CORRECTIONS HORIZON BUILDING
ELEVATOR MODERNIZATION
100% CONSTRUCTION DOCUMENTS

FOR
ORANGE COUNTY
CAPITAL PROJECTS
400 EAST SOUTH STREET, 5TH FLOOR
ORLANDO, FLORIDA 32801

BY
MATERN PROFESSIONAL ENGINEERING, INC.
130 CANDACE DRIVE
MAITLAND, FLORIDA 32751

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SECTION 00100

INSTRUCTIONS TO CONTRACTOR

PART 1 GENERAL

1.01 EXAMINATION

A. In order to discover and resolve conflicts or lack of definition which might create problems, Contractor must review Contract Documents, existing site conditions, and existing equipment specified to be retained for compatibility with its product prior to submitting Bid. Site review shall include, but not be limited to: adequacy of access, retained equipment, elevator hoistways, pits, machine rooms, overhead clearances, electrical power characteristics, structural supports, etc. Investigation and structural calculations required to determine compliance of existing elevator components including machine support beams, with ASME A17.1 are responsibility of Contractor. Owner will not pay for change to building structure, structural supports, mechanical, electrical, or other systems required to accommodate Contractor's equipment.

B. Submission of Bid is considered evidence that Contractor has visited and is conversant with the site facilities, site conditions, requirements of the Contract Documents, pertinent state and local codes, state of labor and material markets, and has made due allowance in his Bid for all contingencies. Should Contractor's investigation of site conditions or local codes or rules reveal requirements contrary to Contract Documents, or if Contractor finds any discrepancies or omissions from Contract Documents, or if Contractor is in doubt as to their meaning, it shall contact the Owner for clarification at least ten (10) working days prior to Bid due date.

C. No oral explanation will be made and no oral instructions will be given before Bid due date. Contractor shall act promptly and allow sufficient time for a reply to reach it before submission of its Bid. Any required interpretation or supplemental instructions will be issued in the form of an addendum to the specifications and forwarded to all Contractors.

D. Provide everything necessary for and incidental to the satisfactory completion of work required by Contract Documents. All required preparations and hoisting and movement of equipment, or removal of existing equipment shall be the responsibility of Contractor.

END OF SECTION

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LIST OF DRAWINGS

1.01 DRAWINGS

A. Submit fixture drawings and machine room layout drawings for elevator consultant approval prior to manufacturing. Submit additional drawings as specified elsewhere in construction document bid package.

END OF SECTION

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SUMMARY OF WORK

PART 1 GENERAL

1.01 WORK COVERED BY CONTRACT DOCUMENTS

A. Modernize 4 Traction elevators
   1. New AC V3F Hoist Motor
   2. New Geared Machines
   3. New Car Operating Panels w/Regional Fire Service Key Switches (site uniformity)
   4. New Hall Stations
   5. New Car Riding Lanters.
   6. New Door Operator.
   7. New Mechanical Door Equipment as Specified.
   8. New Inspection Car Top Station
   9. New Microprocessor Controller.
   10. New Elevator Monitoring and Security System
   11. Most Applicable Stringent Code Compliant Installation.

B. Provide all labor, engineering, tools, transportation, services, supervision, materials, and equipment necessary for and incidental to satisfactory completion of required work as indicated in Contract Documents.

C. Provide all required staging, hoisting, and movement of new equipment, reused equipment, or removal of existing equipment.

D. Applicable conditions of Owner's General, Special, and Supplemental Conditions.

E. Prime contracts are defined below and each is recognized to be a major part of required work to be performed concurrently in close coordination with work of other Contractors.
   1. This Contract: Elevator Modernization.

F. Scope of Contract includes, but is not limited to, the following:
   1. Coordination, scheduling, and management of work of component suppliers and subcontractors.
   2. Modernize or furnish and install equipment as specified utilizing existing and/or modified hoistways and machine rooms or newly constructed hoistways and machine rooms.
   3. Specific item of required work which cannot be determined to be included in another contract is thereby determined to be included in prime contract.
   4. Coordinating with and assisting all subcontractors. No additional fees will be accepted for coordination and assisting subcontractors.

1.02 ELEVATOR CONTRACTOR'S DUTIES

A. Elevator Contractor's duties include the following:
   1. Provide and pay for labor, materials and equipment, tools, construction equipment and machinery, and other facilities and services necessary for proper execution and completion of required work.
   2. Pay for legally required sales, consumer, and state remodel taxes.
   3. Secure and pay for required permits, fees and licenses necessary for proper execution and completion of required work, as applicable at time of quotation due date.
   4. Give required notices.
   5. Comply with codes, ordinances, rules, regulations, orders and other legal requirements of public authorities which bear on performance of required work.
   6. Promptly submit written notice to Consultant of observed variance of Contract Documents from legal requirements.
   7. Enforce strict discipline and good order among employees. Do not employ persons unskilled in assigned task.

1.03 WORK SEQUENCE

A. Construct work in stages performing one elevator at a time.

1.04 CONTRACTOR USE OF PREMISES

A. Confine operations at site to areas permitted by law, ordinances, permits, Contract Documents, and Owner's specific instructions.

B. Do not unreasonably encumber site with materials or equipment. Staging area will be located as directed by Owner.

C. Do not load structure with weight that will endanger structure. Coordinate with Owner.

D. Assume full responsibility for protection and safekeeping of tools and products stored on or off premises.

E. Move stored products which interfere with operations of building or the operations of other trades.

F. Obtain and pay for use of additional storage or work areas needed for operations.

1.05 CONCURRENT MODERNIZATION WORK AND BUILDING OPERATION

A. This project is a major elevator modernization in an existing building which is open for public business and will continue to operate throughout all phases of required work. It is essential that Contractor give special attention and priority to all matters concerning project safety, protection from dust and loose materials, reduction of

noise level, protection from water and air infiltration into building, and maintenance of neat, sightly conditions in and around work areas inside and outside of building. Packaging, scrap materials, and demolition debris shall be promptly removed from building and site on a daily basis.

B. At all times, Contractor shall provide clearly visible warning and directions signs, barricades, temporary lighting, overhead protection, and hazard-free walking surfaces throughout public areas. At all times, special attention must be given to building entrances, exits, and proper safe exiting through work areas as required by law.

Contractor shall consult Owner and other Contractors to establish and maintain safe temporary routes including, but not limited to, proper barricades, walking surfaces, lighting, fire protection, exiting, warning and directional signs, and general protection of persons from all hazards in accordance with OSHA Standards due wholly or partially to its operations.

END OF SECTION

SECTION 01027
APPLICATION FOR PAYMENT

PART I GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section specifies administrative and procedural requirements governing the Contractor's Applications for Payment.

B. The Contractor's Construction Schedule and Submittal Schedule are included in Section 01300 – "SUBMITTALS".

1.03 SCHEDULE OF VALUES

A. Coordinate preparation of the Schedule of Values with preparation of Contractor's Construction Schedule.

1. Submit the Schedule of Values to the Owner at the earliest feasible date, but in no case later than Preconstruction Meeting. Refer to Section 01200.

2. Sub-Schedules: Where the Work is separated into phases that require separately phased payments, provide sub-schedules showing values correlated with each phase of payment.

B. Format and Content: Use the Project Manual Table of Contents as a guide to establish the format for the Schedule of Values.

1. Identification: Include the following project identification on the Schedule of Values:

a. Project name and location.
b. Name of the Architect
c. Project Number
d. Contractor's name and address
e. Date of submittal

2. Arrange the Schedule of Values in a tabular form with separate columns to indicate the following for each item listed:

a. Generic name
b. Related Specification Section
c. Change Orders (numbers) that have affected value
d. Dollar Value
e. Percentage of Contract Sum to the nearest one-hundredth percent,

adjusted to total 100 percent

3. Provide a breakdown of the Contract Sum in sufficient detail to facilitate continued evaluation of Applications for Payment and progress reports. Break principal subcontract amounts down into several line items:

   a. A value will be given for at least every major specification section (subsections can logically be grouped together).
   b. A single material subcontractor (i.e. sod, window blinds) will not be required to be broken down into labor and material unless it is anticipated the materials will be stored and invoiced prior to installation.
   c. All multiple item subcontracts or work items (i.e. concrete, roofing, painting, mechanical, electrical items, etc.) will be shown broken down at least in labor and material (all taxes, burden and overhead and profit included).
   d. Mobilization (move-on, bond, insurance, temporary office and sanitary service installation) shall not exceed 2 1/2% of contract price.
   e. For multi-story work all items broken down per floor.
   f. Concrete broken down at least into foundation slab on grade, columns, beams and suspended slabs.
   g. Masonry divided into C.M.U. brick, stem walls, exterior walls, interior walls and elevator shaft.
   h. Plumbing broken down at least into underslab rough-in, vents and stacks, supply piping, equipment items (each listed separately), fixtures and trim.
   I. HVAC: Typically shown per specification section, labor and material, per floor.
   j. Electrical: same as HVAC.
   k. Fire protection broken down at least into underground, rough-in and trim. All per building and labor and material.
   l. Logical grouping of specification subsections are permitted.

4. Round amounts off the nearest whole dollar, the total shall equal the Contract Sum.

5. For each part of the Work where an Application for Payment may include materials or equipment, purchased or fabricated and stored, but not yet installed, provide separate line items on the Schedule of Values for initial cost of the materials, for each subsequent stage of completion, and for total installed value of that part of the Work.

6. Margins of Cost: Show line items for indirect costs, and margins on actual costs, only to the extent that such items will be listed individually in Applications for Payment. Each item in the Schedule of Values and Applications for Payment shall be complete including its total cost and proportionate share of general overhead and profit margin.

a. At the Contractor's option, temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown as separate line items in the Schedule of Values or distributed as general overhead expense.

7. Schedule Updating: Update and resubmit the Schedule of Values when Change Orders or Construction Change Directives result in a change in the contract sum.

1.04 APPLICATIONS FOR PAYMENT

A. Each Application for Payment shall be consistent with previous applications and payments as reviewed by the Owner's representative and paid for by the Owner.

1. The initial Application for Payment, the Application for Payment at time of Substantial Completion, and the Final Application for Payment involve additional requirements. See items G, I, J and K of this section.

B. Payment Application Times: The period of construction work covered by each Application of Payment is the period indicated in the Agreement.

C. Payment Application Forms: Use the County's most updated form as the form for Application for Payment. Form given at the Preconstruction Conference.

D. Application Preparation: Complete every entry on the form, including notarization and execution by person authorized to sign legal documents on behalf of the Owner. Incomplete applications will be returned without action.

1. Entries shall match data on the Schedule of Values and Contractor's Construction Schedule. Use updated schedules if revisions have been made.

2. Include amounts of Change Orders and Construction Change Directives issued prior to the last day of the construction period covered by the application.

E. Transmittal: Submit six (6) original executed copies of each Application for Payment to the Project Manager by means ensuring receipt within 24 hours; one copy shall be complete, including waivers of lien and similar attachments, when required.

1. Transmit each copy with a transmittal form listing attachments, and recording appropriate information related to the application in a manner acceptable to the Project Manager.

F. Not used.

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

1. List of principal subcontractors

2. List of principal suppliers and fabricators
3. Schedule of Values
4. Approved Contractor's Construction Schedule (preliminary if not final)
5. Schedule of principal products
6. Schedule of unit prices (if applicable)
7. Submittal schedule (preliminary if not final)
8. List of Contractor's staff assignments
9. List of Contractor's principal consultants
10. Copies of building permits for trades requiring separate permits
11. Copies of authorizations and licenses from governing authorities for performance of the Work
12. Initial progress report
13. Report of Pre-construction Meeting
14. Initial settlement survey and damage report, (if required)
15. Listing of all long lead procurement items monthly applications for payment will be accompanied with updated schedule and review of as-built drawings

H. Interim Application for Payment: Payment will be processed once a month. No applications will be processed without receipt of previous months waiver of lien described in subsection F above. Payment for item will be based on percentage completed as determined and approved by the County Project Manager or invoice for stored materials. Retainage (10%) will be held for all interim applications.

I. Application for Payment at Substantial Completion: Following issuance of the Certificate of Substantial Completion, submit an Application for Payment; this application shall reflect any Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work. Application shall also include all items listed in Part H. above.

J. Administrative actions and submittals that shall proceed or coincide with Substantial Completion Payment. Substantial Completion as defined per General Conditions Section "F" application include:

1. Occupancy permits and similar approvals
2. Warranties (guarantees) and maintenance agreements
3. Test/adjust/balance records
4. Maintenance instructions
5. Start-up performance reports

6. Change-over information related to Owner's occupancy, use, operation and maintenance
7. Final cleaning
8. Application for reduction of retainage, and consent of surety
9. List of incomplete Work, recognized as exceptions to Project Manager's Certificate of Substantial Completion

K. Final Payment Application: Administrative actions and submittals which must precede or coincide with submittal of the final payment. Application for Payment includes the following:

1. Completion of Project Close-Out requirements
2. Completion of items specified for completion after Substantial Completion
3. Assurance that unsettled claims will be settled
4. Assurance that all work has been completed and accepted
5. Proof that taxes, fees and similar obligations have been paid
6. Removal of temporary facilities and services
7. Removal of surplus materials, rubbish and similar elements
8. Change of door locks to Owner's access

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

END OF SECTION 01027

SECTION 01030

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1.01 SCOPE 1

SECTION 01030

ALTERNATES

PART 1 GENERAL

1.01 SCOPE

A. Provide material and labor required for complete execution of accepted alternates. Comply with all provisions of the Contract Documents.

B. Alternates:

1. Provide New Gearless Machine
   a. AC induction or P.M.S.M. ACV³F gearless traction type motor with brakes, drive sheave, and deflector sheave mounted in proper alignment on a common, isolated bedplate.
   b. Provide bedplate blocking to elevate secondary or deflector sheave above machine room.
   c. Provide hoist machine mounted direct drive, digital, closed-loop velocity encoder.
   d. Provide machine bedplate mounted to existing machine beams.
   e. Provide all material, labor and engineering involved with removal of existing geared machine and installation of new gearless machine.
   f. Provide applicable deflector sheave(s).

END OF SECTION

SECTION 01035
MODIFICATION PROCEDURES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This section specifies administrative and procedural requirements for handling and processing Contract modifications.

B. Related Sections: The following sections contain requirements that relate to this section:

1. Division 1 Section 01300 Submittals for requirements for the Contractor's Construction Schedule.
2. Division 1 Section 01027 Application for Payment for administrative procedures governing applications for payment.
3. Division 1 Section 01631 Product Substitutions for administrative procedures for handling requests for substitutions made after award of the Contract.

1.03 MINOR CHANGES IN THE WORK

A. Supplemental instructions authorizing minor changes in the work, not involving an adjustment to the Contract Sum or Contract Time, will be issued by the Project Manager.

1.04 CHANGE ORDER PROPOSAL REQUESTS

A. Owner-Initiated Proposal Requests: Proposed changes in the work that will require adjustment to the Contract Sum or Contract Time will be issued by the Project Manager, with a detailed description of the proposed change and supplemental or revised Drawings and Specifications, if necessary.

1. Proposal requests issued by the Project Manager are for information only. Do not consider them instruction either to stop work in progress, or to execute the proposed change.

2. Unless otherwise indicated in the proposal request, within 7 days of receipt of the proposal request, submit to the Project Manager from the Owner's review, an estimate of cost necessary to execute the proposed change.

a. Include a list of quantities of products to be purchased and unit costs, along with the total amount of purchases to be made. Where requested, furnish survey data to substantiate quantities.
b. Indicate applicable taxes, delivery charges, equipment rental, and

amounts of trade discounts.

c. Include a statement indicating the effect the proposed change in the work will have on the Contract Time.

d. Contractor and subcontractors will provide a complete detailed labor and material breakdown to justify change order request amount.

B. Contractor-Initiated Change Order Proposal Requests: When latent or other unforeseen conditions in mutual accord with the Owner Representatives findings require modifications to the Contract, the Contractor may propose changes by submitting a request for a change to the Architect.

1. Include a statement outlining the reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and Contract Time.

2. Include a list of quantities of products to be purchased and unit costs along with the total amount of purchases to be made. Where requested, furnish survey data to substantiate quantities.

3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.

4. Comply with requirements in Section 01631 “Product Substitutions” - if the proposed change in the work requires that substitution of one product or system for a product or system not specified.

5. Contractor and subcontractors will provide a complete detailed labor and material breakdown to justify change order request amounts.

C. Proposal Request Form: Project Manager will transfer the information to the appropriate forms for approval. Use AIA Document G 709 for Change Order Proposal Requests.

D. Proposal Request Form: Use forms provided by the Owner for Change Order Proposals.

1.05 CONSTRUCTION CHANGE DIRECTIVE

A. Construction Change Directive: When the Owner and Contractor are not in total agreement on the terms of a Change Order Proposal Request, the Project Manager may issue a Construction Change Directive instructing the Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.

1. The Construction Change Directive will contain a complete description of the change in the Work and designate the method to be followed to determine change in the Contract Sum or Contract Time.

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

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

1.06 CHANGE ORDER PROCEDURES

A. Upon the Owner's approval of a Change Order Proposal Request, the Project Manager will issue a Change Order for signatures of the Owner and Contractor on County's Change Order form, as provided in the Conditions of the Contract.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

END OF SECTION 01035

SECTION 01040

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SECTION 01040

PROJECT PROCEDURES

PART 1 GENERAL

1.01 APPLICABLE CODES

A. Compliance with Regulatory Agencies: Comply with most stringent applicable provisions of following Codes, laws, and/or Authorities, including revisions and changes in effect:
   1. Safety Code for Elevators and Escalators, ASME A17.1
   2. Guide for Inspection of Elevators, Escalators, and Moving Walks, ASME A17.2
   3. Elevator and Escalator Electrical Equipment, ASME A17.5
   4. National Electrical Code, NFPA 70
   5. Americans with Disabilities Act, ADA
   6. Local Fire Authority
   7. Requirements of most stringent provision of local applicable building code.
   8. Life Safety Code, NFPA 101
   9. Uniform Federal Accessibility Standard, UFAS

1.02 STAGING AREA

A. Staging area will be very limited, see drawings and plans. All tools must be removed from job site daily.

1.03 WORK PHASE

A. Perform work by removing only one elevator from service at a time with the exception for testing and interfacing purposes which shall be performed during afterhours per the Owner's approval.

1.04 OCCUPANCY AND WORK BY OTHERS

A. Contractor expressly affirms Owner's rights to let other contracts and employ other Contractors in connection with required work. Contractor will afford other Contractors and their workmen reasonable opportunity for introduction and storage of materials and equipment, for execution of their work, and will properly connect and coordinate its work with theirs. Contractor will also incorporate comparable provisions in all its subcontracts.

B. Contractor declares that other Contractors employed by Owner on basis of separate contracts may proceed at such times as necessary to install items of work required by Owner.

C. Contractor declares that it will cooperate with other Contractors employed by Owner and, in addition to other coordination and expediting efforts, will coordinate

their work by written notices regarding necessity of such work to be done on or before certain dates.

D. Contractor declares that it is responsible for review, stamped, and signed approval of all shop drawings for required work.

E. Contractor hereby declares that content of foregoing paragraphs and influence they may have on project:
   1. Shall not cause a change in stipulated Contract Sum
   2. Shall not cause a change in Construction Time Schedule

END OF SECTION

SECTION 01045
CUTTING AND PATCHING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section specifies administrative and procedural requirements for cutting and patching.

B. Refer to other Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.

1. Requirements of this Section apply to mechanical and electrical installations. Refer to Division-15 and Division-16 Sections for other requirements and limitations applicable to cutting and patching mechanical and electrical installations.

1.03 SUBMITTALS

A. Cutting and Patching Proposal: Where approval of procedures for cutting and patching is required before proceeding, submit a proposal describing procedures well in advance of the time cutting and patching will be performed and request approval to proceed. Include the following information, as applicable, in the proposal:

1. Describe the extent of cutting and patching required and how it is to be performed; indicate why it cannot be avoided.

2. Describe anticipated results in terms of changes to existing construction; include changes to structural elements and operating components as well as changes in the building's appearance and other significant visual elements.

3. List products to be used and firms or entities that will perform Work.

4. Indicate dates when cutting and patching is to be performed.

5. List utilities that will be disturbed or affected, including those that will be relocated and those that will be temporarily out-of-service. Indicate how long service will be disrupted.

6. Where cutting and patching involves addition of reinforcement to structural elements, submit details and engineering calculations to show how reinforcement is integrated with the original structure.

7. Approval by the Architect to proceed with cutting and patching does not

waive the Architect's right to later require complete removal and replacement of a part of the Work found to be unsatisfactory.

1.04 QUALITY ASSURANCE

A. Requirements for Structural Work: Do not cut and patch structural elements in a manner that would reduce their load carrying capacity or load-deflection ratio.

1. Obtain approval of the cutting and patching proposal before cutting and patching the following structural elements.

a. Foundation construction
b. Bearing and retaining walls
c. Structural concrete
d. Structural steel
e. Lintels
f. Timber and primary wood framing
g. Structural decking
h. Miscellaneous structural metals
I. Stair systems
j. Exterior curtain wall construction
k. Equipment supports
l. Piping, ductwork, vessels and equipment

B. Operational and Safety Limitations: Do not cut and patch operating elements or safety related components in a manner that would result in reducing their capacity to perform as intended, or result in increased maintenance, or decreased operational life or safety. Refer to Divisions 15 and 16 regarding Fire Rated Penetrations.

1. Obtain approval of the cutting and patching proposal before cutting and patching the following operating elements or safety related systems.

a. Shoring, bracing and sheeting
b. Primary operational systems and equipment
c. Air or smoke barriers
d. Water, moisture, or vapor barriers
e. Membranes and flashings
f. Fire protection systems
g. Noise and vibration control elements and systems
h. Control systems
I. Communication systems
j. Conveying systems
k. Electrical wiring systems

C. Visual Requirements: Do not cut and patch construction exposed on the exterior or in occupied spaces, in a manner that would, in the Architect's opinion, reduce the building's aesthetic qualities, or result in visual evidence of cutting and patching. Remove and replace work cut and patched in a visually unsatisfactory manner.

1. If possible retain the original installer or fabricator to cut and patch the following categories of exposed work, or if it is not possible to engage the

original installer or fabricator, engage another recognized experienced and specialized firm:

a. Processed concrete finishes
b. Preformed metal panels
c. Window wall system
d. Stucco and ornamental plaster
e. Acoustical ceilings
f. Carpeting
g. Wall covering
h. HVAC enclosures, cabinets or covers
I. Roofing systems

PART 2 PRODUCTS

2.01 MATERIALS

A. Use materials that are identical to existing materials. If identical materials are not available or cannot be used where exposed surfaces are involved, use materials that match existing adjacent surfaces to the fullest extent possible with regard to visual effect unless otherwise indicated by Architect/Owner. Use materials whose installed performance will equal or surpass that of existing materials.

PART 3 EXECUTION

3.01 INSPECTION

A. Before cutting existing surfaces, examine surfaces to be cut and patched and conditions under which cutting and patching is to be performed. Take corrective action before proceeding, if unsafe or unsatisfactory conditions are encountered.

1. Before proceeding, meet at the site with all parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

3.02 PREPARATION

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

B. Protection: Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of the Project that might be exposed during cutting and patching operations.

C. Avoid interference with use of adjoining areas and interruption of free passage to adjoining areas.

D. Take all precautions necessary to avoid cutting existing pipe, conduit or ductwork serving the building, but scheduled to be removed or relocated until provisions have been made to bypass them.

3.03 PERFORMANCE

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

1. Cut existing construction to provide for installation of other components or performance of other construction activities and the subsequent fitting and patching required to restore surfaces to their original condition.

B. Cutting: Cut existing construction using methods least likely to damage elements to be retained or adjoining construction. Where possible review proposed procedures with the original installer; comply with the original installer's recommendations.

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

2. To avoid marring existing finished surfaces, cut or drill from the exposed or finished side into concealed surfaces.

3. Cut through concrete and masonry using a cutting machine such as a Carborundum saw or diamond core drill.

4. Comply with requirements of applicable Sections of Division-2 where cutting and patching required excavating and backfilling.

5. By-pass utility services such as pipe or conduit, before cutting, where services are shown or required to be removed. Cap, valve or plug and seal the remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after by-passing and cutting.

C. Patching: Patch with durable seams that are as invisible as possible. Comply with specified tolerances.

1. Where feasible, inspect and test patched areas to demonstrate integrity of the installation.

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

3. Where removal of walls or partitions extends one finished area into another, patch and repair floor and wall surfaces in the new space to provide an even surface of uniform color and appearance. Remove existing floor and wall coverings and replace with new materials if necessary to achieve uniform color and appearance.

a. Where patching occurs in a smooth painted surfaces, extend final coat over entire unbroken surfaces containing the patch, after the patched area has received primer and second coat.

3.04 CLEANING

A. Thoroughly clean areas and spaces where cutting and patching is performed or used as access. Remove completely paint, mortar, oils, putty and items of similar nature. Thoroughly clean piping, conduit and similar features before painting or other finishing is applied. Restore damaged materials to their original condition.

END OF SECTION 01045

SECTION 01095
REFERENCE STANDARDS AND DEFINITIONS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 DEFINITIONS

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

B. Indicated: The term *indicated* refers to graphic representations, notes or schedules on the Drawings, or other Paragraphs or Schedules in the Specifications, and similar requirements in the Contract Documents. Where terms such as shown, noted, scheduled and specified are used, it is to help the reader locate the reference; no limitation on location is intended.

C. Directed: Terms such as directed, requested, authorized, selected, accepted, required, and permitted mean directed by the Project Manager, requested by the Architect/Project Manager and similar phrases.

D. Approved: This term approved means accepted, where used in conjunction with the Architect's action on the Contractor's submittals, applications, and requests, is limited to the Architect's duties and responsibilities as stated in the Conditions of the Contract.

E. Regulations: The term Regulations includes laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within the construction industry that control performance of the Work.

F. Furnish: The term furnish is used to mean supply and deliver to the Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

G. Install: The term install is used to describe operations at project site including the actual unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

H. Provide: The term provide means to furnish and install, complete and ready for the intended use.

I. Installer: An Installer is the Contractor or an entity engaged by the Contractor, either as an employee, subcontractor, or contractor of lower tier for performance of a particular construction activity, including installation, erection, application, and similar operations. Installers are required to be experienced in the operations they are engaged to perform.

1. The term experienced, when used with the term Installer, means having a minimum of five previous projects similar in size and scope to this Project,

being familiar with the special requirements indicated, and having complied with requirements of the authority having jurisdiction.

2. Trades: Use of titles such as carpentry is not intended to imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as carpenter. It also does not imply that requirements specified apply exclusively to trades persons of the corresponding generic name.

J. Project Site is the space available to the Contractor for performance of construction activities, either exclusively or in conjunction with others performing other work as part of the Project. The extent of the Project Site is shown on the Drawings and may or may not be identical with the description of the land on which the Project is to be built.

K. Testing Laboratories: A testing laboratory is an independent entity engaged to perform specific inspections or tests, either at the Project sites or elsewhere, and to report on and, if required, to interpret results of those inspections or tests.

1.03 SPECIFICATION FORMAT AND CONTENT EXPLANATION

A. Specification Format: These Specifications are organized into Divisions and Sections based on the Construction Specifications Institute's 16 Division format and MASTER FORMAT numbering system.

B. Specification Content: This Specification uses certain conventions in the use of language and the intended meaning of certain terms, words, and phrases when used in particular situations or circumstances. These conventions are explained as follows:

1. Abbreviated Language: Language used in Specifications and other Contract Documents is the abbreviated type. Words and meaning shall be interpreted as appropriate. Words that are implied, but not stated shall be interpolated as the sense required. Singular words will be interpreted as plural and plural words interpreted as singular where applicable and the context of the Contract Documents so indicates.

2. Imperative and streamlined language is used generally in the Specifications. Requirements expressed in the imperative mood are to be performed by the Contractor. At certain locations in the text, for clarity, subjective language is used to describe responsibilities that must be fulfilled indirectly by the Contractor, or by others when so noted.

a. The words, shall be shall be included by inference wherever a colon (:) is used within a sentence or phrase.

1.04 INDUSTRY STANDARDS

A. Applicability of Standards: Except where the Contract Documents include more stringent requirements, applicable construction industry standards have the same

force and effect as if bound or copies directly into the Contract Documents to the extend reference. Such standards are made part of the Contract Documents by reference.

B. Publication Dates: Comply with the standard in effect as of the date of the Contract Documents.

C. Conflicting Requirements: Where compliances with two or more standards are specified, and the standards may establish different or conflicting requirements for minimum quantities or quality levels. Refer requirements that are different, but apparently equal, and uncertainties to the Architect for a decision before proceeding.

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

D. Copies of Standards: Each entity engaged in construction on the Project is required to be familiar with industry standards applicable to that entity's construction activity. Copies of applicable standards are not bound with the Contract Documents.

1. Where copies of standards are needed for performance of a required construction activity. The Contractor shall obtain copies directly from the publication source or any other authorized source.

E. Abbreviations and Names: Trade association names and titles of general standards are frequently abbreviated. Where such acronyms or abbreviations are used in the Specifications or other Contract Documents, they mean the recognized name of the trade association, standards generating organization, authority having jurisdiction, or other entity applicable to the context of the text provision. See Trade Reference List at the end of this Section refer to the Encyclopedia of Associations, published by Gale Research Co., available in most libraries.

1.05 GOVERNING REGULATIONS/AUTHORITIES

A. The Architect has contacted authorities having jurisdiction where necessary to obtain information necessary the preparation of Contract Documents. Contact authorities having jurisdiction directly for information and decisions having a bearing on the work.

1.06 SUBMITTALS

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

1.07 TRADE REFERENCES

Acronyms for abbreviations used in the Specifications or other Contract Documents mean the recognized name of the trade association, standards generating organization, authority that have jurisdiction or other entity applicable to the context of the text provision.

AA	Aluminum Association
AABC	Associated Air Balance Council
AAMA	American Architectural Manufacturer's Association
AAN	American Association of Nurserymen
AASHTO	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
ACIL	American Council of Independent Laboratories
ACPA	American Concrete Pipe Association
ADC	Air Diffusion Council
AGA	American Gas Association
AHA	American Hardboard Association
AI	Asphalt Institute
AIHA	American Industrial Hygiene Association
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AMCA	Air Movement and Control Association
ANSI	American National Standards Institute
APA	American Plywood Association
ARI	Air Conditioning and Refrigeration Institute
ASA	Acoustical Society of America
ASC	Adhesive and Sealant Council
ASHRAE	American Society of Heating, Refrigerating, and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers

ASPE	American Society of Plumbing Engineers
ASSE	American Society of Sanitary Engineers
ASTM	American Society of Testing of Materials
AWI	Architectural Woodwork Institute
AWPB	American Wood Preservers Bureau
AWS	American Welding Society
AWWA	American Water Works Association
BHMA	Builders Hardware Manufacturers Association
CISPI	Cast Iron Soil Pipe Institute
CRSI	Concrete Reinforcing Steel Institute
DHI	Door and Hardware Institute
DLPA	Decorative Laminate Products Association
EIMA	Exterior Insulation Manufacturers Association
FGMA	Flat Glass Marketing Association
FM	Factory Mutual Engineering and Research
GA	Gypsum Association
ICBO	International Conference of Building Officials
IEEE	Institute of Electrical and Electronic Engineers
IESNA	Illuminating Engineering Society of North America
MBMA	Metal Building Manufacturer’s Association
ML/SFA	Metal Lath/Steel Framing Association
MSS	Manufacturers Standardization Society of the Valve and Fittings Industry
NAAMM	National Association of Architectural Metal Mfgs.
NAPA	National Asphalt Pavement Association
NAPF	National Association of Plastic Fabricators (Now DLPA)

NBHA	National Builder's Hardware Association (Now DHI)
NCMA	National Concrete Masonry Association
NEC	National Electric Code
NECA	National Electric Contractors Association
NEII	National Elevator Industry, Inc.
NFPA	National Fire Protection Association
NHLA	National Hardwood Lumber Association
NPA	National Particle board Association
NPCA	National Paint and Coatings Association
NRCA	National Roofing Contractors Association
NSF	National Sanitation Foundation
NWMA	National Woodwork Manufacturers Association (Now NWWDA)
NWWDA	National Wood Window and Door Association (Formerly NWMA)
PDI	Plumbing and Drainage Institute
RFCI	Resilient Floor Covering Institute
RMA	Rubber Manufacturers Association
SDI	Steel Deck Institute
S.D.I.	Steel Door Institute
SGCC	Safety Glazing Certification Council
SHLMA	Southern Hardwood Lumber Manufacturers Association (Now HMA)
SIGMA	Sealed Insulating Glass Manufacturers Association
SMACNA	Sheet Metal and Air Conditioning Contractor’s National Association
SJI	Steel Joist Institute
SPRI	Single Ply Roofing Institute
SSPC	Steel Structures Painting Council
SWI	Steel Window Institute

TCA Tile Council of America

UL Underwriters' Laboratories

WCMAWall Covering Manufacturers Association

WRI Wire Reinforcement Institute

WSFI Wood and Synthetic Flooring Institute

1.08 FEDERAL GOVERNMENT AGENCIES

A. Names and titles of federal government standard or Specification producing agencies are frequently abbreviated. The following acronyms or abbreviations referenced in the Contract Documents indicate names of standard of Specification producing agencies of the federal government. Names and addresses are subject to change but are believed to be, but are not assured to be, accurate and up-to-date as of the date of the Contract Documents.

