions are intended to indicate the sequence in which the work shall be performed, not to define fully the scope of the work.

B. Install operator's terminal, peripherals, graphic software, and LAN prior to placing any equipment under the control of the new BAS.

C. Work which requires shutting down a pump motor, fan motor, or chiller shall be considered a utility shutdown and shall be subject to the restrictions specified in Division 0.1

D. The following sequence applies to an individually controlled HVAC subsystem, such as

an air handling unit. Only one such system shall be placed under manual control (as described below) at any given time.

1. Install controllers adjacent to (or within) existing control panel. Programming shall be complete (except for loading and debugging) prior to installation. Install all field devices, which do not require interruption of the existing control system.
2. Install all conduit, wiring, and pneumatic tubing which does not require interruption of the existing control system.
3. Provide temporary variable pressure type hand pumps at each pneumatically controlled output, for temporary use by DTCC maintenance and operation contractor personnel. Schedule this step at least 48 hours in advance with the Building Engineer.
4. Remove existing controls including wiring, conduit, and tubing (except materials to be reused in accordance with provisions specified elsewhere) which must be removed to facilitate installation of new BAS materials and equipment.
5. Remove existing digital control system points (if applicable). Install and calibrate remainder of new BAS materials and equipment for this subsystem. Load controller software. Connect controller(s) to LAN.
6. Perform all field testing and calibration that does not require connection of permanent pneumatic outputs.
7. Remove temporary hand pumps and install permanent pneumatic output connections. Place the system under the control of the new DDC/BAS equipment. Conclude field testing and submit field testing report prior to placing the next subsystem under temporary manual control. DTCC shall be given a password with a priority level that allows monitoring (but not control until notification of substantial completion has been approved).
8. Remove remaining existing pneumatic and digital control system materials and equipment (except materials to be reused in accordance with provisions specified elsewhere). All existing digital controls equipment for those subsystems that have not yet been converted shall remain intact, on-line, and fully functional.
9. Schedule work in DTCC's occupied spaces 3 days in advance with DTCC's representative.

3.06 CONTROL POWER SOURCE AND SUPPLY

A. Section 23 09 50 Contractor shall extend all power source wiring required for operation of all equipment and devices provided under Sections 23 09 50 through 23 09 55 and Sequences of Operation.

B. General requirements for obtaining power include the following:

1. Obtain power from a source that feeds the equipment being controlled such that both the control component and the equipment are powered from the same panel. Where equipment is powered from a 460V source, obtain power from the electrically most proximate 120v source fed from a common origin.
2. Where control equipment is located inside a new equipment enclosure, coordinate with the equipment manufacturer and feed the control with the same source as the equipment. If the equipment's control transformer is large enough and of the correct

voltage to supply the controls it may be used. If the equipment's control transformer is not large enough or of the correct voltage to supply the controls provide separate transformer

3. Where a controller controls multiple systems on varying levels of power reliability (normal, emergency, and/or interruptible), the controller shall be powered by the highest level of reliability served. Furthermore, the controller in that condition shall monitor each power type served to determine so logic can assess whether a failure is due to a power loss and respond appropriately. A three-phase monitor into a digital input shall suffice as power monitoring.
4. Standalone Functionality: Refer to Section 23 09 53.

3.07 BAS STARTUP, COMMISSIONING AND TRAINNING

A. Refer to Section 23 09 59

3.08 SEQUENCE OF OPERATION

A. Refer to Section 23 09 58 - Sequences of Operation

END OF SECTION 23 09 50