CE Corps of Engineers
(US Department of the Army)
Chief of Engineers - Referral
Washington, DC 20314 (202) 272-0660

CFR Code of Federal Regulations
Available from the Government Printing Office
North Capitol St. Between G and H Street, NW
Washington, DC 20402 (202) 783-3238

(MATERIAL IS USUALLY FIRST PUBLISHED IN THE FEDERAL REGISTER)

CPSC Consumer Product Safety Commission
5401 Westbard Avenue
Washington, DC 20816 (800) 638-2772

CS Commercial Standard
(US Department of Commerce)
Government Printing Office
Washington, DC 20402 (202) 377-2000

DOC Department of Commerce
14th Street and Constitution Ave., NW
Washington, DC 20230 (202) 377-2000

DOT Department of Transportation
400 Seventh St., SW
Washington, DC 20590 (202) 426-4000

EPA Environmental Protection Agency
401 M. St., SW

	Washington, DC 20460	(202) 382-2090
FAA	Federal Aviation Administration (U.S. Department of Transportation) 800 Independence Avenue SW Washington, DC 20590	(202) 366-4000
FCC	Federal Communications Commission 1919 M. Street NW Washington, DC 20554	(202) 632-7000
NBS	National Bureau of Standards (U.S. Department of Commerce) Gaithersburg, MD 20899	(301) 921-1000
OSHA	Occupational Safety and Health Administration (U.S. Department of Labor) Government Printing Office Washington, DC 20402	(202) 523-7001
PS	Product Standard of NBS (U.S. Department of Commerce) Government Printing Office Washington, DC 20402	(202) 783-3238
USDA	U.S. Department of Agriculture Independence Avenue Between 12th and 14 Street, SW Washington, DC 20250	(202) 447-8732

PART 2 PRODUCTS

(Not Applicable)

PART 3 EXECUTION

(Not Applicable)

END OF SECTION 01095

SECTION 01200
PROJECT MEETINGS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section specifies administrative and procedural requirements for project meetings including but not limited to:

1. Pre-Construction Conference
2. Pre-Installation Conference
3. Coordination Meetings
4. Progress Meetings

B. Construction schedules are specified in Section 01300 Submittals.

1.03 PRE-CONSTRUCTION CONFERENCE

A. Schedule a pre-construction conference and organizational meeting at the project site or other convenient location no later than 20 days after execution of the agreement and prior to commencement of construction activities. Conduct the meeting to review responsibilities and personnel assignments.

B. Attends: The OWNERS, Representative, the Contractor and its superintendent, major subcontractors, manufacturers, suppliers and other concerned parties shall each be represented at the conference by persons familiar with and authorized to conclude matters relating to the work.

C. Agenda: Discuss items of significance that could affect progress including such topics as:

1. Tentative construction schedule
2. Critical Work sequencing and/coordinating
3. Designation of responsible personnel
4. Procedures for processing field decisions and Change Orders
5. Procedures for processing Applications for Payment
6. Distribution of Contract Documents
7. Submittal of Shop Drawings, Product Data and Samples
8. Preparation of record documents
9. Use of the Premises
10. Office, Work and storage areas
11. Equipment deliveries and priorities
12. Safety procedures
13. First aid

14. Security
15. Housekeeping
16. Working hours

D. Contractor must submit at the time of the meeting at least the following items:

1. Schedule of Values
2. Listing of key personnel including project superintendent and subcontractors with their addresses, telephone numbers, and emergency telephone numbers.
3. Preliminary Construction Schedule
4. Submittal Schedule

1.04 PRE-INSTALLATION CONFERENCE

A. Conduct a Pre-installation conference at the site before each construction activity that requires coordination with other construction. The Installer and representatives of manufacturers and fabricators involved in or affected by the installation, and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise at least 48 hours in advance the Project Manager of scheduled meeting dates.

1. Review the progress of other construction activities and preparations for the particular activity under consideration at each pre-installation conference, including requirements for:

a. Contract Documents
b. Options
c. Related Change Orders
d. Purchases
e. Deliveries
f. Shop Drawings, Product Data and Quality Control Samples
g. Possible conflicts
h. Compatibility problems
I. Time schedules
j. Weather limitations
k. Manufacturer's recommendations
l. Comparability of materials
m. Acceptability of substrates
n. Temporary facilities
o. Space and access limitations
p. Governing regulations
q. Safety
r. Inspection and testing requirements
s. Required performance results
t. Recording requirements
u. Protection

2. Record significant discussions and agreements and disagreements of each conference along with and approved schedule. Distribute the record of the meeting to everyone concerned promptly including the Owner and

Architect.

3. Do not proceed if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of Work and reconvene the conference at the earliest feasible date.

1.05 COORDINATION MEETINGS

A. Conduct project coordination meeting at weekly intervals on day and time as established by the Project Manager or more frequently, if necessary convenient for all parties involved. Project coordination meetings are in addition to specific meetings held for other purposes, such as regular progress meetings and special pre-installation meetings.

B. Request representation at each meeting by every party currently involved in coordination or planning for the construction activities involved, to include subcontractors and representatives.

C. Contractor shall record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

1.06 PROGRESS MEETINGS

A. Conduct progress meetings at the Project site at bimonthly intervals or more frequently if necessary as directed by the Project Manager. Notify the Owner at least 48 hours in advance of scheduled meeting time and dates. Coordinate dates of meetings with preparation of the payment request.

B. Attendees: In addition to representatives of the Owner and Architect, each subcontractor, supplier or other entity concerned with current progress of involved in planning, coordination or performance of future activities with the project and authorized to conclude matters relating to progress.

C. Agenda: Review and correct or approve minutes of the previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to the current status of the Project.

1. Contractor's Construction Schedule: Review progress since the last meeting. Determine where each activity is in relation to the Contractor's Construction Schedule, whether on time, ahead, or behind schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

2. Review the present and future needs of each entity present, including such items as:

a. Interface requirements

b. Time
c. Sequences
d. Deliveries
e. Off-site fabrication problems
f. Access
g. Site utilization
h. Temporary facilities and services
I. Hours of work
j. Hazards and risks
k. Housekeeping
l. Quality and work standards
m. Change Orders
n. Documentation of information for payment requests.

D. Reporting: No later than 3 days after each progress meeting date, distribute copies of minutes of the meeting to each party present and to other parties who should have been present. Include a brief summary, in narrative form, or progress since the previous meeting and report.

PART 2 PRODUCTS

(Not Applicable)

PART 3 EXECUTION

(Not Applicable)

END OF SECTION 01200

SECTION 01300

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SECTION 01300

SUBMITTALS

PART 1 GENERAL

1.01 SUBMITTALS

A. Within 30 calendar days after award of contract and before beginning equipment fabrication, submit shop drawings, and required material samples for review.
   1. Scaled or Fully Dimensioned Layout: Plan of pit, hoistway, and machine room indicating equipment arrangement, and car/hall signal fixtures.
   2. Design Information: Indicate equipment lists, reactions, and design information on layouts.
   3. Power Confirmation Information: Design for existing conditions.
   4. Fixtures: Cuts, samples, or shop drawings.
   5. Finish Material: Submit 3" x 12" samples of actual finished material for review of color, pattern, and texture. Compliance with other requirements is the exclusive responsibility of the Contractor. Include, if requested, signal fixtures, lights, graphics, Braille plates, and detail of mounting provisions.
   6. Design Information: Provide calculations verifying the following:
      a. Adequacy of existing electrical provisions.
      b. Machine room heat emissions in B.T.U.
      c. Adequacy of existing car platform structure for intended loading.
      d. Adequacy of plunger wall thickness for intended loading.
   7. Written Maintenance Control Program (MCP) specifically designed for the equipment included under this contract. Include any unique or product specific procedures or methods required to inspect or test the equipment. In addition, identify weekly, bi-weekly, monthly, quarterly, and annual maintenance procedures, including statutory and other required equipment tests.

B. Submittal review shall not be construed as an indication that submittal is correct or suitable, or that the work represented by submittal complies with the Contract Documents. Compliance with Contract Documents, code requirements, dimensions, fit, and interface with other work is Contractor’s responsibility.

C. Acknowledge and/or respond to review comments within 14 calendar days of return. Promptly incorporate required changes due to inaccurate data or incomplete definition so that delivery and installation schedules are not affected. Identify and cloud drawing revisions, including Contractor elective revisions on each re-submittal. Contractor’s revision response time is not justification for equipment delivery or installation delay.

1.02 FINAL CONTRACT DOCUMENTS

A. See Section 01700, Project Closeout.

END OF SECTION

SECTION 01380
CONSTRUCTION PHOTOGRAPHS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. General: This Section specifies administrative and procedural requirements for construction photographs.

1.03 SUBMITTALS

A. General: Refer to Division 1 Section “Submittals” for general requirements for submitting photographs.

B. Prints: Submit 3 prints of each view directly to the Project Manager within 5 days of taking photographs. The Project Manager will distribute prints as follows:

1. One print to the Contractor shall be retained in the field office at the project site and available at all times for reference.

2. One print to the Owner as the Owner’s permanent record.

3. One print shall be retained in the Architect’s files.

C. Extra Prints: When requested by the Architect, the photographer shall submit extra prints of photographs, with distribution directly to designated parties who will pay the costs for the extra prints directly to the photographer.

D. Negatives: Retain the photographic negatives 3 years after date of Substantial Completion. During this period, the photographer shall fill orders by the Architect for extra prints. Extra prints shall be priced at prevailing local commercial prices.

1.04 QUALITY ASSURANCE

A. Engage a qualified commercial photographer to take photographs during construction.

B. Photographer’s Qualifications: Photographer shall be a firm or an individual of established reputation who has been regularly engaged as a professional photographer for not less than 3 years.

C. Associated Services: Cooperate with the photographer’s work. Provide reasonable auxiliary services as requested, including access and use of temporary facilities including temporary lighting.

PART 2 PRODUCTS

2.01 PHOTOGRAPHIC COPIES

A. Provide 8" x 10" smooth surface gloss color prints on single-weight commercial-grade stock, mounted on muslin. Allow a 1" wide margin punched for standard 3-ring binder. Place margin on the left edge for vertical shots and at the top for horizontal shots.

B. Identification: Label each photograph on the front in the bottom margin with project name and date the photograph was taken. On the back of each print provide an applied label or rubber stamped impression with the following information:

1. Name of the Project
2. Name and address of the photographer
3. Name of the Architect
4. Name of the Contractor
5. Date the photograph was taken
6. Architect's Project No.

C. Description of vantage point, in terms of location, direction (by compass point), and evaluation of story on construction.

PART 3 EXECUTION

3.01 PHOTOGRAPHIC REQUIREMENTS

A. Take three (3) color project photographs at monthly intervals, coinciding with the cutoff date associated with each Application for Payment. The photographer shall select the vantage points for each shot each month to best show the status of construction and progress since the last photographs were taken.

B. Additional Photographs: From time to time the Architect may issue requests for additional photographs, in addition to periodic photographs specified. Additional photographs will be paid for by Change Order, and are not included in the Contract Sum or an Allowance.

1. The Architect will give the photographer 3 days notice, where feasible.

2. In emergency situations, the photographer shall take additional photographs within 24 hours of the Architect's request.

C. Circumstances that could require additional photographs include, but are not limited to:

1. Substantial Completion of a major phase or component of Work.

2. Owner's request for special publicity photographs.

3. Special events planned at project site.

D. Immediate follow-up when on-site events result in construction damage or losses. Photographs to be taken at fabrication locations away from project site; these are not subject to unit prices or unit-cost allowances. Extra record photographs at time of final acceptance.

E. Construction projects over $1,000,000 shall include at least one of the photographs listed in 3.01.A be aerial.

END OF SECTION 01380

SECTION 01400
QUALITY CONTROL SERVICES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section specifies administrative and procedural requirements for quality control services.

B. Quality control services include inspections and tests and related actions including reports, performed by independent agencies, governing authorities, and the Contractor. They do not include Contract enforcement activities performed by the Architect.

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

D. Requirements of this Section relate to customized fabrication and installation procedures, not production of standard products.

1. Specific quality control requirements for individual construction activities are specified in the Sections that specify those activities. Those requirements, including inspections and test, cover production of standard products as well as customized fabrication and installation procedures.

2. Inspection, test and related actions specified are not intended to limit the Contractor’s quality control procedures that facilitates compliance with Contract Document requirements.

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

1.03 GENERAL QUALITY CONTROL

A. The Contractor shall be responsible for maintaining and ensuring quality control over subcontractors, suppliers, manufacturers, materials, equipment, products, services, site conditions and workmanship to product work of specified quality. The completed work shall be of high quality throughout.

1.04 WORKMANSHIP

A. Comply with well-known standards recognized be each trade except when more restrictive tolerances or specified requirements indicate more rigid standards or more precise workmanship.

B. Perform work by persons qualified to produce workmanship of specified quality. Said qualifications shall be determined by well-known standards recognized by the trade for each respective portion of contract work.

C. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration and racking.

1.05 MANUFACTURER'S INSTRUCTIONS

A. Comply with instructions in full detail, including each step in sequence. Should instructions conflict with Contract Documents, request clarification from Architect before proceeding.

1.06 MANUFACTURER'S CERTIFICATES

A. When required by individual Specifications Section, submit manufacturer's certificate and supporting documentation, in duplicate, that products meet or exceed specified requirements.

B. ASBESTOS FREE MATERIALS - Manufacturer and/or supplier shall provide a written and notarized statement on manufacturer's company letterhead to certify and warrant that product (s) utilized on project are asbestos free.

1.07 MOCKUPS

A. When required by individual Specifications Section, erect complete, full-scale mockup of assembly at Project Site.

1.08 MANUFACTURER□S FIELD SERVICES

A. When specified in respective Specification Sections, require supplier and/or manufacturer to provide qualified personnel to observe field conditions, conditions of surfaces and installation, quality of workmanship, test, adjust and balance of equipment as applicable and to make appropriate recommendations.

B. Representative shall submit written report to Owner listing observations, recommendations, and certifying full conformance and compliance with manufacturers standards or requirements.

1.09 TESTING LABORATORY SERVICES

A. The County shall employ and pay for services of an Independent Testing Laboratory to perform inspections, tests for construction materials (soils, concrete) and threshold inspections.

B. Services will be performed in accordance with requirements of governing authorities and with specified standards.

C. Reports will be submitted to the County, Contractor and Architect giving observations and results of tests, indicating compliance or noncompliance with specified standards and with Contract Documents.

D. Contractor shall cooperate with testing laboratory personnel; furnish tools, samples of materials, design, mix equipment, storage and assistance as requested.

1. The contractor shall be responsible for notifying the testing laboratory at least 24 hours prior to expected time for operations requiring testing services. Longer length of notice to testing laboratory shall be provided by Contractor when required by the testing laboratory to ensure the timely scheduling and performance of all tests required.

2. The Contractor is responsible for obtaining and paying tests including but not limited to test and balance, portable water bacteriological tests and test required in Divisions 7 through 16.

E. The costs of any tests which fail will be paid for by the Contractor. The amount to be reimbursed to the County by the Contractor, will be the amount invoiced to the County by the testing laboratory in accordance with the testing services fees set forth in its contract with the County.

1.10 TEMPERATURE/HUMIDITY LOG

A. The Contractor shall be responsible for preparing rain, temperature and humidity measuring devices at the project site and maintaining a log of temperature and humidity measurements.

B. Said log shall contain a daily record of exterior temperature, rainfall amount and humidity conditions and where environmental conditions are specified in individual sections, a daily record of the temperature and humidity conditions where the work of those sections is stored and installed.

C. The Temperature/Humidity Log shall be available to the Project Manager.

1.11 RESPONSIBILITIES

A. The Owner shall provide inspections, tests and similar quality control services, specified in individual Specification Sections and these services include those specified to be performed by an independent agency and not by the Contractor.

B. The Contractor shall cover all costs of tests or inspections to evaluate means and methods of installation performed as a substitution and not as originally specified.

1. Retesting: The Contractor is responsible for retesting where results of required inspections, test or similar services prove unsatisfactory and do not indicate compliance with Contract Documents requirements, regardless of whether the original test was the Contractor’s responsibility.

a. Cost of retesting construction revised or replaced by the Contractor is the Contractor's responsibility, where required tests were performed on original construction.

2. Associated Services: The Contractor shall cooperate with agencies performing required inspections, tests and similar services and provide reasonable auxiliary services as requested. Notify the agency sufficiently in advance of operations to permit assignment of personnel. Auxiliary services required include, but are not limited to:
   a. Providing access to the work and furnishing incidental labor and facilities necessary to facilitate inspections and tests.
   b. Taking adequate quantities of representatives samples of materials that require testing or assisting the agency in taking samples.
   c. Providing facilities for storage and curing the test samples.
   d. Providing the agency with a preliminary design mix proposed for use for materials mixes that require control by the testing agency.
   e. Security and protection of samples and test equipment at the Project site.

C. Duties of the Testing Agency: The independent testing agency engages to perform inspections, sampling and testing of materials and construction specified in individual Specification Sections shall cooperate with Architect and Contractor in performance of its duties, and shall provide qualified personnel to perform required inspections and tests.

1. The agency shall notify the Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.

2. The agency is not authorized to release, revoke, alter or enlarge requirements of the Contract Documents, or approve or accept any portion of the Work.

3. The agency shall not perform any duties of the Contractor.

D. Coordination: The Contractor and each agency engaged to perform inspection, tests and similar services shall coordinate the sequence of activities to accommodate required services with a minimum of delay. In addition, the Contractor and each agency shall coordinate activities to avoid the necessity of removing and replacing construction to accommodate inspections and tests.

1. The Contractor is responsible for scheduling times for inspections, tests, taking samples and similar activities.

1.12 SUBMITTALS

A. Qualification for Service Agencies: Engage inspection and testing service agencies, including independent testing laboratories, which are prequalified as complying with "Recommended Requirements for Independent Laboratory qualification" by the American Council of Independent Laboratories, and which

specialize in the types of inspections and tests to be performed.

1. Each independent inspection and testing agency engages on the Project shall be authorized by authorities having jurisdiction to operate in the State in which the Project is located.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.01 REPAIR AND PROTECTION

A. General: Upon completion of inspection, testing, sample-taking and similar services, repair damaged construction and restore substrates and finished to eliminate deficiencies, including deficiencies in visual qualities of exposed finishes. Comply with Contract Document requirements for “Cutting and Patching”.

B. Protect construction exposed by or for quality control service activities, and protect and repaired construction.

C. Repair and protection in the Contractor’s responsibility regardless of the assignment of responsibility for inspection, testing or similar services.

END OF SECTION 01400

SECTION 01600

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SECTION 01600

MATERIAL AND HANDLING

PART 1 GENERAL

1.01 SITE CONDITION INSPECTION

A. Prior to beginning installation of equipment, examine hoistway and machine room areas. Verify no irregularities exist which affect execution of work specified.

B. Do not proceed with installation until work in place conforms to project requirements.

1.02 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver material in Contractor's original, unopened protective packaging.

B. Store material in original protective packaging. Prevent soiling, physical damage, or moisture damage.

C. Protect equipment and exposed finishes from damage and stains during transportation, erection, and construction.

D. Allocate available site storage areas and coordinate their use with Owner and other Contractors.

E. Provide suitable temporary weather-tight storage facilities as may be required for materials which will be stored in the open.

1.03 INSTALLATION REQUIREMENTS

A. Install all equipment in accordance with Contractor's instructions, referenced codes, specification, and approved submittals.

B. Install machine room equipment with clearances in accordance with referenced codes and specification.

C. Install all equipment so it may be easily removed for maintenance and repair.

D. Install all equipment for ease of maintenance.

E. Install all equipment to afford maximum accessibility, safety, and continuity of operation.

F. Remove oil, grease, scale, and other foreign matter from the following equipment and apply one coat of field-applied machinery enamel.
   1. All exposed equipment and metal work installed as part of this work which does not have architectural finish.

2. Machine room equipment, and pit equipment.
3. Hoistway equipment including guide rails, guide rail brackets, and pit equipment.
4. Neatly touch up damaged factory-painted surfaces with original paint color. Protect machine-finish surfaces against corrosion.

1.04 MANUFACTURER'S NAMEPLATES

A. Manufacturer's name plates and other identifying markings shall not be affixed on surfaces exposed to public view. This requirement does not apply to Underwriter's Laboratories and code required labels.

B. Each major component of mechanical and electrical equipment shall have identification plate with the Manufacturer's name, address, model number, rating, and any other information required by governing codes.

1.05 COLORS OF FACTORY-FINISHED EQUIPMENT

A. All colors will be selected from the Manufacturer's standard range unless custom colors are specified herein.

B. Submit samples of all standard colors available and/or specified custom colors for review and approval. See Section 01300, Submittals

C. Submit samples of all specified architectural metals specified for review and approval. See Section 01300, Submittals.

1.06 MATERIALS AND FINISHES

A. Steel:
1. Sheet Steel (Furniture Steel for Exposed Work): Stretcher-leveled, cold-rolled, commercial quality carbon steel, complying with ASTM A366, matte finish.
2. Sheet Steel (for Unexposed Work): Hot-rolled, commercial quality carbon steel, pickled and oiled, complying with ASTM A568/A568M-03.
3. Structural Steel Shapes and Plates: ASTM A36.

B. Stainless Steel: Type 316 complying with ASTM A240, with standard tempers and hardness required for fabrication, strength and durability. Apply mechanical finish on fabricated work in the locations shown or specified, Federal Standard and NAAMM nomenclature, with texture and reflectivity required to match Architect's sample. Protect with adhesive paper covering.
1. No. 4 Satin: Directional polish finish. Graining directions in vertical dimension.

C. Aluminum: Extrusions per ASTM B221; sheet and plate per ASTM B209.

D. Fire-Retardant Treated Particle Board Panels: Minimum ¾" thick backup for natural finished wood and plastic laminate veneered panels, edged and faced as

shown, provided with suitable anti-warp backing; meet ASTM E84 Class “I” rating with a flame-spread rating of 25 or less, registered with local authorities for elevator finish materials.

E. Paint: Clean exposed metal parts and assemblies of oil, grease, scale, and other foreign matter and factory paint one shop coat of standard rust-resistant primer. After erection, provide one finish coat of industrial enamel paint. Galvanized metal need not be painted.
   1. Paint Black: Pit channel, buffers, counterweight guards, cross head, machine block up beams.
   2. Paint Grey: Pit floor, machine room floor, car top, counterweights, counterweight frames.
   3. Paint Blue: Machine, motor
   4. Paint White: Machine room walls, machine room railings.
   5. Patch/Paint any area in which was damaged during project to return to condition prior to modernization work.

F. Prime Finish: Clean all metal surfaces receiving a baked enamel paint finish of oil, grease, and scale. Apply one coat of rust-resistant primer followed by a filler coat over uneven surfaces. Sand smooth and apply final coat of primer.

END OF SECTION

SECTION 01631
PRODUCTS SUBSTITUTIONS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section specifies administrative and procedural requirements for handling request for substitutions made during bidding and after award of the Contract.

B. The Contractor’s Installation Schedule and the Schedule of Submittals are included under Section “Submittals”.

C. Standards: Refer to Section “Definitions and Standards” for applicability of industry standards to products specified.

D. Procedural requirements governing the Contractor’s selection of products and product options are included under Section “Materials and Equipment”.

1.03 DEFINITIONS

A. Definitions used in this Article are not intended to change or modify the meaning of other terms used in the Contract Documents.

B. Substitutions: The Contract will be awarded based on the design, methods, materials and/or equipment as addressed in the Contract Drawings and/or described in the Contract Specifications, without any consideration for substitution or "or-equal" replacement. Addressing, describing or naming an item is intended to establish the type, function, characteristics and quality required in order to establish a base for bidding.

a. Within thirty (30) days after Contract award, the Contractor may submit for approval substitutes for any equipment and/or material. In addition to the product documents, a written certification shall accompany the documentation indicating that the proposed substitute will have the same characteristics, will perform in accordance with the design requirements and that complies with all the requirements set for in the Contract. Any additional information required by the Owner or County Representative shall be provided by the Contractor. Rejection of any proposed substitute will be considered final and the Contractor shall not get into any agreement with manufacturers or providers until the submittal has been finally approved.

1.04 SUBMITTALS

A. Substitution Request Submittal: Request for substitution will be considered if received within thirty (30) days after commencement of the Work. As long as this time allowance will not impact the construction schedule.

1. Submit three (3) copies of each request for substitution for consideration. Submit requests in the form and in accordance with procedures required for Change Order proposals.

2. Identify the product, or the fabrication or installation method to be replaced in each request. Include related Specification Section and Drawing numbers. Provide complete documentation showing compliance with the requirements for substitution, and the following information, as appropriate:
   a. Product Data, including Drawings, and descriptions of products, fabrication and installation procedures.
   b. Samples, where applicable or requested.
   c. A detailed comparison of significant qualities of the proposed substitution with those of the Work specified. Significant qualities may include elements such as size, weight, durability, performance and visual effect.
   d. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by the Owner and separate Contractors that will become necessary to accommodate the proposed substitution.
   e. A statement indicating the substitution's effect on the Contractor's construction schedule compared to the schedule without approval of the substitution. Indicate the effect of the proposed substitution on overall Contract Time.
   f. Cost information, including a proposal of the net change, if any in the Contract Sum.
   g. Certification by the Contractor that the Substitution proposed is equal-to or better in every significant respect to that required by the Contract Documents, and that it will perform adequately in the application indicated. Include the contractor's waiver of rights to additional payment or time that may subsequently become necessary because of the failure of the substitution to perform adequately.

3. Architect's Action: Within two weeks of receipt of the request for substitution, the Architect will request additional information or documentation necessary for evaluation of the request if needed. Within two (2) weeks of receipt of the request, or one week of receipt of the additional information or documentation, which ever is later, the Architect will notify the Contractor of acceptance or rejection of the proposed substitution. If a decision on use of a proposed substitute cannot be made or obtained within the time allocated, use the project specified by name. Decision on the use of a product substitution or its rejection by the Architect is

considered final. Acceptance will be in the form of a Change Order.

PART 2 PRODUCTS

2.01 SUBSTITUTIONS

A. Conditions: The Contractor's substitution request will be received and considered by the Architect when one or more of the following conditions are satisfied, as determined by the Architect; otherwise request will be returned without action except to record noncompliance with these requirements.

1. Extensive revisions to Contract Documents are not required.

2. Proposed changes are in keeping with the general intent of Contract Documents.

3. The request is timely, fully documented and properly submitted.

4. The specified product or method of construction cannot be provided within the Contract Time. The request will not be considered if the product or method cannot be provided as a result of failure to pursue the work promptly or coordinate activities properly.

5. The specified product or method of construction cannot receive necessary approval by a governing authority, and the requested substitution can be approved.

6. A substantial advantage is offered to the Owner, in terms of cost, time, energy conservation or other considerations of merit, after deducting offsetting responsibilities the Owner may be required to bear. Additional responsibilities for the Owner may include additional compensation to the Architect for redesign and evaluation services, increased cost of other construction by the Owner or separate Contractors, and similar consideration.

7. The specified product or method of construction cannot be provided in a manner that is compatible with other materials, and where the Contractor certifies that the substitution will overcome the incompatibility.

8. The specified product or method of construction cannot be coordinated with other materials, and where the Contractor certifies that the proposed substitution can be coordinated.

9. The specified product or method of construction cannot provide a warranty required by the Contract Documents and where the Contractor certifies that the proposed substitution provide the required warranty.

B. The Contractor's submittal and Project Manager's acceptance of Shop Drawings, Product Data or Samples that relate to construction activities not complying with the Contract Documents does not constitute an acceptable or valid request for

substitution, nor does it constitute approval.

C. Substitution request constitutes a representation that the Contractor:

1. Has investigated proposed product and determined that it meets or exceeds, in all respects, specified product.

2. Will provide the same warranty for substitution as for specified product.

3. Will coordinate installation and make other changes which may be required for work to be complete in all respects.

4. Waives claims for additional costs which may subsequently become apparent. All costs associated with the substitution will be paid by the Contractor regardless of approvals given, and regardless of subsequent difficulties experienced as a result of substitutions.

END OF SECTION 01631

SECTION 01700

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SECTION 01700

FINAL CONTRACT COMPLIANCE REVIEW

PART 1 GENERAL

1.01 FINAL CLEANING

A. As a minimum:
1. Elevator hoistways and all equipment therein shall be cleaned and left free of rust, filings, welding slag, rubbish, loose plaster, mortar drippings, extraneous construction materials, dirt, and dust. Include walls, building beams, sill ledges, and hoistway divider beams.
2. Care shall be taken by workpersons not to mark, soil, or otherwise deface existing or new surfaces. Clean and restore such surfaces to their original condition.
3. Clean down surfaces and areas which require final painting and finishing work. Cleaning includes removal of rubbish, broom cleaning of floors, removal of any loose plaster or mortar, dust, and other extraneous materials from finish surfaces, and surfaces that will remain visible after the work is complete.

1.02 CONSULTANT'S FINAL OBSERVATION AND REVIEW REQUIREMENTS

A. Review procedure shall apply for individual elevators, portions of groups of elevators and completed groups of elevators accepted on an interim basis, or elevators and groups of elevators completed, accepted, and placed in operation.

B. Contractor shall perform review and evaluation of all aspects of its work prior to requesting Consultant's final review. Work shall be considered ready for Consultant's final contract compliance review when all Contractor's tests are complete and all elements of work or a designated portion thereof are in place and elevator or group of elevators are deemed ready for service as intended.

C. Furnish labor, materials, and equipment necessary for Consultant's review. Notify Consultant five (5) working days in advance when ready for final review of elevator or group of elevators.

D. Consultant's written list of observed deficiencies of materials, equipment, and operating systems will be submitted to Contractor for corrective action. Consultant's review shall include as a minimum:
1. Workmanship and equipment compliance with Contract Documents.
2. Contract speed, capacity, floor-to-floor, and door performance comply with Contract Documents.
3. Performance of following is satisfactory:
   a. Starting, accelerating, running
   b. Decelerating and stopping accuracy
   c. Door operation and closing force
   d. Equipment noise levels

e. Signal fixture utility
f. Overall ride quality
g. Performance of door control devices
h. Operations of emergency two-way communication device
i. Operations of firefighters' service

4. Test Results:
   a. In all test conditions, obtain specified contract speed, performance times, stopping accuracy without re-leveling, and ride quality to satisfaction of Owner and Consultant. Tests shall be conducted under both no load and full load condition.
   b. Temperature rise in motor windings limited to 50° Celsius above ambient. A full-capacity one (1) hour running test, stopping at each floor for ten (10) seconds in up and down directions, may be required.

E. Performance Guarantee: Should Consultant's review identify defects, poor workmanship, variance or noncompliance with requirements of specified codes and/or ordinances, or variance or noncompliance with the requirements of Contract Documents, Contractor shall complete corrective work in an expedient manner to satisfaction of Owner and Consultant at no cost as follows:
   1. Replace equipment that does not meet code or Contract Document requirements.
   2. Perform work and furnish labor, materials, and equipment necessary to meet specified operation and performance.
   3. Perform retesting required by Governing Code Authority, Owner, and Consultant.

F. A follow-up final contract compliance review shall be performed by Consultant after notification by Contractor that all deficiencies have been corrected. Provide Consultant with copies of the initial deficiency report marked to indicate items which Contractor considers complete.

1.03 OWNER'S INFORMATION

A. Provide three sets of neatly bound written information necessary for proper maintenance and adjustment of equipment within 30 days following final acceptance. Final retention will be withheld until data is received by Owner and reviewed by Consultant. Include the following as minimums:
   1. Straight-line wiring diagrams of "as-installed" elevator circuits with index of location and function of components. Provide one set reproducible master. Mount one set wiring diagrams on panels, racked, or similarly protected, in elevator machine room. Provide remaining set rolled and in a protective drawing tube. Maintain all drawing sets with addition of all subsequent changes. These diagrams are Owner's property.
   2. Written Maintenance Control Program (MCP) specifically designed for the equipment included under this contract. Include any unique or product specific procedures or methods required to inspect or test the equipment. In addition, identify weekly, bi-weekly, monthly, quarterly, and annual maintenance procedures, including statutory and other required equipment tests.

3. Provide any necessary interface cards required for equipment maintenance, code mandated testing, and troubleshooting.
4. Lubrication instructions including recommended grade of lubricants.
5. Parts catalogs for all replaceable parts including ordering forms and instructions.
6. Four sets of keys for all switches and control features properly tagged and marked.
7. Neatly bound instructions explaining all operating features including all apparatus in the car and lobby control panels.
8. Neatly bound maintenance and adjustment instructions explaining areas to be addressed, methods and procedures to be used, and specified tolerances to be maintained for all equipment.
9. Diagnostic equipment complete with access codes, adjusters manuals and set-up manuals for adjustment, diagnosis and troubleshooting of elevator system, and performance of routine safety tests.

B. Non-Proprietary Equipment Design: Provide three sets of neatly bound written information necessary for proper maintenance and adjustment of equipment within 30 days following final acceptance. Final retention will be withheld until data is received by Owner and reviewed by Consultant. Include the following as minimums:
   1. Straight-line wiring diagrams of “as-installed” elevator circuits with index of location and function of components. Mount one set wiring diagrams on panels, racked, or similarly protected, in elevator machine room. Provide remaining set rolled and in a protective drawing tube. Maintain all drawing sets with addition of all subsequent changes. These diagrams are Owner’s property. A legend sheet shall be furnished with each set of drawings to provide the following information:
      a. Name and symbol of each relay, switch, or other apparatus.
      b. Location on drawings, drawing sheet number and area, and location of all contacts.
      c. Location of apparatus, whether on controller or on car.
   2. Written Maintenance Control Program (MCP) specifically designed for the equipment included under this contract. Include any unique or product specific procedures or methods required to inspect or test the equipment. In addition, identify weekly, bi-weekly, monthly, quarterly, and annual maintenance procedures, including statutory and other required equipment tests.
   3. Printed instructions explaining all operating features.
   4. Complete software documentation for all installed equipment.
   5. Lubrication instructions, including recommended grade of lubricants.
   6. Parts catalogs listing all replaceable parts including Contractor’s identifying numbers and ordering instructions.
   7. Four sets of keys for all switches and control features properly tagged and marked.
   8. Diagnostic test devices together with all supporting information necessary for interpretation of test data, troubleshooting of elevator system, and performance of routine safety tests.
   9. The elevator installation shall be a design which can be maintained by any licensed elevator maintenance company employing journeymen mechanics,

without the need to purchase or lease additional diagnostic devices, special tools, or instructions from the original equipment Contractor.

a. Provide on site capability to diagnose faults to the level of individual circuit boards and individual discrete components for the solid state elevator controller.
b. Provide a separate, detachable device, as required, to the Owner as part of this installation if the equipment for fault diagnosis is not completely self-contained within the controller. Such device shall be in possession of and become property of the Owner.
c. Installed equipment not meeting this requirement shall be removed and replaced with conforming equipment at no cost to the Owner.

10. Provide upgrades and/or revisions of software during the progress of the work, warranty period and the term of the ongoing maintenance agreement between the Owner and Contractor.

C. Acceptance of such records by Owner/Consultant shall not be a waiver of any Contractor deviation from Contract Documents or shop drawings or in any way relieve Contractor from his responsibility to perform work in accordance with Contract Documents.

END OF SECTION

SECTION 01700
PROJECT CLOSE-OUT

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.01 SUMMARY

A. This Section specifies administrative and procedural requirements for project close-out, including but not limited to:

1. Inspection procedures
2. Project record document submittal. (substantial completion requirements)
3. Operating and Maintenance Manual Submittal (substantial completion requirements).
4. Submittal of warranties (substantial completion requirement).
5. Final cleaning

B. Close-out requirements for specific construction activities are included in the appropriate Sections in Divisions 2 through 16.

C. Final Payment to be made when the County has received all required close-out documents.

1.03 SUBSTANTIAL COMPLETION

A. Preliminary Procedures: Before requesting inspection for Certification of Substantial Completion, complete the following: List exceptions in the request.

1. In the Application for Payment that coincided with, or first follows, the date Substantial Completion in claimed, show 100 percent completion for the portion of the Work claimed as substantially complete. Include supporting documentation for completion as indicated in these Contract Documents and a statement showing an accounting of changes to the Contract Sum.

a. If 100 percent completion cannot be shown, include a list of incomplete items, the value of incomplete construction, and reasons the work is not complete.

2. Advise Owner of pending insurance change-over requirements.

3. Submit specific warranties, workmanship bonds, maintenance agreements, final certifications and similar documents.

4. Obtain and submit releases enabling the Owner unrestricted use of the

work and access to services and utilities; include occupancy permits, operating certificates and similar releases.

5. Complete final clean up requirements, including touch-up painting. Touch-up and otherwise repair and restore marred exposed finishes.

B. Inspection Procedures: On receipt of a request for inspection, the Project Manager will either proceed with inspection or advise the Contractor of unfilled requirements. The Project Manager will prepare the Certificate of Substantial Completion following inspection, or advise the Contractor of construction that must be completed or corrected before the certificate will be issued.

1. Results of the completed inspection will form the basis of requirements for final acceptance.

2. Should the project fail to meet the standards required for Substantial Completion as defined in the documents, the Contractor will pay the expense of a second inspection by the Architect/Consultants and the Owner. Cost will be deducted from the Contractor's retainage.

1.04 FINAL ACCEPTANCE

A. Preliminary Procedures: Before requesting final inspection for certification of final acceptance and final payment, complete the following list exceptions in the request:

1. Submit the final payment request with releases and supporting documentation not previously submitted and accepted. Include certificates of insurance for products and complete operations where required.

2. Submit an updated final statement, accounting for final additional changes to the Contract Sum.

3. Submit a certified copy of the Architect or Owner’s final inspection list of items to be completed or corrected, stating that each item has been completed or otherwise resolved for acceptance, and the list has been endorsed and dated by the Project Manager.

4. Submit final meter readings for utilities, a measured record of stored fuel and similar data as of the date of Substantial Completion, or when the Owner took possession of the responsibility for corresponding elements of the Work.

5. Submit consent of surety to final payment.

6. Submit a final liquidated damages settlement statement

7. Submit evidence of final, continuing insurance coverage complying with insurance requirements.

B. Reinspection Procedure: The Architect will reinspect the work upon receipt of notice that the work, including inspection list items from earlier inspections, has been completed, except items whose completion has been delayed because of circumstances acceptable to the Architect.

1. Upon completion of reinspection, the Architect will prepare a certification of final acceptance, or advise the contractor of work that is incomplete or of obligations that have not been fulfilled but are required for final acceptance.

1.05 RECORD DOCUMENT SUBMITTALS

A. General: Do not use record documents for construction purposed; protect from deterioration and loss in a secure, fire-resistive location; provide access to record documents for the Architect's reference during normal working hours.

B. Record Drawings: Maintain a clean, undamaged set of blue or black line white-prints of Contract Drawings and Shop Drawings. Mark the set to show the actual installation; where the installation varies substantially from the work as originally shown. Mark whichever drawing is most capable of showing conditions fully and accurately; where Shop Drawings are used, record a cross-reference at the corresponding location on the Contract Drawings. Give particular attention to concealed elements that would be difficult to measure and record at a later date. Provide for project photographs if deemed necessary by Owner's representative.

1. Mark record sets with red erasable pencil; use other colors to distinguish between variations in separate categories of the work.

2. Mark new information that is important to the Owner, but was not shown on Contract Drawings or Shop Drawings.

3. Note related Change Order numbers where applicable.

4. Organize record drawing sheets, and print. suitable titles, dates and other identification on the cover of each set.

5. Provide three (3) additional sets of black line drawing sets of As-Builts Drawings.

C. Record Specifications: Maintain one complete copy of the Project Manual, including addenda, and one copy of other written construction documents such as Change Orders and modifications issued in printed form during construction. Mark these documents to show substantial variations in actual work performed in comparison with the text of the specifications and modifications. Give particular attention to substitutions, selection of options and similar information on elements that are concealed or cannot otherwise be readily discerned later by direct observation. Note related record drawing information and Project Data.

1. Upon completion of the Work, submit record Specifications to the Architect for the Owner's records.

D. Record Project Data: Maintain one copy of each Product Data submittal. Mark these documents to show significant variation in actual work performed in comparison with information submitted. Include variations in products delivered to the site, and from the manufacturer's installation instructions and recommendations. Give particular attention to concealed products and portions of the Work which cannot otherwise be readily discerned later by direct observation. Note related Change Orders and mark-up of record drawings and Specifications.

1. Upon completion of mark-up, submit complete set of record Product Data in the three ring binder (indexed) to the Architect for the Owner’s records.

E. Record Sample Submitted: Immediately prior to the date or dates of substantial completion, the Contractor will meet at the site with the Architect and the Owners personnel to determine which of the submitted Samples that have been maintained during progress of the work are to be transmitted to the Owner for record purposes. Comply with delivery to the Owners Sample storage area.

F. Miscellaneous Record Submittals: Refer to other Specification Sections for requirements of miscellaneous record-keeping and submittals in connection with actual performance of the work. Immediately prior to the date or dates of substantial completion, complete miscellaneous record and place in good order, properly identified and bound or filed, ready for continued use and reference. Submit to the Project Manager for the Owner's records.

G. Maintenance Manuals: Organize operating and maintenance data into five (5) suitable sets of manageable size. Bind properly indexed data in individual heavy-duty 2-inch, 3-ring vinyl covered binders, with pocket folders for folded sheet information. Mark appropriate identification on front and spine of each binder. Include the following types of information:

1. Emergency instructions
2. Spare parts list
3. Copies of warranties
4. Wiring diagrams
5. Recommended turn-around cycles
6. Inspection procedures
7. Shop Drawings and Product Data
8. Fixture lamping schedule

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.01 CLOSE-OUT PROCEDURES

A. Operating and Maintenance Instructions: Arrange for each installer of equipment that required regular maintenance. If installers are not experienced in procedures, provide instruction by manufacturers representatives. All items to be provided or competed prior to Certificate of Substantial Completion being issued by the Owner. Include a detailed review of the following items:

1. Maintenance manuals
2. Record documents
3. Spare parts and materials
4. Tools
5. Lubricants
6. Fuels
7. Identification systems
8. Control sequences
9. Hazards
10. Cleaning
11. Warranties and bonds
12. Maintenance agreements and similar continuing commitments
13. On site instructions to County maintenance personnel on major systems operations such as HVAC as per technical specifications.

B. As part of instruction for operating equipment, demonstrate the following procedures, prior to the Owner issuing Certificate of Substantial Completion:

1. Start-up
2. Shutdown
3. Emergency operations
4. Noise and vibration adjustments
5. Safety procedures
6. Economy and efficiency adjustments

2.02 PROJECT CLOSE-OUT MANUALS AT SUBSTANTIAL COMPLETION

A. Submit Project Close-out Manuals prior to issuance of final application for payment. Provide three (3) copies.

B. Bind in commercial quality 8 ½" x 11" three ring binder, indexed with hardback, cleanable, plastic covers.

C. Label cover of each binder with typed title PROJECT CLOSE-OUT MANUAL, with title of project; name, address, and telephone number of Contractor and name of responsible Principal.

D. Provide table of contents: Neatly typed, in the following sequence:

1. Final Certificate of Occupancy
2. Warranty Service Subcontractors Identification List
3. Final Lien Waivers and Releases
4. Warranties and Guarantees
5. Systems Operations and Maintenance Instruction
6. Manufacturers Certificates and Certifications
7. Maintenance Service Contracts
8. Spare Parts Inventory List
9. Special Systems Operating Permits or Approvals
10. Asbestos free materials notarized statement

E. Provide all documents for each section listed. List individual documents in each section in the Table of Contents, in the sequence of the Table of Contents of the Project Manual.

F. Identify each document listed in the Table of Contents with the number and title of the specification section in which specified, and the name of the product or work item.

G. Separate each section with index to sheets that are keyed to the Table of Contents listing.

H. Warranty Service Subcontractors List shall identify subcontractor supplier, and manufacturer for each warranty with name, address and emergency telephone number.

3.02 FINAL CLEANING

A. General: General cleaning during construction is required by the General Conditions and included in Section - Temporary Facilities.

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

1. Complete the following cleaning operations before requesting inspection for Certification of Substantial Completion.

a. Remove labels that are not permanent labels.
b. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compound and other substances that are noticeable vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials.
c. Clean exposed exterior and interior hard-surfaced finished to a dust-free condition, free of stains, films and similar foreign substances. Restore reflective surfaces to their original reflective condition. Leave concrete floors broom clean. Vacuum carpeted surfaces.
d. Wipe surfaces of mechanical and electrical equipment. Remove excess lubrication and other substances. Clean plumbing fixtures to a sanitary condition. Clean light fixtures and lamps.
e. Clean the site, including landscape development areas, of rubbish, litter and other foreign substances. Sweep paved areas broom clean; remove stains, spills and other foreign deposits. Rake grounds that are neither paved nor planted, to a smooth even-textured surface. Remove waste and surplus materials from the site in an appropriate manner.

C. Pest Control: Engage an experienced exterminator to make a final inspection, and rid the Project of rodents, insects and other pests.

D. Removal of Protection: Remove temporary protection and facilities installed for protection of the work during construction.

E. Compliance: Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on the Owner's property. Do not discharge volatile, harmful or dangerous materials into drainage systems. Remove waste materials from the site and dispose of in a lawful manner.

1. Where extra materials of value remaining after completion of associated work have become the Owner's property, arrange for disposition of these materials as directed.

END OF SECTION 01700

SECTION 01740
WARRANTIES AND BONDS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section specifies general administrative and procedural requirements for warranties and bonds required by the Contractor Documents, including manufacturers standard warranties on products and special warranties.

1. Refer to the General Conditions for terms of the Contractor's special warranty of workmanship and materials.

2. General close-out requirements are included in Section "Project Close-Out".

3. Specific requirements for warranties for the work and products and installations that are specified to be warranted, are included in the individual Sections of Division 2 through 16.

4. Certifications and other commitments and agreements for continuing services to Owner are specified elsewhere in the Contract Documents.

B. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties to not relieve the Contractor of the warranty on the work that incorporates the products, nor does it relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor.

1.03 WARRANTY REQUIREMENTS

A. Related Damages and Losses: When correcting warranted work that has failed, remove and replace other work that has been damaged as a result of such failure or that must be removed and replaced to provide access for correction of warranted work.

B. Reinstatement of Warranty. When work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.

C. Replacement Cost: Upon determination that work covered by a warranty has failed, replace or rebuild the work to an acceptable condition complying with requirements of Contract Documents.

D. Owner's Recourse: Written warranties made to the Owner are in addition to implied warranties, and shall not limit the duties, obligation, rights and remedies otherwise available under the law, nor shall warranty periods be interpreted as limitations on time in which the Owner can enforce such other duties, obligation, rights, or remedies.

1. Rejection of Warranties: The Owner reserves the right to reject warranties and to limit selections to products with warranties not in conflict with requirements of the Contract Documents.

E. The Owner reserves the right to refuse to accept work for the Project where a special warranty, certification, or similar commitment is required on such work or part of the Work, until evidence is presented that entities required to countersign such commitments are willing to do so.

1.04 WARRANTY PERIOD

A. The Contractor shall participate with the County and the Architect's representative, at the beginning of the tenth month of the warranty period, in conducting an on site review and evaluation of all items of equipment, materials and workmanship covered by the warranties and guarantees. Contractor shall act promptly and without cost to the County to correct all defects, problems, or deficiencies determined as such by the Architect/Owner during on the site review.

B. All warranties and guarantees shall commence on the date of Substantial Completion except for items which are determined by the County to be incomplete or a non-comply status at the time of Substantial Completion. The coverage commencement date for warranties and guarantees of such work shall be the date of the County's acceptance of that work.

C. Warranty period shall be manufacturer's standard for product specified except where specific warranty periods are specified in individual sections. But in no case less than one year.

1.05 SUBMITTALS

A. Submit written warranties to the Owner prior to the date certified for Substantial Completion. If the Architect's Certificate of substantial Completion designates a commencement date for warranties other than the date of Substantial Completion for the Work, or a designated portion of the work, submit written warranties upon request of the Project Manager.

1. When a designated portion of the work is completed and occupied or used by the Owner, by separate agreement with the Contractor during the construction period, submit properly executed warranties to the Project Manager within fifteen days of completion of that designated portion of the work.

B. When a special warranty is required to be executed by the Contractor, or the Contractor and a subcontractor, supplier or manufacturer, prepared a written document that contains appropriate terms and identification, ready for executing

by the required parties. Submit a draft to the Architect for approval prior to final execution.

1. Refer to individual Sections of Division 2 through 16 for specific content requirements, and particular requirements for submittal of special warranties.

C. Form of Submittal: At Final Completion compile two (2) copies of each required warranty and bond properly executed by the Contractor, or by the Contractor, subcontractor, supplier, or manufacturer. Organize the warranty documents into an orderly sequence based on the table of contents of the Project Manual.

D. Bind (3) three sets of warranties and bonds in heavy-duty, commercial quality, durable 3-ring vinyl covered loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8 1/2“ by 11" paper.

1. Provide heavy paper dividers with Celluloid covered tabs for each separate warranty. Mark the tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product, and the name, address and telephone number of the installer.

2. Identify each binder on the front and the spine with the typed or printed title “WARRANTIES AND BONDS’, the Project title or name, and the name of the Contractor.

3. When operating and maintenance manuals are required for warranted construction, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

END OF SECTION 01740

SECTION 14220

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SECTION 14220

ELECTRIC TRACTION ELEVATOR MODERNIZATION

PART 1 GENERAL

1.01 WORK INCLUDED

A. 4 traction elevators as follows:
   1. 4 3500lb Geared Passenger/Prisoner Elevators. State #'s 45030-45033

B. All engineering, equipment, labor, and permits required to satisfactorily complete elevator modernization required by Contract Documents.

C. Applicable conditions of General, Special, and Supplemental Conditions, Division 1, and all sections listed in Contract Documents "Table of Contents."

D. Preventive maintenance and warranty as described in Section 01800.

E. Cartage and Hoisting: All required staging, hoisting, and movement to, on, and from the site including new equipment, reused equipment, or dismantling and removal of existing equipment.

F. Unless specifically identified as "Reuse," "Retain," or "Refurbish," provide new equipment.

G. Protective barriers between cars in normal operation and adjacent car(s) in the modernization process. Full depth and height of hoistway.

H. Hoistway, pit, and machine room barricades as required.

1.02 RELATED WORK PROVIDED UNDER OTHER SECTIONS

A. See Drawings.

1.03 DEFINITIONS

A. Terms used are defined in the latest edition of the Safety Code for Elevators and Escalators, ASME A17.1.

B. Reference to a device or a part of the equipment applies to the number of devices or parts required to complete the installation.

C. Provisions of this specification are applicable to all elevators unless identified otherwise.

1.04 QUALITY ASSURANCE

A. Compliance with Regulatory Agencies: See Section 01040, Project Procedures.

B. Warranty:

1. Material and workmanship of installation shall comply in every respect with Contract Documents. Correct defective material or workmanship which develops within one year from date of final acceptance of all work to satisfaction of Architect, Owner and Consultant at no additional cost, unless due to ordinary wear and tear or improper use or care by Owner. Perform maintenance in accordance with terms and conditions indicated in the Preventive Maintenance Agreement.

   a. **See Orange County Preventative Maintenance Agreement for terms and conditions and service standards.**

2. Defective is defined to include, but not be limited to: Operation or control system failures, car performance below required minimum, excessive wear, unusual deterioration, or aging of materials or finishes, unsafe conditions, the need for excessive maintenance, abnormal noise, or vibration, and similar unsatisfactory conditions.
3. Retained Equipment: All retained components, parts, and materials shall be cleaned, checked, modified, repaired, or replaced so each component and its parts are in like new operating condition. Retained equipment must be compatible for integration with new systems. All retained equipment shall be covered under the warranty provisions, of Article 1.04, D., 1. & 2. above. No prorations of equipment or parts shall be allowed on preventive maintenance contract, between the Contractor and Owner.
4. Make modifications, requirements, adjustments, and improvements to meet performance requirements.

1.05 DOCUMENT AND SITE VERIFICATION

A. In order to discover and resolve conflicts or lack of definition which might create problems, Contractor must review Contract Documents and site conditions for compatibility with its product prior to submittal of quotation. Review existing structural, electrical, and mechanical provisions for compatibility with Contractor's products. Owner will not pay for change to structural, mechanical, electrical, or other systems required to accommodate Contractor's equipment.

1.06 SUBMITTALS

A. See Section 01300 Submittals and Section 01700 Final Contract Compliance Review.

1.07 PERMIT, TEST AND INSPECTION

A. Obtain and pay for permit, license, and inspection fee necessary to complete installation and building related work.

B. Perform test required by Governing Authority in accordance with procedure described in ASME A17.2 Guide for Inspection of Elevators, Escalators, and Moving Walks in the presence of Authorized Representative.

C. Supply personnel and equipment for test and final review by Consultant.

1.08 MAINTENANCE

A. Interim: Contractor will perform interim maintenance and services as outlined in the County Elevator Maintenance Agreement. Commencement of these services shall be the same day of Elevator Modernization Project Commencement.

B. Warranty Maintenance: 12 Month Warranty Shall Commence at the conclusion of all elevators passing all required alteration inspections. All elevators shall commence warranty at the same time. Service standards and requirements shall be referenced in the County Elevator Maintenance Agreement.

PART 2 PRODUCTS

2.01 SUMMARY

A. Unless specifically identified as “retain existing,” provide new equipment.

	Existing Equipment	Disposition
Number:	Cars 1,2,3,4	Retain Existing
Capacity:	3,500lbs	Retain Existing
Class Loading:	Class A	Retain Existing
Contract Speed:	350 F.P.M.	Retain Existing
Roping:	1:1	Retain Existing
Machine:	Geared	Provide New Geared Machine
Machine Location:	Overhead	Retain Existing
Supervisory Control:	Group Automatic Microprocessor-Based System	Provide New Group Automatic Microprocessor-Based System
Motor Control:	DC Motor	Provide New AC Variable Voltage Variable Frequency Microprocessor Based with Digital Closed-Loop Feedback

	Existing Equipment	Disposition
Power Characteristics:	480 Volts, 3 Phase, 60 Hertz	Retain Existing/Field Verify
Stops:	State # 45030: 8 State # 45031-33: 7	Retain Existing Retain Existing
Openings:	State # 45030: 9 State # 45031-33: 7	Retain Existing Retain Existing
Floors Served:	State # 45030: 8 State # 45031-33: 7	Retain Existing Retain Existing
Entrance Size:	48” x 84”	Retain Existing
Entrance Type:	Dual Speed Side Opening	Retain Existing
Door Operation:	Medium Speed, Heavy-Duty Door Operator, Minimum Opening Speed 1-1/2 F.P.S.	Provide New High Speed, Heavy-Duty, Door Operator, Minimum Opening Speed 2-1/2 F.P.S. Provide: GAL MOVFR or MAC Closed loop Operator.
Door Protection:	Infrared, Full Screen Device	Provide 3D Infrared, Full Screen Device with Differential Timing, Nudging and Interrupted Beam Time
Guide Rails:	Planed Steel Tees	Retain Existing
Buffers:	Oil	Retain Existing. Fill with new oil.
Car Enclosure:		Provide additional 4hr Battery Back Up Blower Ventilation. Battery Powered Emergency Car Lighting. Provide Separate Constant Pressure Test Button In Car Service Compartment.
Signal Fixtures:		LED Illumination Vandal Resistant Design.

	Existing Equipment	Disposition
Hall and Car Pushbutton Stations:		All Cars: Single Hall Pushbutton Riser on all floors State #45030: Additional Hall Riser located at Floor 1R. All Cars: Single Vandal Resistant Car Pushbutton Station.
Car Position Indicators:		Provide digital fixture located in transom. Provide vandal resistant assembly. Include Position Indicators in the Remote Firefighters' Control Panel.
In Car Lanterns:		All Car Entrance Columns with volume adjustable electronic chime or tone. Sound twice for down direction. Provide vandal resistant assembly.
Communication System:		Self-Dialing, Vandal Resistant, Push to Call, Two-Way Communication System with Recall, Tracking and Voiceless Communication. Provide two-way communication between elevator and remote room within building. Provide Intercom System Provide phone line operability detection and monitoring device.
Fixture Submittal:		Submit Brochure Depicting Contractor's Proposed Designs with Bid
Additional Features:		 Provide New Car Top Inspection Station.

Existing Equipment	Disposition
	Firefighters' Service, Phase I and II, including Alternate Floor Return Standby Power Transfer (Automatic to Main Floor) with Manual Override in Firefighters' Control Panel Emergency Signage. Provide New Hoistway Access Switches, Top And Bottom Floors located in most cost effective location. Load-Weighing Device Independent Service Feature CCTV Provisions All Cars Firefighters' Control Panel and Remote Wiring and Conduit. Remote Monitoring/Operational Stations and remote wiring. Provide New Machine room equipment floor isolation. Tamper Resistant Fasteners for All Fastenings Exposed to the Public One Year Warranty Maintenance with 24-Hour Call-Back Service No Visible Company Name or Logo Wiring Diagrams, Operating Instructions, and Parts Ordering Information

2.02 MATERIALS

A. See Section 01600, Materials.

2.03 CAR AND GROUP PERFORMANCE

A. Car Speed: ± 3% of contract speed under any loading condition.

B. Car Capacity: Safely lower, stop and hold 125% of rated load.

C. Car Stopping Zone: ±1/4" under any loading condition.

D. Door Opening Time: Seconds from start of opening to fully open:
   1. 2.4 seconds

E. Door Closing Time: Seconds from start of closing to fully closed:
   1. 4.6 seconds

F. Car Floor-to-Floor Performance Time: Seconds from start of doors closing until doors are 1/2 open for side opening doors and car level and stopped at next successive floor under any loading condition or travel direction (12' typical floor height) add/subtract .2 seconds for each foot of travel difference: 11.9 seconds.

G. Car Ride Quality:
   1. Horizontal and vertical acceleration within car during all riding and door operating conditions. Not more than 10 mg peak to peak (adjacent peaks) in the 1 - 10 Hz range.
   2. Acceleration and Deceleration: Smooth constant and not less than and not more than 3 feet/second^2 with an initial ramp between 0.5 and 0.75 second.
   3. Sustained Jerk: Not more than 8 feet/second^3.
   4. Measurement Standards: Measure and evaluate ride quality consistent with ISO 18738, using low pass cutoff frequency of 10 Hz and A95 peak-to-peak average calculations.

H. Noise and Vibration Control
   1. Airborne Noise: Measured noise level of elevator equipment and its operation shall not exceed 55 dBA inside car under any condition including door operation and car ventilation exhaust blower on its highest speed. Limit noise level in the machine room relating to elevator equipment and its operation to no more than 80 dBA. All dBA readings to be taken 3'-0" off the floor and 3'-0" from the equipment using the "A" weighted scale.
   2. Vibration Control: All elevator equipment shall be mechanically isolated from the building structure and electrically isolated from the building power supply and to each other to minimize the possibility of objectionable noise and vibrations being transmitted to occupied areas of the building.

2.04 OPERATION

A. Group Automatic:
   1. Approved microprocessor-based, group dispatch, car and motion control systems as follows:
      a. MCE or ECC Control System
   2. Include as a minimum, the following features:
      a. Any special tools required for setting parameters, adjusting, diagnosing and testing equipment. Such items may be for example but not limited to: Laptop with lifetime software updates, handheld electronic service tool devices, electronic chips, special connector cables from devices to controller.
      b. Operate cars as a group capable of balancing service and providing continuity of group operation with one or more cars removed from the system.
      c. Register service calls from pushbuttons located at each floor and in each car. Slow cars and stop automatically at floors corresponding to registered calls. Make stops at successive floors for each direction of travel irrespective of order in which calls are registered except when bypassing hall calls to balance and improve overall service; stop only one car in response to a particular hall call. Assign hall calls to specific cars and continually review and modify those assignments to improve service. Simultaneous to initiation of slow down of a car for a hall call, cancel that call. Render hall pushbutton ineffective until car doors begin to close after passenger transfer. Cancel car calls in the same manner. Give priority to coincidental car and hall calls in car assignment.
      d. Operate system to meet changing traffic conditions on a service demand basis. Include provisions for handling traffic which may be heavier in either direction, intermittent or very light. As traffic demands change, automatically and continually modify group and individual car assignment to provide the most-effective means to handle current traffic conditions. Provide means to sense long-wait hall calls and preferentially serve them. Give priority to coincidental car and hall calls in hall call assignment. Accomplish car direction reversal without closing and reopening doors.
      e. Use easily reprogrammable system software. Design basic algorithm to optimize service based on equalizing system response to registered hall calls and equalizing passenger trip time to shortest possible time.
      f. Serve floors below main floor in a manner which logically minimizes delay in passing or stopping at main floor in both directions of travel. Provide manual means to force a stop at the main floor when passing to or from lower levels.
      g. Required Features:
         1) Dispatch Protection: Backup dispatching shall function in the same manner as the primary dispatching.
         2) Delayed Car Removal: Automatically remove delayed car from group operation.

3) Position Sensing: Update car position when passing or stopping at each landing.
4) Hall Pushbutton Failure: Provide multiple power sources and separate fusing for pushbutton risers.
5) Communication link: Provide serial or duplicate communication link for all group and individual car computers.

B. Other Items:
1. Load Weighing: Provide means for weighing car passenger load. Control system to provide dispatching at main floor in advance of normal intervals when car fills to capacity. Provide hall call by-pass when the car is filled to preset percentage of rated capacity and traveling in down direction. Field adjustment range: 10% to 100%.
2. Anti-Nuisance Feature: If car loading relative to weight in car is not commensurate with number of registered car calls, cancel car calls. Systems employing either load weighing or door protective device for activation of this feature are acceptable.
3. Independent Service: Provide controls for operation of each car from its pushbuttons only. Close doors by constant pressure on desired destination floor button or door close button. Open doors automatically upon arrival at selected floor.
4. Car-to-Lobby Feature: Provide the means for automatic return to the lobby floor. Return car nonstop after answering pre-registered car calls, and park with doors open for an adjustable time period of 60-90 seconds. Upon expiration of time period, car shall automatically revert to normal operation and close its doors until assigned as next car or until the car is placed on manual control via in-car attendant or out-of-service switch. Provide via LIFT-NET Monitoring/Control System or pre-approved equal.

C. Firefighters' Service: Provide equipment and operation in accordance with Code requirements.

D. Automatic Car Stopping Zone: Stop car within 1/4" above or below the landing sill. Maintain stopping zone regardless of load in car, direction of travel, distance between landings, hoist rope slippage, or stretch.

E. Remote Monitoring and Diagnostics: Equip each controller and the group dispatch controller with standard ports, interface boards, and drivers to accept maintenance, data logging, fault finding diagnostic and monitoring computers, keyboards, modems, and programming tools. The system shall be capable of driving remote color CRT monitors that continually scan and display the status of each car and call if such system were to be utilized.

F. Motion Control: Microprocessor based AC, variable-voltage, variable frequency with digitally encoded closed-loop velocity feedback suitable for operation specified and capable of providing smooth, comfortable car acceleration, retardation, and dynamic braking. Limit the difference in car speed between full load and no load to not more than ±3% of the contract speed.

G. Door Operation: Automatically open doors when car arrives at main floor. At expiration of normal dwell time, close doors. Reopen doors when car is designated for loading. Provide “heavy door/variable air pressure” feature for consistent specified door operation within appropriate speed and inertia limits.

H. Standby Lighting and Alarm: Car mounted battery unit with solid-state charger to operate alarm bell and car emergency lighting. Battery to be rechargeable with minimum 5-year life expectancy. Include required transformer. Provide constant pressure test button in service compartment of car operating panel.

I. Standby Power Operation: Upon loss of normal power, adequate standby power will be supplied via building electrical feeders to simultaneously start and run one car in each group and single cars at contract car speed and capacity.
   1. Automatically return one car at a time in the group nonstop to designated floor, open doors for approximately 3.0 seconds, close doors, and park car. During return operation, car and hall call pushbuttons shall be rendered inoperative. As each car parks, system shall immediately select the next car until all cars in a group have returned to the designated floor. If a car fails to start or return within 30 seconds, system shall automatically select the next car in the group to automatically return.
      a. ELEVATOR CONTRACTOR IS REQURIED TO ASSIST IN EMERGENCY POWER CONNECTIONS, PROGRAMING, TESTING AND TROUBLESHOOTING SHOULD IT BE ASSOCIATED WITH THE ELEVATORS.
   2. When all cars in a group have returned to the designated floor, one car in each group shall be designated for automatic operation. When a service demand exists for 30 seconds and designated car fails to start, next available car in the group shall be automatically selected for operation.
      a. ELEVATOR CONTRACTOR IS REQURIED TO ASSIST IN EMERGENCY POWER CONNECTIONS, PROGRAMING, TESTING AND TROUBLESHOOTING SHOULD IT BE ASSOCIATED WITH THE ELEVATORS.
   3. Provide separate group selection switches and indicators in firefighters’ control panel that shall be located as directed in the plans.
      a. Switches shall be labeled “STANDBY POWER OVERRIDE” with positions marked “AUTO” and appropriate car numbers controlled by each respective switch. Key shall be keyed same as the key utilized for firefighters’ Phase I and II key switch. Key shall be removable in “AUTO” position only.
      b. Switch shall override automatic return and automatic selection functions, and cause the manually selected car to operate. Manual selection shall cause car to start and proceed to designated floor and open and close its doors before standby power is manually transferred to next selected car.
      c. Provide “STANDBY POWER” indicator lights, one per car, in firefighters’ control panel. Indicator light illuminates when corresponding car is selected, automatically or manually, to operate on standby power.
      d. Car floor and direction of travel position indicator for each elevator.

4. Successive Starting: When normal power is restored or there has been a power interruption, individual cars in each bank shall restart at five second intervals.
5. **REMOVE EXISTING EMERGENCY POWER SELECTION SWITCHES FIXTURE IN LOBBY AND PLATE OVER FIXTURE HOLE OR DESIGN PHONE LINE MONITORING DEVICE TO REPLACE SAID FIXTURE.**

J. Pushbutton Crossover Network: Provide an interim crossover network to interface new and old group supervisory systems for purposes of cross cancellation of registered car and hall calls until modernization of individual group is complete.

2.05 MACHINE ROOM EQUIPMENT

A. Arrange equipment in existing machine room spaces and coordinate with all subcontractors to ensure a code compliant installation of all systems and components.

B. Geared Traction Hoist Machine: Provide New.
1. Single worm geared type with AC induction or P.M.S.M. ACV^{3}F motor, brake, gear, drive shaft, new deflector sheave, and gear case mounted in proper alignment on an isolated bedplate.
2. Provide hoist machine mounted direct drive, digital, closed-loop velocity encoder.
3. Provide hoist machine drip pans to collect lubricant seepage.

C. Solid State Power Conversion and Regulation Unit:
1. Provide solid state, alternating current, variable voltage, variable frequency (ACV3F), I.G.B.T. converter/inverter drives.
2. Design unit to limit current, suppress noise, and prevent transient voltage feedback into building power supply. Provide internal heat sink cooling fans for the power drive portion of the converter panels. Conform to IEEE standards 519-1992 for line harmonics and switching noise.
3. Isolate unit to minimize noise and vibration transmission. Provide isolation transformers, filter networks, and choke inductors.
4. Suppress solid-state converter noises, radio frequency interference, and eliminate regenerative transients induced into the mainline feeders or the building standby power generator.
5. Supplemental direct-current power for the operation of hoist machine brake, door operator, dispatch processor, signal fixtures, etc., from separate static power supply.
6. ACV3F Drives shall be regenerative and utilize IGBT converter/inverter and dynamic braking during overhauling condition.

D. Encoder: Direct drive, solid-state, digital type. Update car position at each floor and automatically restore after power loss.

E. Controller: UL/CSA labeled. Provide MCE or ECC Controller with regenerative drive.

1. Compartment: Securely mount all assemblies, power supplies, chassis switches, relays, etc., on a substantial, self-supporting steel frame. Completely enclose equipment with covers. Provide means to prevent overheating.
2. Relay Design: Magnet operated with contacts of design and material to insure maximum conductivity, long life, and reliable operation without overheating or excessive wear. Provide wiping action and means to prevent sticking due to fusion. Contacts carrying high inductive currents shall be provided with arc deflectors or suppressors.
3. Microprocessor-Related Hardware:
   a. Provide built-in noise suppression devices which provide a high level of noise immunity on all solid-state hardware and devices.
   b. Provide power supplies with noise suppression devices.
   c. Isolate inputs from external devices (such as pushbuttons) with opto-isolation modules.
   d. Design control circuits with one leg of power supply grounded.
   e. Safety circuits shall not be affected by accidental grounding of any part of the system.
   f. System shall automatically restart when power is restored.
   g. System memory shall be retained in the event of power failure or disturbance.
   h. Equipment shall be provided with Electro Magnetic Interference (EMI) shielding within FCC guidelines.
4. Wiring: CSA labeled copper for factory wiring. Neatly route all wiring interconnections and securely attach wiring connections to studs or terminals.
5. Permanently mark components (relays, fuses, PC boards, etc.) with symbols shown on wiring diagrams.
6. Provide controller or machine mounted auxiliary, lockable “open,” disconnect if mainline disconnect is not in sight of controller and/or machine.

F. Sleeves and Guards: Provide 2" steel angle guards around cable or duct slots through floor slabs or grating. Provide rope and smoke guards for sheaves, cables, and cable slots in machine room.

G. Machine and Equipment Support Beams: Retain existing in place. Provide all required supplemental supports and attachments as required.

H. Governor: Provide New Centrifugal-type Car Governor, machine room mounted with pull-through jaws and bi-directional shutdown switches. Provide required bracketing and supports for attachment to building structure.

I. Emergency Brake:
   1. Provide means to prevent ascending car over-speed and unintended car movement per Code.
   2. Acceptable emergency brake devices:
      a. BODE Rope Brake
      b. Hollister-Whitney Rope Gripper

3. Mount the auxiliary brake on suitable structural steel supports. Provide a drawing showing the supports, stamped by Professional Engineer verifying the adequacy of the support provided.
4. Provide control circuits to enable the device to function as required by Code.

2.06 HOISTWAY EQUIPMENT

A. Guide Rails: Retain main and counterweight guide rails in place.
1. Clean rails and brackets. Remove rust.
2. Check all rail and bracket fastenings and tighten.
3. Realign rails as required to provide smooth car ride.
4. Provide supplemental rail brackets and/or backing as required by Code or to enhance car ride quality.

B. Buffers, Car, and Counterweight: Retain existing.
1. Drain, flush, refill, and test.
2. Rebuild as required and paint.
3. Retrofit switch to limit elevator speed if buffer is compressed.

C. Pit Ladder: Alter existing to comply with code or provide new if alteration is not feasible.

D. Deflector Sheaves: Provide New
1. Machined grooves and sealed bearings. Provide mounting means to structural members.

E. Counterweight: Retain existing.
1. Replace all rollers.
2. Provide all rebalancing required.

F. Counterweight Guard: Retain Existing Metal Guard.

G. Governor Rope Tensioning Sheaves: Provide New. Mount sheaves and support frame on pit floor or guide rail. Provide frame with guides or pivot point to enable free vertical movement and proper tension of rope and tape.

H. Hoist and Governor Ropes: Provide New All Elevators
1. 8 x 19 or 8 x 25 Seale construction, traction steel type. Fasten with staggered length, adjustable, spring isolated wedge type shackles.
2. Governor rope to suit Contractor’s specification.

I. Terminal Stopping: Provide normal, final and emergency terminal speed limiting devices.

J. Electrical Wiring and Wiring Connections:
1. Conductors and Connections: Copper throughout with individual wires coded and connections on identified studs or terminal blocks. Use no splices or similar connections in wiring except at terminal blocks, control compartments, or junction boxes. Provide 10% spare conductors throughout. Run spare

wires from car connection points to individual elevator controllers in the machine room. Provide four pair of spare shielded communication wires in addition to those required to connect specified items. Tag spares in machine room.

2. Conduit: Painted or galvanized steel conduit, EMT, or duct. Conduit size, 1/2" minimum. Flexible heavy-duty service cord may be used between fixed car wiring and car door switches for door protective devices. Provide when existing is not compliant.
3. Traveling Cables: Flame and moisture-resistant outer cover. Prevent traveling cable from rubbing or chafing against hoistway or equipment within hoistway. Provide required type and quantity for specified items in specification.
4. Auxiliary Wiring: Connect fire alarm initiating devices, emergency two-way communication system within building, and security (if present) in each car controller in machine room. If specified items are not being installed at time of elevator upgrades, label all wires in controller and in car operating panel.
5. Connect all security camera's and intercom systems to maintain similar existing operation and design.

K. Entrance Equipment: Retain/Replace/Refurbish as follows:
1. Door Hangers: Retain existing..
2. Door Hanger Rollers: Replace all new with neoprene roller surface.
3. Door Track: Clean and tighten fittings as required.
4. Door Interlocks: Provide New.
   a. Shall be a make/model that is "heavy-duty" material quality and design to withstand very rough usage. Should Contractor install a make/model that does not withstand the usage type and conditions within the 12 month warranty period, Contractor shall replace all with a new make/model at no additional charge.
5. Door Unlocking Devices: Provide New.
   a. Shall be a make/model that is "heavy-duty" material quality and design to withstand very rough usage. Should Contractor install a make/model that does not withstand the usage type and conditions within the 12 month warranty period, Contractor shall replace all with a new make/model at no additional charge.
6. Door Closers: Provide New.

***DOOR PERFORMANCE SHALL BE OF QUIET AND SMOOTH OPERATION AT EVERY LEVEL**

L. Escutcheons: Provide where missing.

M. Hoistway Access Switches: Mount in entrance jamb.

N. Floor Numbers: Stencil paint 4" high floor designations in contrasting color on inside face of hoistway doors or hoistway fascia in location visible from within car.

2.07 HOISTWAY ENTRANCES

A. Frames: Retain existing.

B. Transom Panels: Retain existing.

C. Door Panels: Retain existing. Provide new door gibs with fire tabs at all floors. Minimum two gibs per panel, one at leading edge, and one at trailing edge of each panel.

D. Door Retainers: Provide as per code requirements.

E. Sight Guards: Retain existing. Replace damaged/missing sight guards.

F. Sills: Retain existing. Clean and polish. Check and tighten all fastenings.

G. Sill Supports: Retain existing. Check and tighten all fastenings.

H. Fascia, Toe Guards, and Hanger Covers: Retain existing. Provide as required where damaged or missing. Check and tighten all fastenings.

I. Struts and Headers: Retain existing. Check and tighten all fastenings.

2.08 CAR EQUIPMENT

A. Frame: Retain Existing. Check and tighten all fastenings.

B. Safety Device: Retain existing. Check and tighten all fastenings. Replace if testing results require or if during further review conditions require replacement.

C. Platform: Retain existing. Reinforce if required. Check and tighten all fastenings.

D. Platform Apron: Provide new extended platform apron to meet Code. Minimum 14 gauge steel, reinforced and braced to car platform with black enamel.

E. Guide Shoes: Retain existing, replace rollers that emit noise or vibration.

F. Finish Floor Covering: Retain Existing.

G. Sills: Retain existing. Clean and polish. Check and tighten all fastenings.

H. Doors: Retain existing. Install dual gibs, one at trailing edge and one at leading edge of each panel with fire tabs.

I. Door Hangers: Provide New. Two-point hanger roller with neoprene roller surface and suspension with eccentric upthrust roller adjustment.

J. Door Track: Provide New. Bar or formed, cold-drawn removable steel track with smooth roller contact surface

K. Door Header: Retain existing. Check and tighten all fastenings. Modify as required to accept new door operator equipment.

L. Door Electrical Contact: Provide New. Prohibit car operation unless car door is closed.

M. Door Clutch: Provide New. Heavy-duty clutch, linkage arms, drive blocks and pickup rollers or cams to provide positive, smooth, quiet door operation. Design clutch so car doors can be closed, while hoistway doors remain open.

N. Door Restriction: Provide Hoistway door Flag and Car door Straight Arm style restrictor. Linkage or plunger type restrictors not acceptable. Restrictor to prevent the doors from opening outside the landing zone.

O. Door Operator: Provide New. High speed, heavy-duty door operator capable of meeting specified opening door times. Accomplish reversal in no more than 2-1/2" of door movement. Provide solid-state door control with closed loop circuitry to constantly monitor and automatically adjust door operation based upon velocity, position, and motor current. Maintain consistent, smooth, and quiet door operation at all floors, regardless of door weight or varying air pressure.
   1. Provide G.A.L. MOVFRII or MAC Closed loop operator.

P. Door Control Device: Provide New.
   1. Infrared Reopening Device: Provide 3D Infrared Door Edge.
   2. Nudging Operation: After beams of door control device are obstructed for a predetermined time interval (minimum 20.0 - 25.0 seconds), warning signal shall sound and doors shall attempt to close with a maximum of 2.5 foot pounds kinetic energy. Activation of the door open button shall override nudging operation and reopen doors. Do not activate unless advised by facility
   3. Interrupted Beam Time: When beams are interrupted during initial door opening, hold door open a minimum of 3.0 seconds. When beams are interrupted after the initial 3.0 second hold open time, reduce time doors remain open to an adjustable time of approximately 1.0 - 1.5 seconds after beams are reestablished.
   4. Differential Door Time: Provide separately adjustable timers to vary time that doors remain open after stopping in response to calls.
      a. Car Call: Hold open time adjustable between 3.0 and 5.0 seconds.
      b. Hall Call: Hold open time adjustable between 5.0 and 8.0 seconds. Use hall call time when car responds to coincidental calls.

Q. Car Operating Panel: Provide Innovation Bruiser Collection with PB 25 Button OR pre-approved equivalent.
   1. One (1) car operating panel with faceplates, consisting of a metal box containing vandal resistant operating fixtures. Faceplates shall be hinged and constructed of stainless steel, satin finish.
   2. Suitably identify floor buttons, alarm button, door open button, door close button and emergency push-to-call button with SCS, Visionmark, or Entrada cast tactile symbols. Configure plates per local building code accessibility standards including Braille. Locate operating controls no higher than 48" above the car floor; no lower than 35" for emergency push-to-call button and alarm button.

3. Provide minimum 3/4" diameter raised floor pushbuttons which illuminate to indicate call registration. Include 5/8" high floor designation on face of pushbutton.
4. Provide alarm button to ring bell located on car. Illuminate button when actuated.
5. Provide stainless steel vandal resistant red emergency stop switch to interrupt car power supply. Maintain registered calls when feature is actuated and continue normal service after power is restored. Actuation of switch shall sound car alarm bell and illuminate alarm button. Arrange switch to sound main fire command control panel distress signal when actuated.
6. Provide “door open” button to stop and reopen doors or hold doors in open position.
7. Extended Door Hold Open Button: Provide button to extend normal door hold open period up to 30 seconds. Cancel extended time by registration of car call or actuation of door close button. When activated, illuminate the door hold open button and the door close button. Cancel the hold open time when the door close button is activated. If a hall call is entered at another floor, sound a buzzer to indicate call waiting is activated.
8. Provide “door close” button to activate door close cycle. Cycle shall not begin until normal door dwell time for a car or hall call has expired, except firefighters’ operation.
9. Provide firefighters’ Phase II key switch with engraved instructions filled red. Include light jewel, buzzer, and call cancel button.
10. Provide lockable service compartment with recessed flush door. Door material and finish shall match car return panel or car operating panel faceplate.
11. Inside surface of door shall contain an integral flush window for displaying the elevator operating permit. Window must be large enough to see entire operating permit.
12. Include the following controls in lockable service cabinet with function and operating positions identified by permanent signage or engraved legend:
    a. Inspection switch.
    b. Light switch.
    c. Three-position exhaust blower switch.
    d. Independent service switch.
    e. Constant pressure test button for battery pack emergency lighting.
    f. 120-volt, AC, GFCI protected electrical convenience outlet.
    g. Stop switch.
    h. Switch to select either floor voice annunciation, floor passing tone, or chime.
13. Provide black paint filled (except as noted), engraved, or approved etched signage as follows with approved size and font:
    a. Phase II firefighters’ operating instructions on main operating panel above corresponding keyswitch filled red.
    b. Car number on main car operating panel.
    c. “No Smoking” on main car operating panel.
    d. Car capacity in pounds on main car operating panel.

R. Car Top Control Station: Mount to provide safe access and utilization while standing in an upright position on car top.

S. Work Light and Duplex Plug Receptacle: GFCI protected outlet at top and bottom of car. Include on/off switch and lamp guard. Provide additional GFCI protected outlet on car top for installation of car security system(s).

T. Communication System: **SEE SECTION 2.13C**

1. "Push to Call," two-way communication instrument in car with automatic dialing, tracking, and recall features with shielded wiring to car controller in machine room. Provide dialer with automatic rollover capability with minimum two numbers.
   a. "Push to Call" button or adjacent light jewel shall illuminate and flash when call is acknowledged. Button shall match car operating panel pushbutton design. Provide uppercase "PUSH TO CALL" "HELP ON THE WAY" engraved signage adjacent to button.
   b. Provide "Push to Call" button tactile symbol, engraved signage, and Braille adjacent to button mounted integral with car front return panel.
2. Provide two-way communication and applicable wiring between car and fire command panel, machine room and security control room.
3. Provide Active Line Detection per code requirements.

2.09 CAR ENCLOSURE

A. Car Enclosure Passenger Elevator: Provide the following:
   1. Ventilation: Add New Two-speed Nylube fan with 4 hour battery back-up.

2.10 HALL CONTROL STATIONS

A. Pushbuttons: Provide Vandal Resistant Line Risers with surface mounted faceplates. Include pushbuttons for each direction of travel which illuminate to indicate call registration. Include approved engraved message and pictorial representation prohibiting use of elevator during fire or other emergency situation as part of faceplate. Pushbutton design shall match car operating panel pushbuttons. Provide enlarged faceplate to cover existing wall blockout and facilitate handicapped access requirements. Provide any cutting, patching and relocation of any device/object that may be in the way of new hall fixtures.
   1. Provide Innovation Bruiser Line with PB 25 Buttons OR Pre-Approved Equivalent.

2.11 SIGNALS

A. Car Position Indicator: Digital indicator containing floor designations and direction arrows a minimum of 1/2" high to indicate floor served and direction of car travel. Locate fixture in transom. When a car leaves or passes a floor, illuminate indication representing position and direction of car in hoistway. Illuminate proper direction arrow to indicate direction of travel. Provide vandal resistant assembly.

B. Car Direction Lantern: Provide flush-mounted car lantern in all car entrance columns. Illuminate up or down LED lights and sound electronic tone once for up and twice for down direction travel as doors open. Sound tone once for up direction and twice for down direction. Sound level shall be adjustable from 0 - 80 dBA measured at 5'-0" in front of hall control station and 3'-0" off floor. Provide adjustable car door dwell time to comply with ADA requirements relative to hall call notification time. Provide vandal resistant assembly.

C. Faceplate Material and Finish: Stainless steel Satin

D. Floor Passing Tone: Provide an audible tone of no less than 20 decibels and frequency of no higher than 1500 Hz, to sound as the car passes or stops at a floor served.

E. Voice Synthesizer: Provide electronic device with easily reprogrammable message and female voice to announce car direction, floor, emergency exiting instructions, etc.

F. Firefighters' Control Panel: Fixture faceplate, stainless steel satin finish, including the following features:
1. Car position and digital direction indicator. Identify each position indicator with car number.
2. Indicator showing operating status of car.
3. Manual car standby power selection switches and power status indicators.
4. Two-position firefighters' emergency return switches and indicators with engraved instructions filled red.
5. Any and all features and associated work required by code at time of alteration permitting.
6. Locate in Fire Command Room B158
7. Provide all wiring and conduit from point to point.

2.12 MONITORING AND CONTROL SYSTEM

A. Provide LIFT-NET Monitoring and Control System
1. Provide ONSITE Certified LIFT-NET Engineering Assistance for installation and Owner training purposes.
   a. ONSITE training from Certified LIFT-NET Personnel shall include a minimum of 4 separate training sessions for Owner Personnel to occur from the time the system is installed, through the expiration of the 12 month warranty period. Contractor shall provide such services within 10 business days of request.
   b. ONSITE installation assistance from Certified LIFT-NET personnel shall be performed as needed to ensure proper installation, interface and operation of the system.

B. General: Provide an interactive system to monitor and manage the elevator equipment ("units") hereinafter called "system." Data collection, data storage, and real-time monitoring portion of the system shall be based on Microsoft Windows and be able to run on the latest version of Windows operating systems. Provide the following features:

1. Network based, capable of interfacing with control systems via either serial data link or hardwired interface connections.
2. Operate on any TCP/IP based network system including but not limited to an Ethernet, Token Ring, Arc-Net, Lift-Net, etc.
3. Expansion capability to add unlimited number of monitoring terminals on the network.
4. Monitoring terminals shall operate peer-to peer or with a single client server. Failure of a single network device shall not affect the operation of the remainder of the system.
5. Complete backup of system data shall be accomplished at any single terminal/server location.
6. Display multiple banks, including multiple buildings, on a single monitoring terminal screen.

C. Monitoring Display: Each elevator shown on the plan view shall be individually displayed and shall be visible on the monitoring system display terminal without the need to scroll. Each individual unit, when operating "normally," shall be displayed in green. In the event of a malfunction of any individual unit, the unit shall be displayed by a red blinking light on the monitoring system display. Units which are intentionally placed out of service shall be shown as yellow in the display mode. When malfunctioning units, or units intentionally placed out of service are returned to normal operation the graphical representation for that unit(s) shall automatically return to green. The user shall have the ability to display additional information, such as the cause of fault/alarm, for all units by selecting the unit with a "mouse click" from the plan view of the facility. All monitored units shall be visible from any monitoring terminal on the network. Entry into the network shall be multi-level password protected.

D. System Capabilities:
1. The system shall be capable of real time display of all monitored status points on all monitored equipment. Fault and event notification screens and audible alarms shall be immediately displayed on selected monitoring stations. Different fault and event tables shall be defined on a per-bank basis. The system shall collect and store all status, fault, and event information for later reporting and analysis. The system shall provide statistical analysis of hall call response times, traffic patterns, fault conditions, service logs, and security usage in graphical and tabular format.
2. The system shall maintain a record of every status point change occurring on the monitored equipment and provide the ability to replay these events in a simulation at a later time in real time, slow speed, single step, reverse, or fast forward. This information shall be retained for a period of at least twenty-six weeks and a mechanism shall be provided whereby this information may be archived.
3. The system shall store traffic fault and statistical data for a period of at least three (3) years. The system shall log error type, car number, floor position, and major system status points whenever a fault or logged event occurs.
4. The system shall provide interactive control of certain features provided in the elevator control system. These features may be revised as the requirements of the building change. Some of these interactive controls may include, but

are not limited to: Security floor lockouts, entering car and hall calls, Firefighters' service, lobby recall, up/down peak service, etc.

5. In the case of a power failure the system shall be capable of connecting to emergency power back-up unit. The loss of power shall not affect any stored data. The system shall have the capability to detect the loss (disconnect) of any individual unit from the monitoring system by periodically polling all units to ensure that normal communications between the unit(s) and the terminals/server are maintained.
6. The system will automatically re-boot the program and continue to operate after a power loss or other system malfunction.

E. Monitoring Equipment: The monitoring equipment shall have these minimum characteristics:
   1. Monitoring Station Hardware: Provide 1 monitoring stations and locate in Security Control Room.
      a. Central Processing Unit: IBM compatible microcomputer – desk top or mini-tower.
      b. Type: Most current high-performance processor
      c. Speed: Most current high-performance
      d. Internal Hard Drive: Adequate storage for three years data for entire system
      e. Modem: Most current high-performance
      f. Display Monitor: 20" LCD flat panel, color, capable of simultaneous display of all monitored units
      g. Printer: Current HP Color Desk Jet Series
      h. Keyboard: MS Windows compatible
      i. Mouse: MS Windows compatible
      j. Power Requirements: 90-230 Volts AC, 50-60Hz @ 8A
   2. Monitoring Station Operating System Software
      a. MS Windows (Latest Edition)

F. Network requirements:
   1. Maximum local network rated distance (2-20 gauge shielded TP): > 10 miles
   2. Maximum number of nodes (combined PC, inputs/outputs): 500
   3. Maximum I/O points per node (input or output): 2040
   4. Access time to status bit change (typical 6-car bank): < 25ms
   5. Must be capable of operating on RS485, RS422, Ethernet, Token Ring, Arc-net, Lift-Net, Fiber-Optic and mixed Networks.
   6. County will provide applicable cabling for network to Security room and or Machine Room.

G. Monitoring Requirements: The system shall display and record the following information for each monitored unit. Serial data links may include many more points. Items listed below are minimum requirements.
   1. Group status:
      a. Group operational mode
      b. All units to be monitored on the same screen in a graphical format
      c. In/out of service
      d. Standby power

e. Supervisory failure
f. Location and direction of hall calls

2. Individual car status, expandable menus:
   a. Direction of travel
   b. Independent service
   c. Inspection service
   d. Firefighters' service
   e. Hospital Code Blue service
   f. Position of elevator
   g. Door status (open, opening, closing, closed)
   h. Door dwell time
   i. Load by-pass
   j. Standby power
   k. Power on/off
   l. Door detector
   m. Safety circuit
   n. Door zone
   o. Stop switch
   p. Alarm button
   q. Registered car calls
   r. Out of level
   s. Machine room temperature exceeds 95 degrees
   t. Stop counter (number of starts)
   u. Car speed
   v. Door open times
   w. Door close time
   x. Start to stop motion time
   y. Emergency 2-way communication device
   z. Air conditioner/heater
3. Keyboard, mouse, and time clock control capabilities:
   a. Floor lockouts (car or hall)
   b. Lobby recall
   c. VIP service
   d. Firefighters' service
   e. Hospital Code Blue service
   f. Up/down peak
4. Faults monitored with visual and audible alarm, triggered by combinations of any of the above status points:
   a. Safety circuit
   b. Alarm bell
   c. Stop switch
   d. Emergency 2-way communication device
   e. Door reversal device

H. Reporting Requirements: System shall provide reports in color graphical format both on-screen and in printed form capability to conveniently switch from one report type to another and from one bank to another using minimal mouse clicks and key strokes. Reports shall be displayed after minimal waiting time. Data for all reports shall be continuously recorded and stored. Reports shall be displayed by simply

selecting a date and time range, bank of equipment and report type. Date and time range selections shall carry forward from one report selection to the next. Reporting functions shall be sub-divided into the following categories:

1. Traffic Reports:
    a. Number of hall calls per floor (hall call distribution on a per floor basis)
    b. Number of hall calls per hour (24 hour time-line)
    c. Hall call waiting times per floor (hall call waiting time distribution on a per floor basis)
    d. Hall call waiting times per hour (24 hour time-line)
    e. Distributed hall call response graph (24 hour time-line)
    f. Detailed hall call response graph (% calls / n seconds)
    g. Longest wait times including floor #, wait time, date, time and direction
2. Fault Reports:
    a. Ten most recent faults (most recent faults listed per bank)
    b. Fault Log: Displays the entire fault log for a given time period
    c. Faults per car (fault distribution on a per car basis)
    d. Faults per floor (fault distribution on a per floor basis)
    e. Faults per day/week/month (fault distribution on a per unit or group basis)
3. Car Use Statistics:
    a. Car use by hour (24 hour time-line of car calls, car starts, door cycles, delayed car, load by pass)
    b. Car use statistics (same as above, shown for an entire bank)
4. Group Service Log:
    a. Cars in service (24 hour time-line with text log of group availability of each car)
    b. Group functions (24 hour time-line with text log of actuation of group functions – Up peak, down peak, fire service, emergency power, etc.

I. Interface to Third Party Building Management Systems: System shall be interfaced and accessible on Server provided by County. Main server located at the Regional Computing Center 4300 S. John Young Parkway, Orlando Florida 32839. The elevator monitoring system shall be capable of interfacing and exchanging data with County's building management systems, in addition to Siemens, Landis & Staefa, Johnson Controls, SCADA, and others. Information shall be exchanged by Modbus protocol, open protocol, or other suitable methods as required.

J. Interactive Features: The control system shall be capable where desired of operating interactive control features provided in the elevator control system. These features may be revised as the requirements of the building change. Some of these interactive controls may include but are not limited to: security floor lockouts, entering car and hall calls, Firefighters' return service, lobby recall, VIP service, up/down peak or Emergency service. Local codes may affect the availability or operation of these features.

1. Security Access Features: The monitoring system shall be capable of providing security enable/disable of all hall and car calls through on-screen menus at a minimum. The monitoring system shall also be capable of interfacing directly with card readers and security keypads in stand-alone mode, and indirectly through a serial interface with a third party security system. When in stand-alone mode, the monitoring system shall maintain a database of elevator users and security pass codes. When on secure mode the use of each elevator will be recorded in a file together with the time, authorized pass code and destination for each call.
2. Elevator Control Features: Each elevator shall be capable of being controlled through the monitoring system. All control points shall be capable of seven-day twenty-four hour time clock automatic operation or manual operation from the mouse and keyboard. The control points shall include, but not be limited to, the following (where allowed by local codes):
   a. Lobby recall
   b. Car call security lockout
   c. Hall call security lockout
   d. Firefighters' service
   e. Independent service
   f. VIP Service
   g. Emergency service
   h. Standby power to selected car
3. Paging Feature: The monitoring system shall be capable of paging a service technician or other personnel based on pre-defined parameters of elevator faults or conditions. The paging system shall provide the ability to page multiple numbers determined by the type of event triggering the notification and shall be able to page different numbers based on preset times of day (i.e. different shifts). The system shall be capable of sending text messages to full text pagers in addition to supporting standard DTMF pagers.
4. Remote Access Feature: The monitoring system shall be capable of allowing approved individuals under multi-level password control to access all system features via the local area network, internet, or via modem over the public telephone network to review the performance of the equipment or to evaluate a fault condition. The remote access feature shall be integrated into the monitoring system and shall not use third party "remote control" software products.
5. Data Transmission to Central Support Location: The system shall be capable where desired of transmitting fault, car usage and other data to a remote service desk or other office location for further processing, technician dispatch or other purposes. The data may be transmitted via the local area network, internet, or via modem over the public telephone network.

2.13 FIRE COMMAND PANEL

A. Firefighters' Control Panel: Locate in building fire control room. Fixture faceplate, stainless steel satin finish, including the following features:
   1. Car position and direction indicator (digital-readout or color SVGA display type). Identify each position indicator with car number.
   2. Indicator showing operating status of car.

3. Manual car standby power selection switches and power status indicators.
4. Two-position firefighters' emergency return switches and indicators with engraved instructions filled red.
5. Firefighters' telephone jack.

B. Where applicable, identify all indicators and manual switches with appropriate engraving. Provide conduit and wiring to control panel.

2.14 INTERCOM AND DISTRESS SIGNAL SYSTEM

A. General: Provide intercommunication system for all cars and all specified Station Locations. Include all wiring between elevator system and location of phone device. Include all trained installation labor for quality installation. Provide applicable owners training if required for system.

Include the following stations:

Station Location	Selection Buttons to Call
1) Security Control Room	All Cars and Each Station
2) Machine Room	
3) Fire Command Room	

B. Specified Products Required
1. 1 Janus EMS5 unit.
2. 4 Janus PNB phones COP mount.
3. 1 Janus SHW Master Station for the Security Desk
4. 1 Janus SDK desk stand for Security Desk Master Station
5. 1 Janus SHW-MR Master Station for the Fire Command Control Room
6. 1 Janus SHW-MR Master Station for the Machine Room
7. 4 PLM2.8 phone line monitoring option (1 per car)
8. 1 LMA Line Monitoring Alert Panel for the group. (Inclusive of all cutting and patching for installation at designated level.
9. 1 LMX Hub to work with the PLM2.8 options and the LMA panel
10. Unlimited technical assistance from Janus to ensure proper operation of entire communication system.

PART 3 EXECUTION

3.01 SITE CONDITION INSPECTION

A. Prior to beginning installation of equipment, examine hoistway and machine room areas. Verify no irregularities exist which affect execution of work specified.

B. Do not proceed with installation until work in place conforms to project requirements.

3.02 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver material in Contractor's original, unopened protective packaging.

B. Store material in original protective packaging. Prevent soiling, physical damage, or moisture damage.

C. Protect equipment and exposed finishes from damage and stains during transportation, erection, and construction.

3.03 INSTALLATION

A. Install all equipment in accordance with Contractor's instructions, referenced codes, specification, and approved submittals.

B. Install machine room equipment with clearances in accordance with referenced codes, and specification.

C. Install all equipment so it may be easily removed for maintenance and repair.

D. Install all equipment for ease of maintenance.

E. Install all equipment to afford maximum accessibility, safety, and continuity of operation.

F. Remove oil, grease, scale, and other foreign matter from the following equipment and apply one coat of field-applied machinery enamel.
   1. All exposed equipment and metal work installed as part of this work which does not have architectural finish.
   2. Machine room equipment, and pit equipment.
   3. Neatly touch up damaged factory-painted surfaces with original paint color. Protect machine-finish surfaces against corrosion.

3.04 FIELD QUALITY CONTROL

A. Work at jobsite will be checked during course of installation. Full cooperation with reviewing personnel is mandatory. Accomplish corrective work required prior to performing further installation.

B. Have Code Authority acceptance inspection performed and complete corrective work.

3.05 ADJUSTMENTS

A. Install rails plumb and align vertically with tolerance of 1/16" in 100'-0". Secure joints without gaps and file any irregularities to a smooth surface.

B. Static balance car to equalize pressure of guide shoes on guide rails.

C. Lubricate all equipment in accordance with Contractor's instructions.

D. Adjust motors, power conversion units, brakes, controllers, leveling switches, limit switches, stopping switches, door operators, interlocks, and safety devices to achieve required performance levels.

3.06 CLEANUP

A. Keep work areas orderly and free from debris during progress of project. Remove packaging materials on a daily basis.

B. Remove all loose materials and filings resulting from work.

C. Clean machine room equipment and floor.

D. Clean hoistways, car, car enclosure, entrances, operating and signal fixtures.

E. Painting of machine room and pit floors shall be grey. Pit equipment painting shall be black. Machine and bed plating shall be painted to match existing color. Machine room walls shall be painted white. Machine room steps and railings shall be painted deck grey.

3.07 ACCEPTANCE REVIEW AND TESTS

A. See Section 01700, Article 1.02, Consultant's Final Observation and Review Requirements.

3.08 OWNER'S INFORMATION

A. See Section 01700, Article 1.03, Final Contract Compliance Review.

END OF SECTION

SECTION 15010
MECHANICAL GENERAL PROVISIONS

PART 1 - GENERAL

1.01 WORK INCLUDED:

A. The work covered under this Division of the Specifications is intended to include the furnishing of all materials, equipment and labor necessary for or reasonably incidental to, the installation of a complete and fully operative mechanical and plumbing systems as indicated on the drawings and specified in this section.

1. The work shall consist generally of, but is not limited to, the following major items:

a. HVAC Equipment
b. Ductwork and Insulation
c. Piping and Insulation
d. Plumbing
e. Plumbing Equipment and Rough-ins for Kitchen
f. Temperature Controls
g. Test and Balance

B. Work Not Included:

The following work is not included in this Section:

1. Electrical

C. Fees and Permits:

1. Obtain all permits required for his/her work and include the cost of same in his/her bid.

D. Certificate of Inspection:

1. The Contractor shall, at his/her expense, have a final inspection made of the complete mechanical installation and shall deliver a certificate of approval of the complete work to the Owner before receiving his/her final payment.

1.02 SUBMITTALS:

A. Submit properly identified manufacturer's literature and technical data before commencing work.

B. Shop Drawings:

1. Submit copies of manufacturer's drawing of HVAC equipment, piping, insulation, plumbing fixtures and any other special mechanical equipment to be installed, and shall receive the Project Engineer's acceptance before

ordering the same for installation.

2. All shop drawings shall be submitted in 3-ring binders with each specification section indicated with tabs.

3. If shop drawings are submitted intermittently and not in 3-ring binders, they will not be reviewed and will be returned to contractor for proper submittal.

4. Accepted Equivalent:

   Any manufacturer and/or catalog number listed on the drawings or in the Project Manual shall be construed to mean "or accepted equivalent".

   a. Any substitutions to be considered as "Accepted Equivalent" shall be submitted with both the cut of the proposed substitution and a cut of the specified equipment to the Purchasing and Contracts Division.

1.03 QUALITY ASSURANCE:

A. Qualifications of manufacturers, materials and equipment:

1. Material and equipment, except as herein otherwise noted, shall be new and conform to standards specified herein defined to include equipment, piping, insulation, and the like.

2. Materials and equipment shall be of an approved design.

   a. Similar materials shall be of one manufacturer wherever possible.

3. Equipment offered under these Specifications shall be limited to products regularly produced and recommended for service ratings in accordance with manufacturer's catalogs, engineering data, or other comprehensive literature made available to the public and in effect at the time of opening of bids.

4. Install equipment in strict accordance with manufacturer's instruction for type, capacity and suitability of each piece of equipment used.

   a. Obtain these instructions which shall be considered a part of these Specifications.

B. Qualifications of supervisor, workmanship and installers:

1. The Contractor shall have a master mechanic constantly supervising the work covered by these Specifications, and so far as possible shall keep the same foreman on the job from start to finish.

   a. The workmanship of the entire job shall be first class in every way and only experienced and competent workers shall be employed for the work.

1.04 CODES AND REGULATIONS:

A. Work shall be installed in accordance with the regulations and requirements of the Life Safety Code NFPA No. 101, 2007 Florida Building Code as well as all rules, state and local codes regulations and requirements.

B. Where ducts and/or pipes penetrate fire rated walls, ceilings or floors, the penetrations shall be firestopped in accordance with Chapter 7, Section 705 of the 2007 Florida Building Code.

1. The above shall be ascertained and fully coordinated before the installation of any material, equipment, and the like, and any discrepancy shall be immediately brought to the attention of the Project Architect in writing, and the Contractor shall receive a disposition of same before proceeding with the work.

2. Furnish, without additional charge, any additional materials and labor that may be required for compliance with these codes, law, rules, regulations or requirements even though the work is not mentioned in these Specifications or shown on the Drawings.

C. Material and equipment shall bear the label of approval of the National Board of Fire Underwriters Laboratory.

1.05 INSPECTIONS:

A. All work and materials covered by these Specifications and shown on the Drawings shall be subject to inspection at any and all times by representatives of the Project Architect or Owner.

B. If the Project Engineer or Owner's inspectors find that any material does not conform with these Specifications, the Contractor shall within three days after being notified by the Project Engineer or Owner, remove the material from the premises, and if said material has been installed, the entire expense of removing and replacing same, including any cutting and patching that may be necessary, shall be borne by the Contractor.

C. Tests:

The Owner reserves the right to inspect and test any portion of the equipment during the progress of this work.

1. The Contractor shall test the entire system in the presence of the Owner or the Owner's representative when the work is completed to insure that all portions are free from defects.

2. All equipment, material and labor necessary to conduct the above tests shall be furnished at the Mechanical Contractor's expense.

1.06 PRODUCT HANDLING:

A. Protection of Equipment, Material and Work: The Contractor shall effectively protect,

at his/her own expense, much of his/her work, materials or equipment, as is liable to injury during the construction period.

1. Openings into any part of the duct and piping system as well as associated fixtures, equipment, and the like, both before and after being set in place, shall be securely covered or otherwise protected to prevent obstruction or injury due to carelessness or maliciously dropped tools or materials, grit, dirt, or any foreign matter.

    a. The Contractor will be held responsible for all damage done until his/her work is fully and finally accepted.

2. Cover duct and pipe ends with capped bushings.

B. Repair of damage: In the event of damage, repair shall be made immediately, to the Project Architect's satisfaction and at no additional cost to the Owner.

C. Special Handling: Special care, storage and handling of new and existing plumbing fixtures shall be taken to minimize breakage.

1.07 JOB CONDITIONS:

A. Accuracy of Data: The data given herein and on the Drawings are as exact as could be secured.

1. The Specifications and Drawings are for the assistance and guidance of the Contractor.

2. Exact locations, distances, levels, and the like, will be governed by the building field conditions and the Contractor shall use the data contained herein with this understanding.

B. Drawings:

1. The mechanical drawings are diagrammatic, but shall be followed as closely as actual construction and work of other Contractors will permit.

2. Deviations from drawings required to make the work of the Contractor conform to the building as constructed, and to the work of other contractors, shall be made by the Contractor at his/her expense.

3. It is not the intention of the drawings or specifications to indicate each piece of pipe, ductwork, fittings and the like, required for the satisfactory operation of the installation and whereby one is indicated, but not specified, or specified but not indicated on the drawings, it shall be considered to be both specified and indicated.

C. Measurements:

1. Review the Contract Drawings and Specifications and visit the job site to ascertain all conditions, including conduit runs, interfacing, interferences,

conflicts, discrepancies, etc., and shall report the same to the Engineer for clarification ten days prior to submittal of the bid.

2. Failure to comply with this condition shall constitute an acceptance of the conditions and any necessary changes will be at Contractor's expense.

3. The Contractor shall make all measurements necessary for his/her work and shall assume responsibility for their accuracy.

D. Structural difficulties: Should any structural difficulties prevent the setting of equipment, and the like, at points indicated on the drawings, the necessary deviation therefrom, as determined by the Project Architect will be permitted and shall be made without additional cost.

E. Cooperation with Other Contractors

1. The Contractor shall arrange all parts of his/her work in proper relation to the work of other contractors.

2. Where interferences occur, the Contractor shall, before installing the work involved, consult with the Project Engineer as to exact location and level of his/her work.

3. The Project Architect's decision will be final.

4. The Contractor shall be responsible for arrangement of his/her work and equipment and maintenance of proper headroom under this work.

5. Should work installed by him/her require any modifications to avoid interference with the other work, such changes shall be made without additional cost.

6. The Engineer's decision as to determination or allocation or responsibility where conditions require changing of work, shall be final.

7. If any work of the Contractor is dependent for its proper execution on contiguous work, examine such work and report in writing any defect thereon or conditions rendering it unsuitable.

8. The beginning of work, without making such report, shall constitute an acceptance of such work, and any defects in his/her own work consequently shall be his/her responsibility.

1.08 CLEANING:

A. Keep the premises free of debris and unusable materials resulting from the work, and immediately upon completion of the work remove such debris and material from the site and leave floors broom clean in areas affected by the work.

1.09 GUARANTEE:

A. Leave the mechanical installation in proper working order and without charge, replace any work or materials which develop defects within one year from date of final inspection and acceptance by the Owner.

1.10 DEFINITIONS:

A. In this Division "provide" is used as a term contraction meaning "to furnish, install and connect up completely in the specified or in an approved manner for the item and/or material described".

PART 2 - PRODUCTS Not Used

PART 3 - EXECUTION Not Used

END OF SECTION

SECTION 15140
SUPPORTS AND ANCHORS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

B. This section is Division 15 Basic Mechanical Materials and Methods section, and is part of each Division 15 section making reference to supports and anchors specified herein.

1.02 DESCRIPTION OF WORK:

A. Extent of supports and anchors required by this section is indicated on drawings and/or specified in other Division 15 sections.

B. Types of supports and anchors specified in this section include the following:

1. Horizontal Piping Hangers and Supports.
2. Vertical Piping Clamps.
3. Hanger Rod Attachments.
4. Building Attachments.
5. Saddles and Shields.
6. Spring Hanger and Supports.
7. Miscellaneous Materials.
8. Anchors.
9. Equipment Supports.

C. Supports and anchors furnished as part of factory fabricated equipment, are specified as part of equipment assembly in other Division 15 sections.

1.03 QUALITY ASSURANCE:

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of supports and anchors, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Codes and Standards:

1. Code Compliance: Comply with applicable plumbing codes, pertaining to product materials and installation of supports.
2. UL and FM Compliance: Provide products which are UL listed and FM approved.
3. MSS Standard Compliance:

a. Provide pipe hangers and supports of which materials, design, and manufacture comply with MSS SP-58.

b. Select and apply pipe hangers and supports, complying with MSS SP-69.
c. Fabricate and install pipe hangers and supports, complying with MSS SP-89.
d. Terminology used in this section is defined in MSS SP-90.

1.04 SUBMITTALS:

A. Product Data: Submit manufacturer's technical product data, including installation instructions for each type of support and anchor.

B. Shop Drawings: Submit manufacturer's assembly type shop drawings for each type of support and anchor, indicating dimensions, weights, required clearances, and methods of assembly of components.

C. Maintenance Data: Submit maintenance data and parts list for each type of support and anchor. Include this data, product data, and shop drawings in maintenance manual; in accordance with requirements of Division 1.

PART 2 - PRODUCTS

2.01 HORIZONTAL PIPING HANGERS AND SUPPORTS:

A. General: Except as otherwise indicated, provide factory fabricated horizontal piping hangers and supports complying with MSS SP-58, of one of the following MSS types listed, selected by Installer to suit horizontal piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select size of hangers and supports to exactly fit pipe size for bare piping, and to exactly fit around piping insulation with saddle or shield for insulated piping. Provide copper plated hanger and supports for copper piping systems.

B. Adjustable Steel Clevis Hangers: MSS Type 1.

C. Steel Double Bolt Pipe Clamps: MSS Type 3.

D. Pipe Saddle Supports: MSS Type 36, including steel pipe base-support and cast iron floor flange.

E. Adjustable Roller Hangers: MSS Type 43.

F. Adjustable Pipe Roll Stands: MSS Type 46.

2.02 VERTICAL PIPING CLAMPS:

A. General: Except as otherwise indicated, provide factory fabricated vertical piping clamps complying with MSS SP-58, of one of the following types listed, selected by Installer to suit vertical piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Select size of vertical piping clamps to exactly fit pipe size of bare pipe. Provide copper plated clamps for copper piping systems.

B. Two Bolt Riser Clamps: MSS Type 8.

C. Four Bolt Riser Clamps: MSS Type 42.

2.03 HANGER ROD ATTACHMENTS:

A. General: Except as otherwise indicated, provide factory fabricated hanger rod attachments complying with MSS SP-58 of one of the following MSS types listed, selected by Installer to suit horizontal piping hangers and building attachments, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select size of hanger rod attachments to suit hanger rods. Provide copper plated hanger rod attachments for copper piping systems.

B. Steel Turnbuckles: MSS Type 13.

2.04 BUILDING ATTACHMENTS:

A. General: Except as otherwise indicated, provide factory fabricated building attachments complying with MSS SP-58, of one of the following MSS types listed, selected by Installer to suit building substrate conditions, in accordance with MSS SP-69 and manufacturer's published product information. Select size of building attachments to suit hanger rods. Provide copper plated building attachments for copper piping systems.

B. Concrete Inserts: MSS Type 18.

C. Center Beam Clamps: MSS Type 21.

D. Welded Beam Attachments: MSS Type 22.

E. Steel Brackets: One of the following for indicated loading:

1. Medium Duty: MSS Type 32.

2.05 SADDLES AND SHIELDS:

A. General: Except as otherwise indicated, provide saddles or shields under piping hangers and supports, factory fabricated, for all insulated piping. Size saddles and shields for exact fit to mate with pipe insulation.

B. Protection Saddles: MSS Type 39, fill interior voids with segments of insulation matching adjoining insulation.

C. Protection Shields: MSS Type 40; of length recommended by manufacturer to prevent crushing of insulation.

D. Manufacturer: Subject to compliance with requirements, provide thermal hanger shields of one of the following:

1. Elcen Metal Products Co.
2. Pipe Shields, Inc.
3. Or approved equal.

2.06 SPRING HANGERS AND SUPPORTS:

A. General: Except as otherwise indicated, provide factory fabricated spring hangers and supports complying with MSS SP-58, of one of the following MSS types listed, selected by Installer to suit piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select spring hangers and supports to suit pipe size and loading.

B. Spring Cushion Hangers: MSS Type 48.

2.07 MANUFACTURERS OF HANGERS AND SUPPORTS:

A. Manufacturer: Subject to compliance with requirements, provide hangers and supports of one of the following:

1. B-Line Systems, Inc.
2. Carpenter and Patterson, Inc.
3. Corner & Lada Co., Inc.
4. Elcen Metal Products Co.
5. Fee & Mason Mfg. Co.; Div. Figgie International.
6. ITT Grinnel Corp.

2.08 MISCELLANEOUS MATERIALS:

A. Metal Framing: Provide products complying with NEMA STD ML 1.

B. Steel Plates, Shapes and Bars: Provide products complying with ASTM A 36.

C. Cement Grout: Portland cement (ASTM C150, Type I or Type III) and clean uniformly graded, natural sand (ASTM C 404, Size No.2). Mix at a ratio of 1.0 part cement to 3.0 parts sand, by volume, with minimum amount of water required for placement and hydration.

PART 3 - EXECUTION

3.01 INSPECTION:

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

3.02 PREPARATION:

A. Proceed with installation of hangers, supports and anchors only after required building structural work has been completed in areas where the work is to be installed. Correct inadequacies including (but not limited to) proper placement of

inserts, anchors, and other building structural attachments.

B. Prior to installation of hangers, supports, anchors and associated work, Installer shall meet at project site with Contractor, installer of each component of associated work, inspection and testing agency representatives (if any), installers of other work requiring coordination with work of this section and Architect/Engineer for purpose of reviewing material selections and procedures to be followed in performing the work in compliance with requirements specified.

3.03 INSTALLATION OF BUILDING ATTACHMENTS:

A. Install building attachments at required locations within concrete or on structural steel for proper piping support. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional building attachments where support is required for additional concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts securely to forms. Where concrete with compressive strength less than 2500 psi is indicated, install reinforced bars through openings at top of inserts.

3.04 INSTALLATION OF HANGERS AND SUPPORTS:

A. General: Install hangers, supports, clamps and attachments to support piping properly from building structure; comply with MSS SP-69. Arrange for grouping of parallel runs of horizontal piping to be supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe. Do not use wire or perforated metal to support piping, and do not support piping from other piping.

B. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers and other accessories. Except as otherwise indicated for exposed continuous pipe runs, install hangers and supports of same type and style as installed for adjacent similar piping.

C. Support fire water piping independently of other piping.

D. Prevent electrolysis in support of copper tubing by use of hangers and supports which are copper plated, or by other recognized industry methods.

E. Provisions for Movement:

1. Install hangers and supports to allow controlled movement of piping systems and to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends and similar units.
2. Load Distribution: Install hangers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connected equipment.
3. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes, and so that maximum pipe deflections allowed by ANSI B31 Pressure Piping Codes are not exceeded.

4. Insulated Piping: Comply with the following installation requirements.

a. Clamps: Attach clamps, including spacers (if any) to piping with clamps projecting through insulation; do not exceed pipe stresses allowed by ANSI B31.
b. Shields: Where low-compressive strength insulation or vapor barriers are indicated on cold or chilled water piping, install coated protective shields. For pipe 8" and over, install wood insulation saddles.
c. Saddles: Where insulation without vapor barrier is indicated, install protection saddles.

3.05 INSTALLATION OF ANCHORS:

A. Install anchors at proper locations to prevent stresses from exceeding those permitted by ANSI B31, and to prevent transfer of loading and stresses to connected equipment.

B. Fabricate and install anchor by welding steel shapes, plates and bars to piping and to structure. Comply with ANSI B31 and with AWS standards.

C. Where expansion compensators are indicated, install anchors in accordance with expansion unit manufacturer's written instruction, to limit movement of piping and forces to maximums recommended by manufacturer for each unit.

D. Anchor Spacings: Where not otherwise indicated, install anchors at ends of principal pipe-runs, at intermediate points in piperuns between expansion loops and bends. Make provisions for preset of anchors as required to accommodate both expansion and contraction of piping.

3.06 EQUIPMENT SUPPORTS:

A. Concrete housekeeping bases will be provided as work of Division 3. Furnish to Contractor, scaled layouts of all required bases. Furnish templates, anchor bolts, and accessories, necessary for base construction.

B. Provide structural steel stands to support equipment not floor mounted or hung from structure. Construct of structural steel members or steel pipe and fittings. Provide factory fabricated tank saddles for tanks mounted on steel stands.

3.07 ADJUSTING AND CLEANING:

A. Hanger Adjustment: Adjust hangers so as to distribute loads equally on attachments.

B. Support Adjustment: Provide grout under supports so as to bring piping and equipment to proper level and elevations.

C. Cleaning: Clean factory finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

END OF SECTION

SECTION 15161
VIBRATION ISOLATION

PART 1 - GENERAL

1.01 DESCRIPTION:

A. This section pertains to the furnishing of all labor, equipment, material and services necessary to provide complete vibration isolation systems for equipment, piping and ductwork including:

1. Vibration isolators.
2. Equipment bases.

B. The general provisions of the contract, including General and Supplementary Conditions, and Special Conditions apply to the work specified in this section.

C. The vibration isolators and equipment bases shall be the product of one manufacturer who shall determine mounting sizes and provide field supervision and inspection to assure proper installation and performance.

1.02 QUALITY ASSURANCE:

A. The general provisions of the contract, including General and Supplementary Conditions, and Special Conditions apply to the work specified in this section.

1.03 SUBMITTALS:

A. Shop drawings as listed shall be submitted.

1. Vibration isolators: Provide catalog cuts, isolation efficiencies and deflections.
2. Equipment bases: Provide catalog cuts or drawings.

1.04 DELIVERY, STORAGE AND HANLDING:

A. Preparation for Transport: Prepare isolators for shipping as follows:

1. Ensure isolators are dry and protected against rusting.

2. Protect valve ends against mechanical damage.

B. Storage: Use the following precautions during storage:

1. Do not remove isolators unless necessary for inspection: then reinstall for storage.

2. Protect valves against weather. Where practical store valves indoors. Maintain valve temperature higher than the ambient dew point temperature. If outdoor storage is necessary, support isolators off the ground or pavement

and protect in watertight enclosures.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. Spring type isolators shall be free standing and laterally stable without any housing and complete with 1/4" neoprene acoustical friction pads between the baseplate and the support. All mountings shall have leveling bolts that must be rigidly bolted to the equipment. Spring diameters shall be no less than 0.8 of the compressed height of the spring at rated load. Springs shall have a minimum additional travel to solid equal to 50% of the rated deflection. Submittals shall include spring diameters, deflections, compressed spring height and solid spring height.

B. Vibration hangers shall contain a steel spring and 0.3" deflection neoprene element in series. The neoprene element shall be molded with a rod isolation busing that passes through the hanger box. Spring diameters and hanger box lower hole sizes shall be large enough to permit the hanger rod to swing thru a 30 deg. arc before contacting the hole and short circuiting the spring. Springs shall have a minimum additional travel to solid equal to 50% of the rated deflection. Submittals shall include a scale drawing of the hanger showing the 30 deg. capability.

C. Air handling equipment shall be protected against excessive displacement which might result from high air thrusts in relation to the equipment weights. The horizontal thrust restraint shall consist of a spring element in series with a neoprene pad as described in Specification B with the same deflection as specified for the mountings or hangers. The spring element shall be contained within a steel frame and designed so it can be preset for thrust at the factory and adjusted in the field to allow for a maximum of 1/4" movement at start and stop. The assembly shall be furnished complete with rods and angle brackets for attachment to both the equipment and ductwork or equipment and the structure. Horizontal restraints shall be attached at the centerline of thrust and symmetrically on either side of the unit.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Installation shall be in accordance with the manufacturers instructions.

B. Vibration isolators shall provide the required deflection under imposed loads and shall produce uniform loading and deflection even when equipment weight is not evenly distributed. Leveling bolts shall not be used as jacking devices. Isolators shall be as follows, except as noted:

TABULATION OF VIBRATION ISOLATION FOR MECHANICAL SYSTEMS

EQUIPMENT ITEM	SPAN OF SUPPORTING STRUCTURE DEFLECTION	TYPE ISOLATOR	MASON INDUSTRIES SPEC.REFER.	MINIMUM STATIC

Air Handling Units	30N	D	B-J	.75"
Inline Fans	30N	D	B-J	.75"

END OF SECTION

SECTION 15700
DECENTRALIZED HVAC EQUIPMENT

Part 1 – General

1.01 SYSTEM DESCRIPTION

The variable capacity, heat pump heat recovery air conditioning system shall be a Mitsubishi Electric CITY MULTI VRFZ (Variable Refrigerant Flow Zoning), Daikin, Samsung or approved equal.

The Y-Series system shall consist of PUHY outdoor unit, multiple indoor units (-E models), and M-NET DDC (Direct Digital Controls). The sum of connected capacity of all indoor air handlers shall range from 50% to 130% of outdoor rated capacity.

1.02 QUALITY ASSURANCE

A. The units shall be listed by Electrical Testing Laboratories (ETL) and bear the ETL label.

B. All wiring shall be in accordance with the National Electrical Code (N.E.C.).

C. The units shall be manufactured in a facility registered to ISO 9001 and ISO14001 which is a set of standards applying to environmental protection set by the International Standard Organization (ISO).

D. All units must meet or exceed the 2010 Federal minimum efficiency requirements and the proposed ASHRAE 90.1 efficiency requirements for VRF systems. Efficiency shall be published in accordance with the DOE alternative test procedure, which is based on the Air-Conditioning, Heating, and Refrigeration Institute (AHRI) Standards 340/360, 1230 and ISO Standard 13256-1.

E. A full charge of R-410A for the condensing unit only shall be provided in the condensing unit.

1.03 DELIVERY, STORAGE AND HANDLING

A. Unit shall be stored and handled according to the manufacturer’s recommendation.

1.04 CONTROLS

A. The control system shall consist of a low voltage communication network of unitary built-in controllers with on-board communications and a web-based operator interface. A web controller with a network interface card shall gather data from this system and generate web pages accessible through a conventional web browser on each PC connected to the network. Operators shall be able to perform all normal operator functions through the web browser interface.

B. System controls and control components shall be installed in accordance with the manufacturer’s written installation instructions.

C. Furnish energy conservation features such as optimal start, night setback, request-based logic, and demand level adjustment of overall system capacity as specified in the sequence.

D. System shall provide direct and reverse-acting on and off algorithms based on an input condition or group conditions to cycle a binary output or multiple binary outputs.

E. Provide capability for future system expansion to include monitoring and use of occupant card access, lighting control and general equipment control.

F. System shall be capable of email generation for remote alarm annunciation.

G. Control system start-up shall be a required service to be completed by the manufacturer or a duly authorized, competent representative that has been factory trained in Mitsubishi controls system configuration and operation. The representative shall provide proof of certification for Mitsubishi CMCN Essentials Training and/or CMCN Hands-On Training indicating successful completion of no more than two (2) years prior to system installation. This certification shall be included as part of the equipment and/or controls submittals. This service shall be equipment and system count dependent and shall be a minimum of one (1) eight (8) hour period to be completed during normal working hours.

Part 2 – Warranty

2.01 The units shall be covered by the manufacturer's limited warranty for a period of one (1) year from date of installation.

If the systems are:

1) designed by a certified CITY MULTI Diamond Designer,

2) installed by a contractor that has successfully completed the Mitsubishi

Electric three day service course, AND

3) verified with a completed commissioning report submitted to and approved

by the Mitsubishi Electric Service Department,

then the units shall be covered by an extended manufacturer's limited warranty for a period of five (5) years from date of installation.

In addition the compressor shall have a manufacturer's limited warranty for a period of seven (7) years from date of installation.

If, during this period, any part should fail to function properly due to defects in workmanship or material, it shall be replaced or repaired at the discretion of the manufacturer.

This warranty shall not include labor.

2.02 Manufacturer shall have a minimum of twenty-nine years of HVAC experience in the U.S. market.

2.03 All manufacturer technical and service manuals must be readily available for download by any local contractor should emergency service be required. Registering and sign-in requirements which may delay emergency service reference are not allowed.

2.04 The CITY MULTI VRFZ system shall be installed by a contractor with extensive CITY MULTI install and service training. The mandatory contractor service and install training should be performed by the manufacturer.

3.01 Y-SERIES OUTDOOR UNIT

A. General:

The Y-Series PUHY outdoor unit shall be specifically used with CITY MULTI VRFZ components. The PUHY outdoor units shall be equipped with multiple circuit boards that interface to the M-NET controls system and shall perform all functions necessary for operation. Each outdoor unit module shall be completely factory assembled, piped, wired and run tested at the factory.

1. The model nomenclature and unit requirements are shown below. All units requiring a factory supplied twinning kit shall be piped together in the field, without the need for equalizing line(s). If an alternate manufacturer is selected, any additional material, cost, and labor to install additional lines shall be incurred by the contractor.

Outdoor Unit Model Nomenclature		
208/230 Volt		Twinning Kit
Model Number	Units	
PUHY-P72TJMU	(1) PUHY-P72TJMU	None
PUHY-P96TJMU	(1) PUHY-P96TJMU	None
PUHY-P120TJMU	(1) PUHY-P120TJMU	None
PUHY-P144TJMU	(1) PUHY-P144TJMU	None
PUHY-P168TSJMU	(1) PUHY-P96TJMU (1) PUHY-P72TJMU	CMY-Y100VBK
PUHY-P192TSJMU	(1) PUHY-P72TJMU (1) PUHY-P120TJMU	CMY-Y100VBK
PUHY-P216TSJMU	(1) PUHY-P96TJMU (1) PUHY-P120TJMU	CMY-Y100VBK
PUHY-P240TSJMU	(2) PUHY-P120TJMU	CMY-Y100VBK
PUHY-P264TSJMU	(1) PUHY-P120TJMU (1) PUHY-P144TJMU	CMY-Y200VBK2
PUHY-P288TSJMU	(2) PUHY-P144TJMU	CMY-Y200VBK2
PUHY-P312TSJMU	(1) PUHY-P72TJMU (2) PUHY-P120TJMU	CMY-Y300VBK2
PUHY-P338TSJMU	(1) PUHY-P96TJMU (2) PUHY-P120TJMU	CMY-Y300VBK2
PUHY-P360TJMU	(1) PUHY-P96TJMU (1) PUHY-P120TJMU (1) PUHY-P144TJMU	CMY-Y300VBK2

Outdoor Unit Model Nomenclature		
460 Volt		Twinning Kit
Model Number	Units	
PUHY-P72YJMU	(1) PUHY-P72YJMU	None
PUHY-P96YJMU	(1) PUHY-P96YJMU	None
PUHY-P120YJMU	(1) PUHY-P120YJMU	None
PUHY-P144YJMU	(1) PUHY-P144YJMU	None
PUHY-P168YSJMU	(1) PUHY-P96YJMU (1) PUHY-P72YJMU	CMY-Y100VBK
PUHY-P192YSJMU	(2) PUHY-P96YJMU	CMY-Y100VBK
PUHY-P216YSJMU	(1) PUHY-P96YJMU (1) PUHY-P120YJMU	CMY-Y100VBK
PUHY-P240YSJMU	(2) PUHY-P120YJMU	CMY-Y100VBK
PUHY-P264YSJMU	(1) PUHY-P120YJMU (1) PUHY-P144YJMU	CMY-Y200VBK2
PUHY-P288YSJMU	(2) PUHY-P144YJMU	CMY-Y200VBK2
PUHY-P312YSJMU	(1) PUHY-P72YJMU (2) PUHY-P120YJMU	CMY-Y300VBK2
PUHY-P338YSJMU	(1) PUHY-P96YJMU (2) PUHY-P120YJMU	CMY-Y300VBK2
PUHY-P360YJMU	(1) PUHY-P96YJMU (1) PUHY-P120YJMU (1) PUHY-P144YJMU	CMY-Y300VBK2

2. Outdoor unit shall have a sound rating no higher than 60 dB(A) individually or 65 dB(A) twinned. Units shall have a sound rating no higher than 50 dB(A) individually or 55 dB(A) twinned while in night mode operation. If an alternate manufacturer is selected, any additional material, cost, and labor to meet published sound levels shall be incurred by the contractor.

3. Outdoor unit shall be able to connect to up to 50 indoor units depending upon model.

4. Both refrigerant lines from the outdoor unit to indoor units shall be insulated.

5. The outdoor unit shall have an accumulator with refrigerant level sensors and controls.

6. The outdoor unit shall have a high pressure safety switch, over-current protection and DC bus protection.

7. The outdoor unit shall have the ability to operate with a maximum height difference of 164 feet (294 feet optional) and have a total refrigerant tubing length of 3280 feet. The greatest length is not to exceed 541 feet between the outdoor unit and the indoor units without the need for line size changes or traps.

8. The outdoor unit shall be capable of operating in heating mode down to -4°F ambient temperature or cooling mode down to 23°F ambient temperature, without additional low ambient controls. If an alternate manufacturer is selected, any additional material, cost, and labor to meet low ambient operating condition and performance shall be incurred by the contractor.

9. outdoor unit shall have a high efficiency oil separator plus additional logic controls to ensure adequate oil volume in the compressor is maintained.

B. Unit Cabinet:

1. The casing(s) shall be fabricated of galvanized steel, bonderized and finished. Units cabinets shall be able to withstand 960 hours per ASTM B117 criteria for seacoast protected models (–BS models).

C. Fan:

1. Each outdoor unit module shall be furnished with one direct drive, variable speed propeller type fan.

2. The fan motor shall have inherent protection, have permanently lubricated bearings, and be completely variable speed. The fan shall be factory set for operation under 0 in. WG external static pressure, but capable of normal operation under a maximum of 0,24 in. WG external static pressure via dipswitch.

3. The fan motor shall be mounted for quiet operation.

4. The fan shall be provided with a raised guard to prevent contact with moving parts.

5. The outdoor unit shall have vertical discharge airflow.

D. Refrigerant

1. R410A refrigerant shall be required for PUHY-T/Y(S)JMU-A outdoor unit systems.

2. Polyolester (POE) oil shall be required. Prior to bidding, manufacturers using alternate oil types shall submit material safety data sheets (MSDS) and comparison of hygroscopic properties for alternate oil with list of local suppliers stocking alternate oil for approval at least two weeks prior to bidding.

E. Coil:

1. The outdoor coil shall be of nonferrous construction with lanced or corrugated plate fins on copper tubing.

2. The coil fins shall have a factory applied corrosion resistant blue-fin finish.

3. The coil shall be protected with an integral metal guard.

4. Refrigerant flow from the outdoor unit shall be controlled by means of an inverter driven compressor.

5. The outdoor coil shall include 4 circuits with two position valves for each circuit, except for the last stage.

F. Compressor:

1. Each outdoor unit module shall be equipped with one inverter driven scroll hermetic compressor. Non inverter-driven compressors, which cause inrush current (demand charges) and require larger wire sizing, shall not be allowed.

2. A crankcase heater(s) shall be factory mounted on the compressor(s).

3. The outdoor unit compressor shall have an inverter to modulate capacity. The capacity shall be completely variable with a turndown of 18%-4% of rated capacity, depending upon unit size

4. The compressor shall be equipped with an internal thermal overload.

5. The compressor shall be mounted to avoid the transmission of vibration.

G. Electrical:

1. The outdoor unit electrical power shall be 208/230 volts, 3-phase, 60 hertz. or 460 volts, 3-phase, 60 hertz.

2. The outdoor unit shall be capable of satisfactory operation within voltage limits of 187-228 volts (208V/60Hz), 207-253V (230V/60Hz) or 414-506V (460V/60Hz).

3. The outdoor unit shall be controlled by integral microprocessors.

4. The control circuit between the indoor units, BC Controller and the outdoor unit shall be 24VDC completed using a 2-conductor, twisted pair shielded cable to provide total integration of the system.

H. Electrical:

1. The outdoor unit electrical power shall be 208/230 volts, 3-phase, 60 hertz.

2. The outdoor unit shall be capable of satisfactory operation within voltage limits of 187-228 volts (208V/60Hz), 207-253V (230V/60Hz).

3. The outdoor unit shall be controlled by integral microprocessors.

4. The control circuit between the indoor units, BC Controller and the outdoor unit shall be 24VDC completed using a 2-conductor, twisted pair shielded cable to provide total integration of the system.

I. Controls:

1. The outdoor unit shall have the capability of up to 12 levels of demand control for each refrigerant system.

3.02 PKFY (Wall Mounted) INDOOR UNIT

A. General:

The PKFY shall be a wall-mounted indoor unit section and shall have a modulating linear expansion device and a flat front. The PKFY shall be used with the R2-Series outdoor unit and BC Controller, Y-Series outdoor unit, or S-Series outdoor unit. The PKFY shall support individual control using M-NET DDC controllers.

B. Indoor Unit

The indoor unit shall be factory assembled, wired and run tested. Contained within the unit shall be all factory wiring, piping, electronic modulating linear expansion device, control circuit board and fan motor. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, an auto restart function, and a test run switch. Indoor unit and refrigerant pipes shall be charged with dehydrated air before shipment from the factory.

C. Unit Cabinet:

1. All casings, regardless of model size, shall have the same white finish

2. Multi directional drain and refrigerant piping offering four (4) directions for refrigerant piping and two (2) directions for draining shall be standard.

3. There shall be a separate back plate which secures the unit firmly to the wall.

D. Fan:

1. The indoor fan shall be an assembly with one or two line-flow fan(s) direct driven by a single motor.

2. The indoor fan shall be statically and dynamically balanced to run on a motor with permanently lubricated bearings.

3. A manual adjustable guide vane shall be provided with the ability to change the airflow from side to side (left to right).

4. A motorized air sweep louver shall provide an automatic change in airflow by directing the air up and down to provide uniform air distribution.

E. Filter:

1. Return air shall be filtered by means of an easily removable, washable filter.

F. Coil:

1. The indoor coil shall be of nonferrous construction with smooth plate fins on copper tubing.

2. The tubing shall have inner grooves for high efficiency heat exchange.

3. All tube joints shall be brazed with phos-copper or silver alloy.

4. The coils shall be pressure tested at the factory.

5. A condensate pan and drain shall be provided under the coil.

6. Both refrigerant lines to the PKFY indoor units shall be insulated.

G. Electrical:

1. The unit electrical power shall be 208/230 volts, 1-phase, 60 hertz.

2. The system shall be capable of satisfactory operation within voltage limits of 187-228 volts (208V/60Hz) or 207-253 volts (230V/60Hz)

H. Controls:

1. This unit shall use controls provided by Mitsubishi Electric to perform functions necessary to operate the system. Please refer to Part 4 of this guide specification for details on controllers and other control options.

2. The unit shall be able to control external backup heat.

3. The unit shall have a factory built in receiver for wireless remote control

4. Indoor unit shall compensate for the higher temperature sensed by the return air sensor compared to the temperature at level of the occupant when in HEAT mode. Disabling of compensation shall be possible for individual units to accommodate instances when compensation is not required.

5. Control board shall include contacts for control of external heat source. External heat may be energized as second stage with 1.8°F – 9.0°F adjustable deadband from set point.

6. Indoor unit shall include no less than four (4) digital inputs capable of being used for customizable control strategies.

7. Indoor unit shall include no less than three (3) digital outputs capable of being used for customizable control strategies.

Part 4 – Controls

4.01 Overview

A. General:

The CITY MULTI Controls Network (CMCN) shall be capable of supporting remote controllers, schedule timers, system controllers, centralized controllers, an integrated web based interface, graphical user workstation, and system integration to Building Management Systems via BACnet® and LonWorks®.

4.02 Electrical Characteristics

A. General:

The CMCN shall operate at 24VDC. Controller power and communications shall be via a common non-polar communications bus.

B. Wiring:

1. Control wiring shall be installed in a daisy chain configuration from indoor unit to ME remote controller to indoor unit, to the BC controller (main and subs, if applicable) and to the outdoor unit. Control wiring to remote controllers shall be run from the indoor unit terminal block to the controller associated with that unit.

2. Control wiring for schedule timers, system controllers, and centralized controllers shall be installed in a daisy chain configuration from outdoor unit to outdoor unit, to system controllers, to the power supply.

3. Control wiring for the Deluxe MA, Simple MA, and Wireless MA remote controllers shall be from the remote controller to the first associated indoor unit (TB-15) then to the remaining associated indoor units (TB-15) in a daisy chain configuration.

4. The AG-150, GB-50ADA, GB-24 centralized controller shall be capable of being networked with other AG-150, GB-50ADA and GB-24 centralized controllers for centralized control.

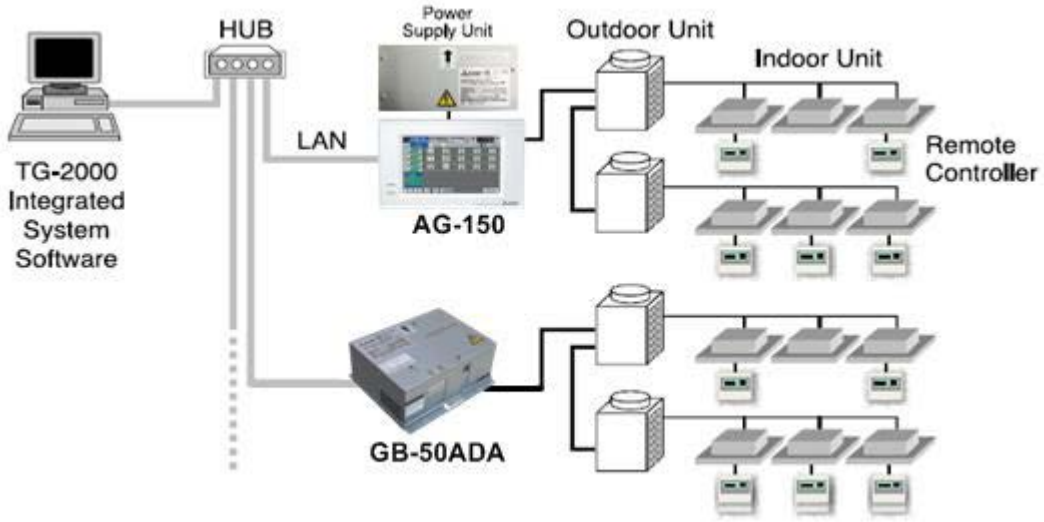
C. Wiring type:

1. Wiring shall be 2-conductor (16 AWG), twisted, stranded, shielded wire as defined by the Design Tool AutoCAD output.

2. Network wiring shall be CAT-5e with RJ-45 connection.

4.03 CITY MULTI Controls Network

The CITY MULTI Controls Network (CMCN) consists of remote controllers, schedule timers, system controllers, centralized controllers, and/or integrated web based interface communicating over a high-speed communication bus. The CITY MULTI Controls Network shall support operation monitoring, scheduling, error email distribution, personal browsers, tenant billing, online maintenance support, and integration with Building Management Systems (BMS) using either LonWorks® or BACnet® interfaces. The below figure illustrates a sample CMCN System Configuration.



CMCN System Configuration

4.04 CMCN: Remote Controllers

A. Deluxe MA Remote Controller (PAR-21MAA)

The Deluxe MA Remote Controller (PAR-21MAA) shall be capable of controlling up to 16 indoor units (defined as 1 group). The Deluxe MA Remote Controller shall be approximately 5” x 5” in size and white in color with a light-green LCD display. The Deluxe MA Remote Controller shall support a selection from multiple languages (Spanish, German, Japanese, Chinese, English, Russian, Italian, or French) for display information. The Deluxe MA supports temperature display selection of Fahrenheit or Celsius. The Deluxe MA Remote Controller shall control the following grouped operations: On/Off, Operation Mode (cool, heat, auto (R2/WR2-Series Simultaneous Heating and Cooling only), dry, and fan), temperature set point, fan speed setting, and airflow direction setting. The Deluxe MA Remote Controller shall support timer settings of on/off/temperature up to 8 times in a day in 1-minute increments. The Deluxe MA Remote Controller shall support an Auto Off timer. The Deluxe MA Remote Controller shall be able to limit the set temperature range from the Deluxe MA. The room temperature shall be sensed at either the Deluxe MA Remote Controller or the Indoor Unit dependent on the indoor unit dipswitch setting. The Deluxe MA Remote Controller shall display a four-digit error code in the event of system abnormality or error.

The Deluxe MA Remote Controller shall only be used in the same group with other Deluxe MA Remote Controllers (PAR-21MAA), Wireless MA (PAR-FL32MA / PAR-FA32MA), or Simple MA Remote Controllers (PAC-YT51CRB), with up to two remote controllers per group.

The Deluxe MA Remote Controller shall require no addressing. The Deluxe MA Remote Controller shall connect using two-wire, stranded, non-polar control wire to the TB15 connection terminal on the indoor unit. The PAR-21MAA shall require cross-over wiring for grouping across indoor units.

PAR-21MAA (Deluxe MA Remote Controller)			
Item	Description	Operation	Display
ON/OFF	Run and stop operation for a single group	Each Group	Each Group
Operation Mode	Switches between Cool/Dry/Auto/Fan/Heat. Operation modes vary depending on the air conditioner unit. Auto mode is in the R2/WR2-Series only.	Each Group	Each Group

PAR-21MAA (Deluxe MA Remote Controller)			
Item	Description	Operation	Display
Temperature Setting	Sets the temperature for a single group. Range of temperature setting from 57°F – 87°F dependant on operation mode and indoor unit.	Each Group	Each Group
Fan Speed Setting	Models with 4 air flow speed settings: Hi/Mid-2/Mid-1/Low Models with 3 air flow speed settings: Hi/Mid/Low Models with 2 air flow speed settings: Hi/Low Fan speed setting (including Auto) varies depending on the indoor unit model.	Each Group	Each Group
Air Flow Direction Setting	Air flow direction angles (4 or 5 angle Swing) Auto Louver ON/OFF Air flow direction settings vary depending on the indoor unit model.	Each Group	Each Group
Weekly Scheduler	ON/OFF/Temperature setting can be done up to 8 times one day in the week. The time can be set by the 1-minute interval.	Each Group	Each Group
Permit / Prohibit Local Operation	Individually prohibit operation of each local remote control function (Start/Stop, Change operation mode, Set temperature, Reset filter). *1: Centrally Controlled is displayed on the remote controller for prohibited functions.	N/A	Each Group *1
Prohibition / Permission of Specified Mode	Setting via the System Controller, the operation for the following modes is prohibited: Cooling Prohibited: Cool, Dry, Auto Heating Prohibited: Heat, Auto Cooling-Heating Prohibited: Cool, Heat, Dry, Auto	N/A	Each Group
Display Indoor Unit Intake Temp	Measures and displays the intake temperature of the indoor unit when the indoor unit is operating.	N/A	Each Group
Error	When an error is currently occurring on an air conditioner unit, the afflicted unit and the error code are displayed	N/A	Each Unit

PAR-21MAA (Deluxe MA Remote Controller)			
Item	Description	Operation	Display
Test Run	Operates air conditioner units in test run mode.	Each Group	Each Group
Ventilation Equipment	Up to 16 indoor units can be connected to an interlocked system that has one LOSSNAY unit. LOSSNAY items that can be set are “Hi”, “Low”, and “Stop”. Ventilation mode switching is not available.	Each Group	Each Group
Set Temperature Range Limit	Set temperature range limit to cooling, heating, or auto mode.	Each Group	Each Group
Auto Lock Out Function	Setting/releasing of simplified locking for remote control buttons can be performed. • Locking of all buttons • Locking of all buttons except ON/OFF button	Each Group	Each Group

SECTION 15870
POWER VENTILATORS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

B. Requirements of the following Division 15 Sections apply to this section:

1. Division 15 Section 15010 "Mechanical General Provisions."
2. Division 15 Section 15050 "Basic Mechanical Materials and Methods."

1.02 SUMMARY

A. This Section includes the following types of power ventilators:

1. Inline and Ceiling mounted ventilators.
2. Centrifugal Roof Ventilators

B. Related Sections: The following sections contain requirements that relate to this section:

1. Division 15 Section 15161 "Vibration Control" for vibration hangers and supports.
2. Division 15 Section 15990 "Testing, Adjusting, and Balancing" for air-handling systems testing, adjusting, and balancing requirements and procedures.

C. Products furnished but not installed under this Section include roof curbs for roof-mounted exhaust fans.

1.03 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections:

1. Product data for selected models, including specialties, accessories, and the following:

a. Certified fan performance curves with system operating conditions indicated.
b. Certified fan sound power ratings.
c. Motor ratings and electrical characteristics plus motor and fan accessories.
d. Materials gages and finishes, including color charts.
e. Dampers, including housings, linkages, and operators.

2. Shop drawings from manufacturer detailing equipment assemblies and

indicating dimensions, weights, required clearances, components, and location and size of field connections.

3. Coordination drawings, in accordance with Division 15 Section "Basic Mechanical Requirements," for roof penetration requirements and for reflected ceiling plans drawn accurately to scale and coordinating penetrations and units mounted above ceiling. Show the following:

    a. Roof framing and support members relative to duct penetrations.
    b. Ceiling suspension members.
    c. Method of attaching hangers to building structure.
    d. Size and location of initial access modules for acoustical tile.
    e. Ceiling-mounted items including light fixtures, diffusers, grilles, speakers, sprinkler heads, access panels, and special moldings.

4. Wiring diagrams that detail power, signal, and control wiring. Differentiate between manufacturer-installed wiring and field-installed wiring.
5. Product certificates, signed by manufacturers of air-handling units, certifying that their products comply with specified requirements.
6. Maintenance data for exhaust fans, for inclusion in Operating and Maintenance Manual specified in Division 1 and Division 15 Section "Basic Mechanical Requirements."

1.04 QUALITY ASSURANCE

A. UL Compliance: Fans shall be designed, manufactured, and tested in accordance with UL 705 "Power Ventilators."

B. UL Compliance: Fans and components shall be UL listed and labeled.

C. Nationally Recognized Testing Laboratory and NEMA Compliance (NRTL): Fans and components shall be NRTL listed and labeled. The term "NRTL" shall be as defined in OSHA Regulation 1910.7.

D. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.

E. Electrical Component Standard: Components and installation shall comply with NFPA 70 "National Electrical Code."

1.05 DELIVERY, STORAGE, AND HANDLING

A. Lift and support units with the manufacturer's designated lifting or supporting points.

B. Disassemble and reassemble units as required for movement into the final location following manufacturer's written instructions.

C. Deliver fan units as a factory-assembled unit to the extent allowable by shipping limitations, with protective crating and covering.

1.06 SEQUENCING AND SCHEDULING

A. Coordinate the installation of roof curbs, roof caps, wall caps, equipment supports, and roof penetrations specified in Division 7.

B. Coordinate the size and location of structural steel support members.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

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

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ceiling-Mounted and Inline Ventilators:
   a. Cook (Loren) Co.
   b. Greenheck Fan Corp.
   c. Penn Ventilator Co.

2. Centrifugal Roof Ventilators:
   a. Greenheck Fan Corp.
   b. Cook (Loren) Co.
   c. Penn Ventilator Co.

3. Upblast Propeller Roof Exhaust Fans:
   a. Greenheck Fan Corp.
   b. Cook (Loren) Co.
   c. Penn Ventilator Co.

4. Fiberglass Axial Wall Ventilators:
   a. Burt/Moffit Systems
   b. MK Plastics
   c. Or approved equal.

2.02 SOURCE QUALITY CONTROL

A. Testing Requirements: The following factory tests are required:

1. Sound Power Level Ratings: Comply with AMCA Standard 301 "Method for Calculating Fan Sound Ratings From Laboratory Test Data." Test fans in accordance with AMCA Standard 300 "Test Code for Sound Rating." Fans shall be licensed to bear the AMCA Certified Sound Ratings Seal.
2. Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings in accordance with AMCA Standard 210/ASHRAE Standard 51 - Laboratory Methods of

Testing Fans for Rating.

2.03 FANS, GENERAL

A. General: Provide fans that are factory fabricated and assembled, factory tested, and factory finished with indicated capacities and characteristics.

B. Fans and Shafts: Statically and dynamically balanced and designed for continuous operation at the maximum rated fan speed and motor horsepower.

1. Fan Shaft: Turned, ground, and polished steel designed to operate at no more than 70 percent of the first critical speed at the top of the speed range of the fan's class.

C. Shaft Bearings: Provide type indicated, having a median life "Rating Life" (AFBMA L (50)) of 200,000, calculated in accordance with AFBMA Standard 9 for ball bearings and AFBMA Standard 11 for roller bearings.

D. Factory Finish: The following finishes are required:

1. Sheet Metal Parts: Prime coating prior to final assembly.
2. Exterior Surfaces: Baked-enamel finish coat after assembly.

2.04 CEILING-MOUNTED AND INLINE VENTILATORS

A. General Description: Centrifugal fan designed for installation in ceiling, wall, or concealed inline applications.

B. Certifications: Fan shall be listed by Underwriter Laboratories (UL 705). Fan shall bear the AMCA certified ratings seal for sound and air performance.

C. Housing: 20 gauge Galvanized steel housing lined with acoustical insulation. Blower and motor assembly shall be mounted to a 14 gauge reinforcing channel.

D. Fan Wheel: Centrifugal, forward curved wheels directly mounted on motor shaft. Fan shrouds, motor, and fan wheel shall be removable for service. Wheel shall be balanced in accordance with AMCA Standard 204-96 “Balance Quality and Vibration Levels for Fans.”

E. Grille: Aluminum, painted, louvered grille.

F. Electrical Requirements: Integral junction box for electrical connection on housing and receptacle for motor plug-in.

G. Accessories:
1. Manufacturer's standard wall or roof cap, corrosion resistant galvanized steel with bird screen.
2. Inlet and Outlet duct collars.
3. Backdraft damper.
4. Solid state speed controller (50% to 100% control)

H. Motors: Open, drip proof type with permanently lubricated sealed bearing and built-in thermal overlaod protection.

2.05 CENTRIFUGAL ROOF VENTILATORS

A. General Description: Belt-driven or direct-drive as indicated, centrifugal consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, curb base, and accessories.

B. Housing: Heavy-gage, removable, spun-aluminum, dome top and outlet baffle; square, one-piece, hinged aluminum base with venturi inlet cone.

1. Up-blast Units: Provide spun-aluminum discharge baffle to direct discharge air upward, with rain and snow drains.

C. Fan Wheel: Aluminum hub and wheel with backward-inclined blades.

D. Belt-Driven Drive Assembly: Resiliently mounted to the housing, with the following features:

1. Pulleys: Cast-iron, adjustable-pitch.
2. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.
3. Fan Shaft: Turned, ground, and polished steel drive shaft keyed to wheel hub.
4. Fan and motor isolated from exhaust air stream.

E. Accessories: The following items are required as indicated:

1. Disconnect Switch: Nonfusible type, with thermal overload protection mounted inside fan housing, factory-wired through an internal aluminum conduit.
2. Bird Screens: Removable 1/2-inch mesh, 16-gage, aluminum or brass wire.
3. Dampers: Counterbalanced, parallel-blade, backdraft dampers mounted in curb base, factory set to close when fan stops.
4. Dampers: Motor-operated, parallel-blade, volume control dampers mounted in curb base.

a. Blades: Die-formed sheet aluminum.
b. Frame: Extruded aluminum, with waterproof, felt blade seals.
c. Linkage: Nonferrous metals, connecting blades to counter weight or operator.
d. Operators: Manufacturer's standard electric motor.
e. Operators: Manufacturer's standard pneumatic motor.

5. f Curbs: Prefabricated, heavy-gage, galvanized steel; mitered and welded corners; 2-inch-thick, rigid, fiberglass insulation adhered to inside walls; built-in cant and mounting flange for flat roof decks; and 2-inch wood nailer. Size as required to suit roof opening and fan base.

a. Overall Height: 12 inches.

2.06 UPBLAST PROPELLER ROOF EXHAUST FANS

A. General Description: Direct-drive, propeller fans consisting of housing, wheel, butterfly-type discharge damper, fan shaft, bearings, motor and disconnect switch, drive assembly, curb base, and accessories.

B. Wind Band, Fan Housing, and Base: Reinforced and braced galvanized steel, containing galvanized steel butterfly dampers and rain trough, motor and drive assembly, and fan wheel.

C. Fan Wheel: Dynamically and statically balanced, replaceable, cast-aluminum blades fastened to cast-aluminum hub. Factory-set pitch angle of blades.

D. Fan Wheel: Replaceable, extruded-aluminum, airfoil blades fastened to cast-aluminum hub. Factory set pitch angle of blades.

E. Shaft Bearings: Prelubricated and sealed, self-aligning, pillow-block-type ball bearings.

F. Motors Mounts: Die formed galvanized steel construction.

G. Roof Curbs: Prefabricated, heavy-gage, galvanized steel; mitered and welded corners; 2-inch-thick, rigid fiberglass insulation adhered to inside walls; built-in cant and mounting flange for flat roof deck; and 2-inch wood nailer. Size as required to suit roof opening and fan base.

1. Overall Height: 12 inches.

2.07 FIBERGLASS AXIAL WALL VENTILATORS

A. General Description: Direct-drive, fiberglass, axial fans consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, and accessories.

B. Housing: fiberglass with FRP mounting flanges.

C. Propeller: Adjustable pitch air foil propeller made of fiberglass reinforced polypropelene (FRP).

1. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.
2. Fan Shaft: Cast aluminum encapsulated in corrosion resistant epoxy.
3. Fan and motor isolated from exhaust air stream.
4. Motor: totally enclosed corrosion duty.
5. Stainless steel bolts and dampers.

D. Accessories: The following items are required as indicated:

1. Disconnect Switch: Nonfusible type, with thermal overload protection mounted inside fan housing, factory-wired through an internal aluminum conduit.

2. Bird Screens: Removable, 1/2-inch mesh, 16-gage aluminum or brass wire.
3. Dampers: Counterbalanced, parallel-blade backdraft dampers mounted in curb base, factory set to close when fan stops.
4. Dampers: Gravity, FRP parallel-blade dampers mounted in FRP curb base.

    a. Blades: Die-formed sheet aluminum.
    b. Frame: Extruded aluminum, with waterproof, felt blade bumpers.
    c. Linkage: Nonferrous metals.

2.08 MOTORS

A. Torque Characteristics: Sufficient to accelerate the driven loads satisfactorily.

B. Motor Sizes: Minimum sizes and electrical characteristics as indicated. If not indicated, large enough so that the driven load will not require the motor to operate in the service factor range.

C. Temperature Rating: 50 deg C maximum temperature rise at 40 deg C ambient for continuous duty at full load (Class A Insulation).

D. Service Factor: 1.15 for polyphase motors and 1.35 for single-phase motors.

E. Motor Construction: NEMA Standard MG 1, general purpose, continuous duty, Design B. Provide permanent-split capacitor classification motors for shaft-mounted fans and capacitor start classification for belted fans.

1. Bases: Adjustable.
2. Bearings: The following features are required:
    a. Ball or roller bearings with inner and outer shaft seals.
    b. Grease lubricated.
    c. Designed to resist thrust loading where belt drives or other drives produce lateral or axial thrust in motor.
3. Enclosure Type: The following features are required:
    a. Open drip-proof motors where satisfactorily housed or remotely located during operation.
    b. Guarded drip-proof motors where exposed to contact by employees or building occupants.
4. Overload protection: Built-in, automatic reset, thermal overload protection.
5. Noise rating: Quiet.
6. Efficiency: Energy-efficient motors shall have a minimum efficiency as scheduled in accordance with IEEE Standard 112, Test Method B. If efficiency not specified, motors shall have a higher efficiency than "average standard industry motors" in accordance with IEEE Standard 112, Test Method B.
7. Nameplate: Indicate the full identification of manufacturer, ratings, characteristics, construction, and special features.

F. Starters, Electrical Devices, and Wiring: Electrical devices and connections are specified in Division 16.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances, roof curbs, equipment supports, and other conditions affecting performance of fans.

B. Do not proceed until unsatisfactory conditions have been corrected.

3.02 INSTALLATION, GENERAL

A. Install fans level and plumb, in accordance with manufacturer's written instructions. Support units as described below, using the vibration control devices indicated. Vibration control devices are specified in Division 15 Section "Vibration Controls."

1. Secure roof-mounted fans to roof curbs with cadmium-plated hardware.

a. Installation of roof curbs is specified in Division 7.

2. Suspended Units: Suspend units from structural steel support frame using threaded steel rods and vibration isolation springs.

B. Arrange installation of units to provide access space around air-handling units for service and maintenance.

3.03 CONNECTIONS

A. Duct installations and connections are specified in other Division 15 sections. Make final duct connections with flexible connections.

B. Electrical Connections: The following requirements apply:

1. Electrical power wiring is specified in Division 16.
2. Temperature control wiring and interlock wiring are specified in Division 15 Section "Electrical Control Systems."
3. Temperature control wiring and interlock wiring are specified in Division 15 Section "Pneumatic Control Systems."
4. Grounding: Connect unit components to ground in accordance with the National Electrical Code.

3.04 FIELD QUALITY CONTROL

A. Manufacturer's Field Inspection: Arrange and pay for a factory-authorized service representative to perform the following:

1. Inspect the field assembly of components and installation of fans including ductwork and electrical connections.
2. Prepare a written report on findings and recommended corrective actions.

3.05 ADJUSTING, CLEANING, AND PROTECTING

A. Adjust damper linkages for proper damper operation.

B. Clean unit cabinet interiors to remove foreign material and construction dirt and dust. Vacuum clean fan wheel and cabinet.

3.06 COMMISSIONING

A. Final Checks Before Start-Up: Perform the following operations and checks before start-up:

1. Remove shipping blocking and bracing.
2. Verify unit is secure on mountings and supporting devices and that connections for piping, ductwork, and electrical are complete. Verify proper thermal overload protection is installed in motors, starters, and disconnects.
3. Perform cleaning and adjusting specified in this Section.
4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearings operations. Reconnect fan drive system, align belts, and install belt guards.
5. Lubricate bearings, pulleys, and other moving parts with factory-recommended lubricants.
6. Disable automatic temperature control operators.

B. Starting procedures for fans:

1. Energize motor; verify proper operation of motor, drive system, and fan wheel. Adjust fan to indicated RPM.
2. Measure and record motor electrical values for voltage and amperage.

C. Shut unit down and reconnect automatic temperature control operators.

D. Refer to Division 15 Section 15990 "Testing, Adjusting, and Balancing" for procedures for air-handling-system testing, adjusting, and balancing.

3.07 DEMONSTRATION

A. Demonstration Services: Arrange and pay for a factory-authorized service representative to train Owner's maintenance personnel on the following:

1. Procedures and schedules related to start-up and shutdown, troubleshooting, servicing, preventative maintenance, and how to obtain replacement parts.
2. Familiarization with contents of Operating and Maintenance Manuals specified in Division 1 Section "Project Closeout" and Division 15 Section "Basic Mechanical Requirements."

B. Schedule training with at least 7 days' advance notice.

END OF SECTION

SECTION 15891
METAL DUCTWORK

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

B. Division 15 Section 15050 Basic Mechanical Materials and Methods Sections apply to work of this section.

1.02 DESCRIPTION OF WORK:

A. Extent of metal ductwork is indicated on drawings and in schedules, and by requirements of this section.

B. Exterior insulation of metal ductwork is specified in other Division-15 sections, and is included as work of this section.

C. Refer to other Division-15 sections for exterior insulation of metal ductwork; not work of this section.

D. Refer to other Division-15 sections for ductwork accessories; not work of this section.

E. Refer to other Division-15 sections for fans and air handling units; not work of this section.

F. Refer to other Division-15 sections for testing, adjusting, and balancing of metal ductwork systems; not work of this section.

1.03 QUALITY ASSURANCE:

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of metal ductwork products of types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Installer's Qualifications: Firm with at least 3 years of successful installation experience on projects with metal ductwork systems similar to that required for project.

C. Codes and Standards:

1. SMACNA Standards: Comply with SMACNA's "HVAC Duct Construction Standards, Metal and Flexible" for fabrication and installation of metal ductwork.
2. ASHRAE Standards: Comply with ASHRAE Handbook, Equipment Volume, Chapter 1 "Duct Construction", for fabrication and installation of metal ductwork.

3. NFPA Compliance: Comply with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems" and NFPA 90B "Standard for the Installation of Warm Air Heating and Air Conditioning Systems".

D. Field Reference Manual: Have available for reference at project field office, copy of SMACNA "HVAC Duct Construction Standards, Metal and Flexible".

1.04 SUBMITTALS:

A. Product Data: Submit manufacturer's technical product data and installation instructions for metal ductwork materials and products.

B. Shop Drawings: Submit 1/4" scaled layout drawings of metal ductwork and fittings including, but not limited to, duct sizes, locations, elevations, and slopes of horizontal runs, wall and floor penetrations, and connections. Show interface and spatial relationship between ductwork and proximate equipment. Show modifications of indicated requirements, made to conform to local shop practice, and how these modifications ensure that free area, materials, and rigidity are not reduced.

C. Record Drawings: At project closeout, submit record drawings of installed metal ductwork and ductwork products, in accordance with requirements of Division 1.

D. Maintenance Data: Submit maintenance data and parts lists for metal ductwork materials and products. Include this data, product data, shop drawings, and record drawings in maintenance manual; in accordance with requirements of Division 1.

1.05 DELIVERY, STORAGE, AND HANDLING:

A. Protection: Protect shop-fabricated and factory-fabricated ductwork, accessories and purchased products from damage during shipping, storage and handling. Prevent end damage and prevent dirt and moisture from entering ducts and fittings. All open ends of stored ductwork shall be sealed airtight and watertight with plastic/visquine.

B. Storage: Where possible, store ductwork inside and protect from weather. Where necessary to store outside, store above grade and enclose with waterproof wrapping.

PART 2 - PRODUCTS

2.01 DUCTWORK MATERIALS:

A. Exposed Ductwork Materials: Where ductwork is indicated to be exposed to view in occupied spaces, provide materials that are free from visual imperfections including pitting, seam marks, roller marks, stains and discolorations, and other imperfections, including those which would impair painting.

B. Sheet Metal: Except as otherwise indicated, fabricate ductwork from galvanized sheet steel complying with ASTM A 527, lockforming quality, with G 90 zinc coating in accordance with ASTM A 525; and mill phosphatized for exposed locations.

2.02 MISCELLANEOUS DUCTWORK MATERIALS:

A. General: Provide miscellaneous materials and products of types and sizes indicated and, where not otherwise indicated, provide type and size required to comply with ductwork system requirements including proper connection of ductwork and equipment.

B. Fittings: Provide radius type fittings fabricated of multiple sections with maximum 15-degree change of direction per section. Unless specifically detailed otherwise, use 45-degree laterals and 45-degree elbows for branch takeoff connections. Where 90-degree branches are indicated, provide conical type tees.

C. Duct Liner: Fibrous glass, complying with Thermal Insulation Manufacturers Association (TIMA) AHC-101; of thickness indicated.

D. Duct Liner Adhesive: Comply with ASTM C 916 "Specifications for Adhesives for Duct Thermal Insulation".

E. Duct Liner Fasteners: Comply with SMACNA HVAC Duct Construction Standards, Article S2.11.

F. Duct Sealant: Non-hardening, non-migrating mastic or liquid elastic sealant, type applicable for fabrication/installation detail, as compounded and recommended by manufacturer specifically for sealing joints and seams in ductwork.

G. Duct Cement: Non-hardening migrating mastic or liquid neoprene based cement, type applicable for fabrication/installation detail, as compounded and recommended by manufacturer specifically for cementing fitting components, or longitudinal seams in ductwork.

H. Ductwork Support Materials: Except as otherwise indicated, provide hot-dipped galvanized steel fasteners, anchors, rods, straps, trim and angles for support of ductwork.

I. Flexible Ducts: Either spiral-wound spring steel with flameproof vinyl sheathing, or corrugated aluminum; complying with UL 181.

1. Where installed in unconditioned spaces other than return air plenums, provide 1" thick continuous flexible fiberglass sheath with vinyl vapor barrier jacket.

2.03 FABRICATION:

A. Shop fabricate ductwork in 4, 8, 10 or 12-ft lengths, unless otherwise indicated or required to complete runs. Pre-assemble work in shop to greatest extent possible, so as to minimize field assembly of systems. Disassemble systems only to extent necessary for shipping and handling. Match-mark sections for reassembly and coordinated installation.

B. Shop fabricate ductwork of gages and reinforcement complying with SMACNA "HVAC Duct Construction Standards".

C. Shop fabricate ductwork of gages and reinforcement complying with ASHRAE Handbook, Equipment Volume, Chapter 1 "Duct Construction".

D. Fabricate duct fittings to match adjoining ducts, and to comply with duct requirements as applicable to fittings. Except as otherwise indicated, fabricate elbows with center-line radius equal to associated duct width; and fabricate to include turning vanes in elbows where shorter radius is necessary. Limit angular tapers to 30 degrees for contracting tapers and 20 degrees for expanding tapers.

E. Fabricate ductwork with accessories installed during fabrication to the greatest extent possible. Refer to Division-15 section "Ductwork Accessories" for accessory requirements.

F. Fabricate ductwork with duct liner in each section of duct where indicated. Laminate liner to internal surfaces of duct in accordance with instructions by manufacturers of lining and adhesive, and fasten with mechanical fasteners.

2.04 FACTORY-FABRICATED LOW PRESSURE DUCTWORK:

A. General: At installer's option, provide factory-fabricated duct and fittings, in lieu of shop-fabricated duct and fittings.

B. Material: Galvanized sheet steel complying with ASTM A 527, lock-forming quality, with ASTM A 525, G90 zinc coating, mill phosphatized.

C. Gage: 28-gage minimum for round and oval ducts and fittings, 4" through 24" diameter.

D. Elbows: One-piece construction for 90 degrees and 45 degree elbows 14" and smaller. Provide multiple gore construction for larger diameters with standing seam circumferential joint.

E. Divided Flow Fittings: 90-degree tees, constructed with saddle tap spot welded and bonded to duct fitting body.

F. Available Manufacturers: Subject to compliance with requirements, manufacturers offering factory-fabricated ductwork that may be incorporated in the work include, but are not limited to, the following:

G. Manufacturers: Subject to compliance with requirements, provide factory-fabricated ductwork of one of the following:

1. Semco Mfg., Inc.
2. United Sheet Metal Div., United McGill Corp.
3. Or approved equal.

2.05 FACTORY-FABRICATED HIGH PRESSURE DUCTWORK:

A. General: At Installer's option, provide factory-fabricated duct and fittings, in lieu of shop-fabricated duct and fittings.

B. Round Ductwork: Construct of galvanized sheet steel complying with ASTM A 527

by the following methods and in minimum gages listed.

Diameter	Minimum Gage	Method of Manufacture
3" to 14"	26	Spiral Lockseam
15" to 26"	24	Spiral Lockseam
27" to 36"	22	Spiral Lockseam
37" to 50"	20	Spiral Lockseam
51" to 60"	18	Spiral Lockseam
Over 60"	16	Longitudinal Seam

1. Provide locked seams for spiral duct; fusion-welded butt seam for longitudinal seam duct.
2. Fittings and Couplings: Construct of minimum gages listed. Provide continuous welds along seams.

Diameter	Minimum Gage
3" to 36"	20
38" to 50"	18
Over 60"	16

C. Flat-Oval Ductwork: Construct of galvanized sheet steel complying with ASTM A 527, of spiral lockseam construction, in minimum gages listed.

Maximum Width	Minimum Gage
Under 25"	24
25" to 48"	22
49" to 70"	20
Over 70"	18

1. Fittings and Coupling: Construct of minimum gages listed. Provide continuous weld along seams.

Maximum Width	Minimum Gage
Under 37"	20
37" to 50"	18
Over 50"	16

D. Double Wall Ductwork: Construct with outer pressure shell, 1" thick insulation layer, and perforated inner liner. Construct shell and liner of galvanized sheet steel complying with ASTM A 527, of spiral lockseam construction, use longitudinal seam for over 59", in minimum gages listed.

Nomimal Duct Diameter	Outer Shell	Inner liner
3" to 12"	26 ga.	24 ga.
13" to 24"	24 ga.	24 ga.
25" to 34"	22 ga.	24 ga.
35" to 48"	20 ga.	24 ga.
49" to 58"	18 ga.	24 ga.
Over 59"	16 ga.	20 ga.

1. Fittings and Couplings: Construct of minimum gages listed. Provide

continuous weld along seams of outer shell.

Nominal Duct Diameter	Outer Shell	Inner Liner
3" to 34"	20 ga.	20 ga.
36" to 48"	18 ga.	20 ga.
Over 48"	16 ga.	20 ga.

2. Inner Liner: Perforate with 3/32" holes for 22% open area or solid metal. Provide metal spacers welded in position to maintain spacing and concentricity.

E. Optional Ducts and Fittings: At Installer's option, provided that certified tests by Manufacturer show that rigidity and performance is equivalent to SMACNA and/or ASHRAE standard gage ductwork, provide ducts and fittings as follows:

1. Ducts: Construct of Manufacturer's standard gage, with spiral lock seam and intermediate standing rib.
2. Fittings: Construct by fabricating with spot welding and bonding with neoprene-base cement in lieu of continuous weld seams.

F. Available Manufacturers: Subject to compliance with requirements, manufacturers offering factory-fabricated ductwork which may be incorporated in the work include, but are not limited to, the following:

G. Manufacturers: Subject to compliance with requirements, provide factory-fabricated ductwork of one of the following:

1. Semco Mfg., Inc.
2. United Sheet Metal Div., United McGill Corp.
3. Or approved equal.

PART 3 - EXECUTION

3.01 INSPECTION:

A. General: Examine areas and conditions under which metal ductwork is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.02 INSTALLATION OF METAL DUCTWORK:

A. General: Assemble and install ductwork in accordance with recognized industry practices which will achieve air-tight (5% leakage for systems rated 3" and under; 1% for systems rated over 3") and noiseless (no objectionable noise) systems, capable of performing each indicated service. Install each run with minimum number of joints. Align ductwork accurately at connections, within 1/8" misalignment tolerance and with internal surfaces smooth. Support ducts rigidly with suitable ties, braces, hangers and anchors of type which will hold ducts true-to-shape and to prevent buckling. Support vertical ducts at every floor.

B. Inserts: Install concrete inserts for support of ductwork in coordination with

formwork, as required to avoid delays in work.

C. Field Fabrication: Complete fabrication of work at project as necessary to match shop-fabricated work and accommodate installation requirements.

D. Routing: Locate ductwork runs, except as otherwise indicated, vertically and horizontally and avoid diagonal runs wherever possible. Locate runs as indicated by diagrams, details and notations or, if not otherwise indicated, run ductwork in shortest route which does not obstruct useable space or block access for servicing building and its equipment. Hold ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building. Limit clearance to 1/2" where furring is shown for enclosure or concealment of ducts, but allow for insulation thickness, if any. Where possible, locate insulated ductwork for 1" clearance outside of insulation. Wherever possible in finished and occupied spaces, conceal ductwork from view, by locating in mechanical shafts, hollow wall construction or above suspended ceilings. Do not encase horizontal runs in solid partitions, except as specifically shown. Coordinate layout with suspended ceiling and lighting layouts and similar finished work.

E. Electrical Equipment Spaces: Do not route ductwork through transformer vaults and their electrical equipment spaces and enclosures.

F. Penetrations: Where ducts pass through interior partitions and exterior walls, and are exposed to view, conceal space between construction opening and duct or duct insulation with sheet metal flanges of same gage as duct. Overlap opening on 4 sides by at least 1-1/2". Fasten to duct and substrate.

1. Where ducts pass through fire-rated floors, walls, or partitions, provide fire-stopping between duct and substrate, in accordance with requirements of Division-7 Section "Fire-stopping".

G. Coordination: Coordinate duct installations with installation of accessories, dampers, coil frames, equipment, controls and other associated work of ductwork system.

H. Installation: Install metal ductwork in accordance with SMACNA HVAC Duct Construction Standards.

3.03 INSTALLATION OF DUCT LINERS:

A. General: Install duct liner in accordance with SMACNA HVAC Duct Construction Standards.

3.04 INSTALLATION OF FLEXIBLE DUCTS:

A. Maximum Length: For any duct run using flexible ductwork, do not exceed 10'-0" extended length.

B. Installation: Install in accordance with Section III of SMACNA's, "HVAC Duct Construction Standards, Metal and Flexible".

3.05 FIELD QUALITY CONTROL:

A. Leakage Tests: After each duct system, which is constructed for duct classes over 3”, is completed, test for duct leakage in accordance with SMACNA HVAC Air Duct Leakage Test Manual. Repair leaks and repeat tests until total leakage is less than 1% of system design airflow.

3.06 EQUIPMENT CONNECTIONS:

A. General: Connect metal ductwork to equipment as indicated; provide flexible connection for each ductwork connection to equipment mounted on vibration isolators, and/or equipment containing rotating machinery. Provide access doors as indicated.

3.07 ADJUSTING AND CLEANING:

A. Clean ductwork internally, unit by unit as it is installed, of dust and debris. Clean external surfaces of foreign substances, which might cause corrosive deterioration of metal or, where ductwork is to be painted, might interfere with painting or cause paint deterioration.

B. Strip protective paper from stainless ductwork surfaces, and repair finish wherever it has been damaged.

C. Temporary Closure: At ends of ducts which are not connected to equipment or air distribution devices at time of ductwork installation, provide temporary closure of polyethylene film or other covering which will prevent entrance of dust and debris until time connections are to be completed.

D. Balancing: Refer to Division-15 section "Testing, Adjusting, and Balancing" for air distribution balancing of metal ductwork; not work of this section. Seal any leaks in ductwork that become apparent in balancing process.

END OF SECTION

SECTION 15900
BUILDING AUTOMATION SYSTEM

PART 1 - GENERAL

1.1 General

A. All work of this Division shall be coordinated and provided by the existing Building Automation System (BAS) Contractor, Johnson Controls (JCI).

B. The work of this Division shall be scheduled, coordinated, and interfaced with the associated work of other trades. Reference the Division 15 Sections for details.

C. The work of this Division shall be as required by the Specifications, Point Schedules and Drawings.

D. If the BAS Contractor believes there are conflicts or missing information in the project documents, the Contractor shall promptly request clarification and instruction from the design team.

E. Refer to attached requirements from the Orange County Information Systems and Services (ISS) division for all Orange County hardware, software, and network requirements.

1.2 BAS Description

A. The existing Building Automation System (BAS) shall be a complete system designed for integration with the new elevator HVAC controls by VRF (Variable Refrigerant Flow) equipment manufacturer. This functionality shall extend into the equipment rooms. Devices residing on the automation network located in equipment rooms and similar shall be fully IT compatible devices that mount and communicate directly on the IT infrastructure in the facility. Contractor shall be responsible for coordination with the owner's IT staff to ensure that the BAS will perform in the owner's environment without disruption to any of the other activities taking place on that LAN.

B. All points of user interface shall be on standard PCs that do not require the purchase of any special software from the BAS manufacturer for use as a building operations terminal. The primary point of interface on these PCs will be a standard Web Browser.

C. The work of the single BAS Contractor shall be as defined individually and collectively in all Sections of this Division specifications together with the associated Point Sheets and Drawings and the associated interfacing work as referenced in the related documents.

D. The existing and new BAS work shall consist of the provision of all labor, materials, tools, equipment, software, software licenses, software configurations and database entries, interfaces, wiring, tubing, installation, labeling, engineering, calibration, documentation, samples, submittals, testing, commissioning, training services, permits and licenses, transportation, shipping, handling, administration, supervision, management, insurance, temporary protection, cleaning, cutting and patching, warranties, services, and items, even though these may not be specifically mentioned in these Division documents which are required for the complete, fully functional BAS.

E. Provide a complete, neat and workmanlike installation. Use only manufacturer employees who are skilled, experienced, trained, and familiar with the specific equipment, software, standards and configurations to be provided for this Project.

F. Manage and coordinate the BAS work in a timely manner in consideration of the Project schedules. Coordinate with the associated work of other trades so as to not impede or delay the work of associated trades.

G. The BAS as provided shall incorporate, at minimum, the following integrated features, functions and services:

1. Operator information, alarm management and control functions.
2. Enterprise-level information and control access.
3. Information management including monitoring, transmission, archiving, retrieval, and reporting functions.
4. Diagnostic monitoring and reporting of BAS functions.
5. Offsite monitoring and management access.
6. Energy management
7. Standard applications for terminal HVAC systems.

H. Acceptable Manufacturers

1) Existing, BAS, Johnson Controls (JCI)
   a. VRF manufacturer provided Bac-Net HVAC system controls
   1. Mitsubishi
   2. Daikin
   3. Carrier/Toshiba
   4. Samsung
2) Johnson Controls

1.3 Quality Assurance

A. General

1. The Building Automation System Contractor shall be the primary manufacturer-owned branch office or primary installer of said manufacturer that is regularly engaged in the engineering, programming, installation and service of total integrated Building Automation Systems.
2. The BAS Contractor shall be a recognized national installer and service provider of BAS.
3. The BAS Contractor shall have a branch facility within a 3-hour response time of the job site supplying complete maintenance and support services on a 24 hour, 7-day-a-week basis.
4. The Building Automation System architecture shall consist of the products of a manufacturer regularly engaged in the production of Building Automation Systems, and shall be the manufacturer's latest standard of design at the time of bid.
5. Single source responsibility of supplier shall be the complete installation and proper operation of the BAS and control system and shall include debugging and proper calibration of each component in the entire system both existing and new.
6. The Building Automation System contractor shall provide the Owner with 24 months of future software system upgrades as part of their package. The upgrade period shall begin once the final completion has been signed off by the engineer of record for each project.

B. Workplace Safety And Hazardous Materials

1. Provide a safety program in compliance with the Contract Documents.
2. The BAS Contractor shall have a corporately certified comprehensive Safety Certification Manual and a designated Safety Supervisor for the Project.
3. The Contractor and its employees and subtrades shall comply with federal, state and local safety regulations.
4. The Contractor shall ensure that all subcontractors and employees have written safety programs in place that covers their scope of work, and that their employees receive the training required by the OSHA have jurisdiction for at least each topic listed in the Safety Certification Manual.
5. Hazards created by the Contractor or its subcontractors shall be eliminated before any further work proceeds.
6. Hazards observed but not created by the Contractor or its subcontractors shall be reported to either the General Contractor or the Owner within the same day. The Contractor shall be required to avoid the hazard area until the hazard has been eliminated.
7. The Contractor shall sign and date a safety certification form prior to any work being performed, stating that the Contractors' company is in full compliance with the Project safety requirements.
8. The Contractor's safety program shall include written policy and arrangements for the handling, storage and management of all hazardous materials to be used in the work in compliance with the requirements of the AHJ at the Project site.
9. The Contractor's employees and subcontractor's staff shall have received training as applicable in the use of hazardous materials and shall govern their actions accordingly.

C. Quality Management Program

1. Designate a competent and experienced employee to provide BAS Project Management. The designated Project Manger shall be empowered to make technical, scheduling and related decisions on behalf of the BAS Contractor. At a minimum, the Project Manager shall:

   Manage the scheduling of the work to ensure that adequate materials, labor and other resources are available as needed.

   Manage the financial aspects of the BAS Contract.

   Coordinate as necessary with other trades.

   Be responsible for the work and actions of the BAS workforce on site.

1.4 Work By Others

A) The demarcation of work and responsibilities between the BAS Contractor and other related trades shall be as outlined in the BAS RESPONSIBILITY MATRIX

BAS RESPONSIBILITY MATRIX				
WORK	FURNISH	INSTALL	Low Volt. WIRING/TUBE	LINE POWER
BAS low voltage and communication wiring	BAS	BAS	BAS	N/A
BAS conduits and raceway	BAS	BAS	BAS	BAS

Automatic dampers	BAS	15	N/A	N/A
BAS Current Switches.	BAS	BAS	BAS	N/A
BAS Control Relays	BAS	BAS	BAS	N/A
All BAS Nodes, equipment, housings, enclosures and panels.	BAS	BAS	BAS	BAS
Fire Alarm shutdown relay interlock wiring	16	16	16	16
Fan Coil Unit controls	BAS	BAS	BAS	16
Starters, HOA switches	16	16	N/A	16

1.5 Submittals

A. Shop Drawings, Product Data, and Samples

1. The BAS contractor shall submit a list of all shop drawings with submittals dates within 45 days of contract award.
2. Submittals shall be in defined packages. Each package shall be complete and shall only reference itself and previously submitted packages. The packages shall be as approved by the Architect and Engineer for Contract compliance.
3. Allow 15 working days for the review of each package by the Architect and Engineer in the scheduling of the total BAS work.
4. Equipment and systems requiring approval of local authorities must comply with such regulations and be approved. Filing shall be at the expense of the BAS Contractor where filing is necessary. Provide a copy of all related correspondence and permits to the Owner.
5. Prepare an index of all submittals and shop drawings for the installation. Index shall include a shop drawing identification number, Contract Documents reference and item description.
6. The BAS Contractor shall correct any errors or omissions noted in the first review.
7. At a minimum, submit the following:
   a. BAS network architecture diagrams including all nodes and interconnections.
   b. Systems schematics, sequences and flow diagrams.
   c. Points schedule for each point in the BAS, including: Point Type, Object Name, Expanded ID, Display Units, Controller type, and Address.
   d. Samples of Graphic Display screen types and associated menus.
   e. Detailed Bill of Material list for each system or application, identifying quantities, part numbers, descriptions, and optional features.
   f. Control Damper Schedule including a separate line for each damper provided under this section and a column for each of the damper attributes, including: Code Number, Fail Position, Damper Type, Damper Operator, Duct Size, Damper Size, Mounting, and Actuator Type.
   g. Control Valve Schedules including a separate line for each valve provided under this section and a column for each of the valve attributes: Code Number, Configuration, Fail Position, Pipe Size, Valve Size, Body Configuration, Close off Pressure, Capacity, Valve CV, Design Pressure, and Actuator Type.
   h. Room Schedule including a separate line for each VAV box and/or terminal unit indicating location and address
   i. Details of all BAS interfaces and connections to the work of other trades.

j. Product data sheets or marked catalog pages including part number, photo and description for all products including software.

1.8 Record Documentation

A. Operation and Maintenance Manuals

1. Three (3) copies of the Operation and Maintenance Manuals shall be provided to the Owner's Representative upon completion of the project. The entire Operation and Maintenance Manual shall be furnished on Compact Disc media, and include the following for the BAS provided:

a. Table of contents.
b. As-built system record drawings. Computer Aided Drawings (CAD) record drawings on the latest version of AUTOCADD shall represent the as-built condition of the system and incorporate all information supplied with the approved submittal.
c. Manufacturers product data sheets or catalog pages for all products including software.
d. System Operator's manuals.
e. Archive copy of all site-specific databases and sequences.
f. BAS network diagrams.
g. Interfaces to all third-party products and work by other trades.

2. The Operation and Maintenance Manual CD shall be self-contained, and include all necessary software required to access the product data sheets. A logically organized table of contents shall provide dynamic links to view and print all product data sheets. Viewer software shall provide the ability to display, zoom, and search all documents.

1.9 Warranty

A. Standard Material and Labor Warranty:

1. Provide a two-year labor and material warranty on the BAS.

2. If within twenty-four (24) months from the date of acceptance of product, upon written notice from the owner, it is found to be defective in operation, workmanship or materials, it shall be replaced, repaired or adjusted at the cost of the BAS Contractor.

3. Maintain an adequate supply of materials within 50 miles of the Project site such that replacement of key parts and labor support, including programming. Warranty work shall be done during BAS Contractor's normal business hours.

2. PART 2 - PRODUCTS

2.1 Advanced Applications Controllers (AAC)

A. General

1. Provide a micro-processor based, networkable, custom programmed, BACnet® Advanced Application Controller for each heat pump and associated fan coil unit where shown on floor-plans. Each AAC shall include an LCD user interface and all input/output points required to monitor and control each unit as a stand-alone system, according to the specified sequence of operation. In addition AAC's shall allow monitoring and remote control via a supervisory network (BACnet) with a WEB-Based Browser-accessible front end.

2. Provide a 5 year standard manufacturer's warranty for the AAC

A. Network Protocol and Operator Connections

1. The AAC's shall allow direct connection to a host network using BACnet® MS/TP (EIA-485) protocol. The network communication speed shall be operator selectable up to 76.8 kbps.

2. Each AAC shall be BTL tested, and listed to meet the B-AAC Standard Device Profile including BIBBs for this level of device. A Protocol Implementation Conformance statement for the AAC proposed shall be submitted along with shop drawings. Network points to be viewable on each AAC are listed in the sequence of operation, however provide a minimum of 32 Read/Write objects per AAC.

3. Each AAC shall include an externally mounted port allowing operators to connect a laptop computer directly to the AAC for network configuration, custom programming, and trouble-shooting.

C. Hardware Components

1. Provide the following hardware input points at minimum in each AAC:
   a. Room temperature sensor, local or remote 10K thermistor with an accuracy of +/- 0.1 Deg C
   b. User set-point adjustment control with programmable set-point limits
   c. On-board room humidity sensor, with replaceable CMOSense element, overall accuracy of +/- 1.8 % over 10 – 90 % range

2. Provide hardware analog and digital output points as required by the sequence of operation, however include the following point types at minimum to allow for future expansion:
   a. Six universal outputs, user-definable as analog or digital
   b. Two additional digital output points
   c. Digital output points shall be dry contacts capable of switching 0.5 Amps at 24 VAC.
3. Provide a large LCD screen for display and adjustment of AAC points and mapped network points. Security codes MUST be provided to prevent unauthorized access from the local LCD screen. Minimum LCD size shall be 128 x 64 pixels. The screen shall be back-lit, however the light may be configured to shut off after a programmable inactive time.

4. Provide push-buttons on the panel face to facilitate navigation, point adjustment, data entry, and switching of operational modes (password protected).

5. AAC memory shall include a minimum 64 Kb RAM for logs and temporary data, and 512 kb flash EEPROM for non-volatile storage of firmware configuration and custom database. Provide a 24 hour clock and 365 day calendar on-board. Clock accuracy shall be +/- 1 second over 24 hours, and system time shall be retained during power outages exceeding 7 years.

6. Provide a software configurable buzzer which shall be set-up to trigger on the occurrence of selected alarms, and shall be audible and acknowledgeable either to all users, or only to those users with sufficient password authority.

7. AAC's shall be capable of monitoring and controlling at least 4 networked, remote temperature sensors, each with adjustable set-point and outputs for zone controls. These networked sensors shall not consume input/output points in the AAC.

D. Custom Configuration

1. Each AAC shall allow custom setup of the primary user interface screen; definition of all points to be monitored, controlled and displayed; alarms; schedules; trends; password access; and programmed sequence of operation as required to optimize the AAC for the specific requirements of this project, and also to allow future modification by the owner. AAC's using canned programs for pre-determined HVAC applications are not acceptable.

2. Each AAC shall allow the following custom set-up at minimum:
   a. Primary User Interface screen set-up, including display of time, system mode, fan mode, primary temperature display, and display of up to 3 additional operator-defined AAC or network points.
   b. ALL physical Inputs AND Outputs of the controller MUST be able to be overridden at the LCD screen for technician checkout of the system locally.
   c. Custom programs of 2000 bytes each, using a BASIC control language, with source code stored on board.
   d. The AAC may be defined with full access by all users without password protection, or with three levels of password protected access. Each level of access shall be enabled by entering a 4 digit password via the front panel keys. AAC's that require removal of the faceplate to unlock the keyboard are not acceptable.
   e. Alarm states shall be defined using AAC custom programming, with the definition including the password level required to acknowledge, reset, and clear alarms. When an AAC alarm condition exists, an alarm icon shall be displayed on all screens.
   f. 48 user-definable program-driven variables, with selectable ranges and standard or custom units.
   g. user-definable PID controls loops
   h. user-definable trend logs, each with 150 samples of 6 points each, and programmable sampling times
   i. 8 user-definable runtime logs to accumulate the run-times of selected digital points, and record the time and date of the last 100 changes of state
   j. 2 user-definable system groups, 50 points per group, allowing related points to be grouped together on one display for use in network graphics
   k. 1 user-definable weekly schedule, including 4 on/off pairs for each weekday, and two additional daily schedules triggered by the annual schedule or by custom programming
   l. Override of the unoccupied schedule for a programmed period of time shall be triggered via a front panel button
   m. 1 annual schedule, allowing pre-programming of holidays 365 days in advance

2.2 Input Devices

A. General Requirements

1. Installation, testing, and calibration of all sensors, transmitters, and other input devices shall be provided to meet the system requirements.

2. Temperature Sensors

a. General Requirements:

Sensors and transmitters shall be provided, as outlined in the input/output summary and sequence of operations.
The temperature sensor shall be of the resistance type, and shall be either two-wire 1000 ohm nickel RTD, or two-wire 1000 ohm platinum RTD.
The following point types (and the accuracy of each) are required, and their associated accuracy values include errors associated with the sensor, lead wire, and A to D conversion:

Point Type	Accuracy
Room Temp	± .5°F.
Duct Temperature	± .5°F.
All Others	± .75°F.

Room Temperature Sensors
Room sensors are existing for either surface or wall box mounting. Replace any room sensor found to be inoperable during construction period.
Room sensors shall have the following options when specified:

- Setpoint reset slide switch providing a ±3 degree (adjustable) range.
- Individual heating/cooling setpoint slide switches.
- A momentary override request push button for activation of after-hours operation.
- Analog thermometer.

Room Temperature Sensors with Integral Display

B. Status and Safety Switches

1. General Requirements

a. Switches shall be provided to monitor equipment status, safety conditions, and generate alarms at the BAS when a failure or abnormal condition occurs. Safety switches shall be provided with two sets of contacts and shall be interlock wired to shut down respective equipment.

2. Current Sensing Switches

a. The current sensing switch shall be self-powered with solid-state circuitry and a dry contact output. It shall consist of a current transformer, a solid state current sensing circuit, adjustable trip point, solid state switch, SPDT relay, and an LED indicating the on or off status. A conductor of the load shall be passed through the window of the device. It shall accept over-current up to twice its trip point range.

b. Current sensing switches shall be used for run status for fans, pumps, and other miscellaneous motor loads.

c. Current sensing switches shall be calibrated to show a positive run status only when the motor is operating under load. A motor running with a broken belt or coupling shall indicate a negative run status.

d. Acceptable manufacturers: Veris Industries or approved equal.

3. PART 3 – EXECUTION

3.1 BAS Specific Requirements

A. Graphic Displays

1. Provide a color graphic system flow diagram display for each system with all points as indicated on the point list. All terminal unit graphic displays shall be from a standard design library.

2. User shall access the various system schematics via a graphical penetration scheme and/or menu selection. .

B. Custom Reports:

1. Provide custom reports as required for this project:

C. Actuation / Control Type

1. Primary Equipment

a. Controls shall be provided by equipment manufacturer as specified herein.

2. Air Handling Equipment

a. All air handlers shall be controlled with a HVAC-DDC Controller

3.2 Installation Practices

A. BAS Wiring

1. All conduit, wiring, accessories and wiring connections required for the installation of the Building Automation System, as herein specified, shall be provided by the BAS Contractor unless specifically shown on the Electrical Drawings under Division 16 Electrical. All wiring shall comply with the requirements of applicable portions of Division 16 and all local and national electric codes, unless specified otherwise in this section.

2. All BAS wiring materials and installation methods shall comply with BAS manufacturer recommendations.

3. The sizing, type and provision of cable, conduit, cable trays, and raceways shall be the design responsibility of the BAS Contractor. If complications arise, however, due to the incorrect selection of cable, cable trays, raceways and/or conduit by the BAS Contractor, the Contractor shall be responsible for all costs incurred in replacing the selected components.

4. Class 2 Wiring

a. All Class 2 (24VAC or less) wiring shall be installed in conduit unless otherwise specified.

b. Conduit is not required for Class 2 wiring in concealed accessible locations. Class 2 wiring not installed in conduit shall be supported every 5’ from the building structure utilizing metal hangers designed for this application. Wiring shall be installed parallel to the building structural lines. All wiring shall be installed in accordance with local code requirements.

5. Class 2 signal wiring and 24VAC power can be run in the same conduit. Power wiring 120VAC and greater cannot share the same conduit with Class 2 signal wiring.

6. Provide for complete grounding of all applicable signal and communications cables, panels and equipment so as to ensure system integrity of operation. Ground cabling and conduit at the panel terminations. Avoid grounding loops.

B. BAS Line Voltage Power Source

1. 120-volt AC circuits used for the Building Automation System shall be taken from panel boards and circuit breakers provided by Division 16.

2. Circuits used for the BAS shall be dedicated to the BAS and shall not be used for any other purposes.

3. DDC terminal unit controllers may use AC power from motor power circuits.

C. BAS Raceway

1. All wiring shall be installed in conduit or raceway except as noted elsewhere in this specification. Minimum control wiring conduit size 1/2".

2. Where it is not possible to conceal raceways in finished locations, surface raceway (Wiremold) may be used as approved by the Architect.

3. All conduits and raceways shall be installed level, plumb, at right angles to the building lines and shall follow the contours of the surface to which they are attached.

4. Flexible Metal Conduit shall be used for vibration isolation and shall be limited to 3 feet in length when terminating to vibrating equipment. Flexible Metal Conduit may be used within partition walls. Flexible Metal Conduit shall be UL listed.

D. Penetrations

1. Provide fire stopping for all penetrations used by dedicated BAS conduits and raceways.

2. All openings in fire proofed or fire stopped components shall be closed by using approved fire resistive sealant.

3. All wiring passing through penetrations, including walls shall be in conduit or enclosed raceway.

4. Penetrations of floor slabs shall be by core drilling. All penetrations shall be plumb, true, and square.

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E. BAS Identification Standards

1. Node Identification. All nodes shall be identified by a permanent label fastened to the enclosure. Labels shall be suitable for the node location.

Cable types specified in Item A shall be color coded for easy identification and troubleshooting.

F. BAS Panel Installation

1. The BAS panels and cabinets shall be located as indicated at an elevation of not less than 2 feet from the bottom edge of the panel to the finished floor. Each cabinet shall be anchored per the manufacturer's recommendations.

2. The BAS contractor shall be responsible for coordinating panel locations with other trades and electrical and mechanical contractors.

G. Input Devices

1. All Input devices shall be installed per the manufacturer recommendation

2. Locate components of the BAS in accessible local control panels wherever possible.

H. HVAC Input Devices – Genera1

1. All Input devices shall be installed per the manufacturer recommendation

2. Locate components of the BAS in accessible local control panels wherever possible.

3. Space Sensors:

a. Shall be mounted per ADA requirements.
b. Provide lockable tamper-proof covers in public areas and/or where indicated on the plans.

3.3 Training

A. The BAS contractor shall provide the following training services:

1. A minimum of one and a half days (12 hours total) of on-site orientation by a system technician who is fully knowledgeable of the specific installation details of the project. This orientation shall, at a minimum, consist of a review of the project as-built drawings, the BAS software layout and naming conventions, and a walk through of the facility to identify panel and device locations.

2. Operational training of the BAS shall include at a minimum: changing set points, overrides, starting and stopping equipment, log in to field controllers when the server or PC is down. The BAS contractor shall be required to develop a training outline for this procedure. The training outline, including the lesson plans and course materials, shall be reviewed and approved by the engineer of record through the submittal process.

3.4 Sequence of Operations

A. Refer to the drawings for the Sequence of Operations.

SECTION 15990
TESTING, ADJUSTING AND BALANCING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

B. Related Sections:

1. Other Division-15 Sections specify balancing devices and their installation, and materials and installations of mechanical systems.
2. Individual Division-15 system sections specify leak testing requirements and procedures.

1.02 SUMMARY:

A. This Section specifies the requirements and procedures total mechanical systems testing, adjusting, and balancing. Requirements include measurement and establishment of the fluid quantities of the mechanical systems as required to meet design specifications, and recording and reporting the results.

B. Test, adjust, and balance the following mechanical systems:

1. Supply air systems;
2. Return air systems;
3. Outside Air Systems;
4. Exhaust air systems;
5. Verify temperature control system operation.
6. Condensing units or chillers.

C. Test systems for proper sound and vibration levels.

D. This Section does not include:

1. Specifications for materials for patching mechanical systems;
2. Specifications for materials and installation of adjusting and balancing devices. If devices must be added to achieve proper adjusting and balancing, refer to the respective system sections for materials and installation requirements.

1.03 DEFINITIONS:

A. Systems testing, adjusting, and balancing is the process of checking and adjusting and rechecking all of the building environmental systems to produce the design objectives. It includes:

1. The balance of air distribution;
2. Adjustment of total system to provide design quantities;

3. Electrical measurement;
4. Verification of performance of all equipment and automatic controls;
5. Sound and vibration measurement.

B. Test: To determine quantitative performance of equipment.

C. Adjust: To regulate the specified fluid flow rate and air patterns at the terminal equipment (e.g., reduce fan speed, throttling).

D. Balance: To proportion flows within the distribution system submains, branches, and terminals according to specified design quantities.

E. Procedure: Standardized approach and execution of sequence of work operations to yield reproducible results.

F. Report forms: Test data sheets arranged for collecting test data in logical order for submission and review. These data should also form the permanent record to be used as the basis for required future testing, adjusting, and balancing.

G. Terminal: The point where the controlled fluid enters or leaves the distribution system. These are supply inlets on water terminals, supply outlets on air terminals, return outlets on water terminals, and exhaust or return inlets on air terminals such as registers, grilles, diffusers, louvers, and hoods.

H. Main: Duct or pipe containing the system's major or entire fluid flow.

I. Submain: Duct containing part of the systems' capacity and serving two or more branch mains.

J. Branch main: Duct serving two or more terminals.

K. Branch: Duct serving a single terminal.

1.04 SUBMITTALS:

A. Agency Data:

1. Submit proof that the proposed Testing, Adjusting, and Balancing agency meets the qualifications specified below.

B. Engineer and Technicians Data:

1. Submit proof that the Test and Balance Engineer assigned to supervise the procedures, and the technicians proposed to perform the procedures meet the qualifications specified below.

C. Procedures and Agenda: Submit a synopsis of the testing, adjusting, and balancing procedures and agenda proposed to be used for this project.

D. Maintenance Data: Submit maintenance and operating data that include how to test, adjust, and balance the building systems. Include this information in maintenance

data specified in Division 1 and Section 15010.

E. Sample Forms: Submit sample forms, if other than those standard forms prepared by the AABC are proposed.

F. Sample Forms: Submit sample forms, if other than those standard forms prepared by the NEBB are proposed.

G. Certified Reports: Submit testing, adjusting, and balancing reports bearing the seal and signature of the Test and Balance Engineer. The reports shall be certified proof that the systems have been tested, adjusted, and balanced in accordance with the referenced standards; are an accurate representation of how the systems have been installed; are a true representation of how the systems are operating at the completion of the testing, adjusting, and balancing procedures; and are an accurate record of all final quantities measured, to establish normal operating values of the systems. Follow the procedures and format specified below:

1. Draft reports: Upon completion of testing, adjusting, and balancing procedures, prepare draft reports on the approved forms. Draft reports may be hand written, but must be complete, factual, accurate, and legible. Organize and format draft reports in the same manner specified for the final reports. Submit 2 complete sets of draft reports. Only 1 complete set of draft reports will be returned.
2. Final Report: Upon verification and approval of draft reports, prepare final reports, type written, and organized and formatted as specified below. Submit 2 complete sets of final reports.
3. Report Format: Report forms shall be those standard forms prepared by the referenced standard for each respective item and system to be tested, adjusted, and balanced. Bind report forms complete with schematic systems diagrams and other data in reinforced, vinyl, three-ring binders. Provide binding edge labels with the project identification and a title descriptive of the contents. Divide the contents of the binder into the below listed divisions, separated by divider tabs:

    a. General Information and Summary
    b. Air Systems
    c. Temperature Control Systems
    d. Special Systems
    e. Sound and Vibration Systems

4. Report Contents: Provide the following minimum information, forms and data:

    a. General Information and Summary: Inside cover sheet to identify Testing, Adjusting, and Balancing agency, Contractor, Owner, Architect, Engineer, and Project. Include addresses, and contact names and telephone numbers. Also include a certification sheet containing the seal and name, address, telephone number, and signature of the Certified Test and Balance Engineer. Include in this division a listing of the instrumentations used for the procedures along with the proof of calibration.

b. Minimum Report Data Of Specifications:

Air Handling Units
Make and Model #
Supply air cfm: actual vs design
Supply air external static pressure
Return air cfm: actual vs design
Return air actual static pressure
Unit total static pressure
Unit external static pressure vs design
Fan motor Hp, volts and phase
Motor amperage draw per phase
Fan rpm
Main supply duct traverse velocity and duct size (prior to any take-off)
Cooling coil entering air temperature
Cooling coil leaving air temperature
Outdoor design conditions db/wb or RH during testing (at start and end of testing)
Outdoor air cfm: actual vs design

Exhaust Fan
Make and Model #
Exhaust cfm actual vs design
Exhaust fan static pressure actual vs design
Motor Hp, volts phase
Motor amperage draw per phase

Diffusers, Register & Grilles
Actual vs design cfm for each supply diffuser or register, return and exhaust registers or grilles.
Size of each diffuser, register and grille and air handling system it's associated with.

Condensing Unit
Make & Model #
Compressor motor quantity, Hp or Kw, volts & phase
Amperage draw of each compressor motor per phase
Condenser fan quantity, Hp, volts & phase
Amperage draw of each fan motor per phase
Suction temperature and pressure
Condensing temperature and pressure
Outdoor conditions during testing
Reversing valve operation (heat pump units)

Chiller (air cooled)
Make and Model #
Compressor motor quantity, Hp or Kw, volts and phase
Amperage draw per phase of each compressor
Condenser fan quantity, HP, volts and phase
Amperage draw per phase of each fan motor

Entering water temp.
Leaving water temp.
Unit amperage draw per phase
Unit safeties are operational

Chilled Water Pump
Make & Model #
Motor Hp, volts & phase
Motor amperage draw per phase
Motor RPM
Suction pressure ((in W.G.)
Discharge pressure (in W.G.)

Temperature Controls
Make of each thermostat or sensor
Location of each thermostat or sensor
Cooling set point temperature
Heating setpoint temperature
Room temperature vs setpoint and A/C system operation (cooling or heating)
Verification that outdoor air damper opens and closes per sequence of operation.

H. Calibration Reports: Submit proof that all required instrumentation has been calibrated to tolerances specified in the referenced standards, within a period of six months prior to starting the project.

1.05 QUALITY ASSURANCE:

A. Test and Balance Engineer's Qualifications: A Professional Engineer (either on the installer's staff or an independent consultant), registered in the State in which the services are to be performed, and having at least 3-years of successful testing, adjusting, and balancing experience on projects with testing and balancing requirements similar to those required for this project.

B. Agency Qualifications:

1. Employ the services of an independent Testing, Adjusting, and Balancing Agency meeting the qualifications specified below, to be the single source of responsibility to test, adjust, and balance the building mechanical systems identified above, to produce the design objectives. Services shall include checking installations for conformity to design, measurement and establishment of the fluid quantities of the mechanical systems as required to meet design specifications, and recording and reporting the results.
2. The independent Testing, Adjusting, and Balancing Agency certified by National Environmental Balancing Bureau (NEBB) in those testing and balancing disciplines required for this project, and having at least one Professional Engineer registered in the State in which the services are to be performed, certified by NEBB as a Test and Balance Engineer.

C. Agency Qualifications:

1. Employ the services of an independent Testing, Adjusting, and Balancing Agency meeting the qualifications specified below, to be the single source of responsibility to test, adjust, and balance the building mechanical systems identified above, to produce the design objectives. Services shall include checking installations for conformity to design, measurement and establishment of the fluid quantities of the mechanical systems as required to meet design specifications, and recording and reporting the results.
2. An independent Testing, Adjusting, and Balancing Agency certified by Associated Air Balance Council (AABC) in those testing and balancing disciplines required for this project, and having at least one Professional Engineer registered in the State in which the services are to be performed, certified by AABC as a Test and Balance Engineer.

D. Codes and Standards:

1. NEBB: "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems."
2. AABC: "National Standards For Total System Balance".
3. ASHRAE: ASHRAE Handbook, 1984 Systems Volume, Chapter 37, Testing, Adjusting, and Balancing.

E. Pre-Balancing Conference: Prior to beginning of the testing, adjusting, and balancing procedures, schedule and conduct a conference/meeting with the Architect/Engineer and representatives of installers of the mechanical systems. The objective of the conference/meeting is final coordination and verification of system operation and readiness for testing, adjusting, and balancing.

1.06 PROJECT CONDITIONS:

A. Systems Operation: Systems shall be fully operational prior to beginning procedures.

1.07 SEQUENCING AND SCHEDULING:

A. Test, adjust, and balance the air systems before hydronic, steam, and refrigerant systems.

B. Test, adjust and balance air conditioning systems during summer season and heating systems during winter season, including at least a period of operation at outside conditions within 5 deg. F wet bulb temperature of maximum summer design condition, and within 10 deg. F dry bulb temperature of minimum winter design condition. Take final temperature readings during seasonal operation.

PART 2 - PRODUCTS

A. Not Used.

PART 3 - EXECUTION

3.01 PRELIMINARY PROCEDURES FOR AIR SYSTEM BALANCING:

A. Before operating the system, perform these steps:

1. Obtain design drawings and specifications and become thoroughly acquainted with the design intent.
2. Obtain copies of approved shop drawings of all air handling equipment, outlets (supply, return, outside air and exhaust) and temperature control diagrams.
3. Compare design to installed equipment and field installations.
4. Walk the system from the system air handling equipment to terminal units to determine variations of installation from design.
5. Check filters for cleanliness.
6. Check dampers (both volume and fire) for correct and locked position, and temperature control for completeness of installation before starting fans.
7. Prepare report test sheets for both fans and outlets. Obtain manufacturer's outlet factors and recommended procedures for testing. Prepare a summation of required outlet volumes to permit a crosscheck with required fan volumes.
8. Determine best locations in main and branch ductwork for most accurate duct traverses.
9. Place outlet dampers in the full open position.
10. Prepare schematic diagrams of system "as-built" ductwork and piping layouts to facilitate reporting.
11. Lubricate all motors and bearings.
12. Check fan belt tension.
13. Check fan rotation.

3.02 MEASUREMENTS:

A. Provide all required instrumentation to obtain proper measurements, calibrated to the tolerances specified in the referenced standards. Instruments shall be properly maintained and protected against damage.

B. Provide instruments meeting the specifications of the referenced standards.

C. Use only those instruments which have the maximum field measuring accuracy and are best suited to the function being measured.

D. Apply instrument as recommended by the manufacturer.

E. Use instruments with minimum scale and maximum subdivisions and with scale ranges proper for the value being measured.

F. When averaging values, take a sufficient quantity of readings which will result in a repeatability error of less than 5 percent. When measuring a single point, repeat readings until 2 consecutive identical values are obtained.

G. Take all reading with the eye at the level of the indicated value to prevent parallax.

H. Use pulsation dampeners where necessary to eliminate error involved in estimating average of rapidly fluctuation readings.

I. Take measurements in the system where best suited to the task.

3.03 PERFORMING TESTING, ADJUSTING, AND BALANCING:

A. Perform testing and balancing procedures on each system identified, in accordance with the detailed procedures outlined in the referenced standards.

B. Cut insulation, ductwork, and piping for installation of test probes to the minimum extent necessary to allow adequate performance of procedures.

C. Patch insulation, ductwork, and housings, using materials identical to those removed.

D. Seal ducts and piping, and test for and repair leaks.

E. Seal insulation to re-establish integrity of the vapor barrier.

F. Mark equipment settings, including damper control positions, valve indicators, fan speed control levers, and similar controls and devices, to show final settings. Mark with paint or other suitable, permanent identification materials.

G. Retest, adjust, and balance systems subsequent to significant system modifications, and resubmit test results.

3.04 TESTING FOR SOUND AND VIBRATION:

A. Test and adjust mechanical systems for sound and vibration in accordance with the detailed instructions of the referenced standards.

3.05 RECORD AND REPORT DATA:

A. Record all data obtained during testing, adjusting, and balancing in accordance with, and on the forms recommended by the referenced standards, and as approved on the sample report forms.

B. Prepare report of recommendations for correcting unsatisfactory mechanical performances when system cannot be successfully balanced.

3.06 DEMONSTRATION:

A. Training:

1. Train the Owner's maintenance personnel on troubleshooting procedures and testing, adjusting, and balancing procedures. Review with the Owner's personnel, the information contained in the Operating and Maintenance Data specified in Division 1 and Section 15010.
2. Schedule training with Owner through the Architect/Engineer or the Owner’s Project Manager with at least 7 days prior notice.

END OF SECTION 15990

SECTION 16010
GENERAL PROVISIONS

PART 1 - GENERAL

1.01 WORK INCLUDED

A. The work covered under this Division of the Specifications is intended to include the furnishing of all materials, equipment and labor necessary for or reasonably incidental to, the installation of a complete and fully operative electrical system as indicated on the drawings and specified in this section.

1. The work shall consist generally of, but is not limited to, the following major items:

a. Main Distribution Boards.
b. Conduit and Wiring.
c. Panelboards.
d. Temporary lighting and power.
e. Telephone conduit system.
f. Fire Alarm System

B. Work Not Included:

The following work is not included in this Section:

1. Temperature controls and related wiring.

C. Fees and Permits:

1. Obtain all permits required for his/her work and include the cost of same in his/her bid.
2. The contractor shall also include in his/her bid the cost for the power company service.

D. Certificate of Inspection:

The Contractor shall, at his/her expense, have a final inspection made of the complete electrical installation and shall deliver a certificate of approval of the complete work to the Owner before receiving his/her final payment.

1.02 SUBMITTALS

A. Submit properly identified manufacturer's literature and technical data before commencing work.

B. Shop Drawings:

1. Submit copies of manufacturer's drawing of lighting fixtures, main distribution boards, safety switches, panelboards, conduit, wire, wiring devices, fire alarm

and voice evacuation system, lighting control system and any other special electrical equipment to be installed, and shall receive the Project Architect's acceptance before ordering the same for installation.

2. All shop drawings shall be submitted in 3-ring binders with each specification section indicated with tabs.

3. If shop drawings are submitted intermittingly and not in 3-ring binders, they will not be reviewed and will be returned to contractor for proper submittal.

4. Accepted Equivalent:

   Any manufacturer and/or catalog number listed on the drawings or in the Project Manual shall be construed to mean "or accepted equivalent".

   a. Any substitutions to be considered as "Accepted Equivalent" shall be submitted with both the cut of the proposed substitution and a cut of the specified equipment to the Purchasing and Contracts Division.

1.03 QUALITY ASSURANCE

A. Qualifications of manufacturers, materials and equipment:

1. Material and equipment, except as herein otherwise noted, shall be new and conform to standards specified herein defined to include conduits, cable, wiring materials and devices, panelboards, and the like.

2. Materials and equipment shall be of an approved design.

   a. Similar materials shall be of one manufacturer wherever possible.

3. Equipment offered under these Specifications shall be limited to products regularly produced and recommended for service ratings in accordance with manufacturer's catalogs, engineering data, or other comprehensive literature made available to the public and in effect at the time of opening of bids.

4. Install equipment in strict accordance with manufacturer's instruction for type, capacity and suitability of each piece of equipment used.

   a. Obtain these instructions which shall be considered a part of these Specifications.

B. Qualifications of supervisor, workmanship and installers:

1. The Contractor shall have a Master Electrician constantly supervising the work covered by these Specifications, and so far as possible shall keep the same foreman on the job from start to finish.

   a. The workmanship of the entire job shall be first class in every way and only experienced and competent workers shall be employed for

the work.

1.04 CODES AND REGULATIONS

A. Work shall be installed in accordance with the regulations and requirements of the National Electrical Code NFPA No. 70; Life Safety Code NFPA No. 101, Standard Building Code as well as all rules, state and local codes regulations and requirements of the telephone and power companies.

B. Where conduits and/or cables penetrate fire rated walls, ceilings or floors, the penetrations shall be firestopped in accordance with chapter 10, section 1001 of the standard building code.

1. The above shall be ascertained and fully coordinated before the installation of any material, equipment, and the like, and any discrepancy shall be immediately brought to the attention of the Project Architect in writing, and the Contractor shall receive a disposition of same before proceeding with the work.

2. Furnish, without additional charge, any additional materials and labor that may be required for compliance with these codes, law, rules, regulations or requirements even though the work is not mentioned in these Specifications or shown on the Drawings.

C. Material and equipment shall bear the label of approval of the National Board of Fire Underwriters Laboratory.

1.05 INSPECTIONS

A. All work and materials covered by these Specifications and shown on the Drawings shall be subject to inspection at any and all times by representatives of the Project Architect or Owner.

B. If the Project Architect or Owner's inspectors find that any material does not conform with these Specifications, the Contractor shall within three days after being notified by the Project Architect or Owner, remove the material from the premises, and if said material has been installed, the entire expense of removing and replacing same, including any cutting and patching that may be necessary, shall be borne by the Contractor.

C. Tests:

The Owner reserves the right to inspect and test any portion of the equipment during the progress of this work.

1. The Contractor shall test the entire system in the presence of the Owner or the Owner's representative when the work is completed to insure that all portions are free from short circuits and grounds.

2. All equipment, material and labor necessary to conduct the above tests shall

be furnished at the Electrical Contractor's expense.

1.06 PRODUCT HANDLING

A. Protection of Equipment, Material and Work: The Contractor shall effectively protect, at his/her own expense, much of his/her work, materials or equipment, as is liable to injury during the construction period.

1. Openings into any part of the conduit system as well as associated fixtures, equipment, and the like, both before and after being set in place, shall be securely covered or otherwise protected to prevent obstruction of the conduit, or injury due to carelessness or maliciously dropped tools or materials, grit, dirt, or any foreign matter.

a. The Contractor will be held responsible for all damage done until his/her work is fully and finally accepted.

2. Cover conduit ends with capped bushings.

B. Repair of damage: In the event of damage, repair shall be made immediately, to the Project Architect's satisfaction and at no additional cost to the Owner.

C. Special Handling: Special care, storage and handling of new and existing lighting fixtures shall be taken to minimize breakage of lenses and lamps shipped with fixtures.

1. Immediately replace any breakage with the exact lens or lamp. Used material is not an acceptable replacement.

1.07 JOB CONDITIONS

A. Accuracy of Data: The data given herein and on the Drawings are as exact as could be secured.

1. The Specifications and Drawings are for the assistance and guidance of the Contractor.

2. Exact locations, distances, levels, and the like, will be governed by the building field conditions and the Contractor shall use the data contained herein with this understanding.

B. Drawings:

1. The electrical drawings are diagrammatic, but shall be followed as closely as actual construction and work of other Contractors will permit.

2. Deviations from drawings required to make the work of the Contractor conform to the building as constructed, and to the work of other contractors, shall be made by the Contractor at his/her expense.

3. The branch circuit wiring and arrangements of home runs have been worked out for maximum economy consistent with adequate sizing for voltage drop, and the like. Maximum number of single phase branch circuits per home-run conduit shall be (3) three.

4. Install the wiring circuits arranged exactly as shown on the drawings.

5. It is not the intention of the drawings or specifications to indicate each piece of conduit, fittings, and the like, required for the satisfactory operation of the installation and whereby one is indicated, but not specified, or specified but not indicated on the drawings, it shall be considered to be both specified and indicated.

C. Measurements:

1. Review the Contract Drawings and Specifications and visit the job site to ascertain all conditions, including conduit runs, interfacing, interferences, conflicts, discrepancies, etc., and shall report the same to the Engineer for clarification ten days prior to submittal of the bid.

2. Failure to comply with this condition shall constitute an acceptance of the conditions and any necessary changes will be at Contractor's expense.

3. The Contractor shall make all measurements necessary for his/her work and shall assume responsibility for their accuracy.

4. Install necessary pull boxes, manholes and junction boxes as may be required to accomplish the distribution system indicated on the riser diagram.

D. Structural difficulties: Should any structural difficulties prevent the setting of cabinets, running conductors, and the like, at points indicated on the drawings, the necessary deviation therefrom, as determined by the Project Architect will be permitted and shall be made without additional cost.

E. Cooperation with Other Contractors

1. The Contractor shall arrange all parts of his/her work in proper relation to the work of other contractors.

2. Where interferences occur, the Contractor shall, before installing the work involved, consult with the Project Architect as to exact location and level of his/her work.

3. The Project Architect's decision will be final.

4. The Contractor shall be responsible for arrangement of his/her work and equipment and maintenance of proper headroom under this work.

5. Should work installed by him/her require any modifications to avoid interference with the other work, such changes shall be made without

additional cost.

6. The Architect's decision as to determination or allocation or responsibility where conditions require changing of work, shall be final.

7. If any work of the Contractor is dependent for its proper execution on contiguous work, examine such work and report in writing any defect thereon or conditions rendering it unsuitable.

8. The beginning of work, without making such report, shall constitute an acceptance of such work, and any defects in his/her own work consequently shall be his/her responsibility.

1.08 TEMPORARY SERVICE

A. Temporary power: Provide, maintain and remove after construction is completed, a temporary lighting, receptacle and power system in accordance with the progress schedule.

1. Lighting: An average of one hundred watt bulb every 200 square feet and a duplex receptacle every 500 square feet.

2. Receptacles: Ground fault interrupter type.

3. Three Phase Power for Testing Motors: Provided at all necessary points.

B. Temporary telephone service: Each respective trade shall be responsible for providing and maintaining their telephone services.

1.09 CLEANING

A. Keep the premises free of debris and unusable materials resulting from the work, and immediately upon completion of the work remove such debris and material from the site and leave floors broom clean in areas affected by the work.

1.10 GUARANTEE

A. Leave the electrical installation in proper working order and without charge, replace any work or materials which develop defects within one year from date of final inspection and acceptance by the Owner.

1.11 DEFINITIONS

A. In this Division "provide" is used as a term contraction meaning "to furnish, install and connect up completely in the specified or in an approved manner for the item and/or material described".

PART 2 - PRODUCTS Not Used

PART 3 - EXECUTION Not Used

END OF SECTION

SECTION 16060
MINOR ELECTRICAL DEMOLITION FOR REMODELING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Electrical demolition.

PART 2 - PRODUCTS

2.01 MATERIALS AND EQUIPMENT

B. Materials and equipment for patching and extending work: As specified in individual Sections.

PART 3 - EXECUTION

3.01 EXAMINATION

C. Verify field measurements and circuiting arrangements are as shown on Drawings.

D. Verify that abandoned wiring and equipment serve only abandoned facilities.

C. Demolition Drawings are based on casual field observation and existing record documents. Report discrepancies to Owner Architect/Engineer before disturbing existing installation.

D. Beginning of demolition means installer accepts existing conditions.

3.02 PREPARATION

E. Disconnect electrical systems in walls, floors, and ceilings scheduled for removal.

F. Coordinate utility service outages with Utility Company.

C. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations.

D. Existing Electrical Service: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Obtain permission from Owner/Architect/Engineer at least 24 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area.

E. Existing Fire Alarm System: Maintain existing system in service until new system is accepted. Disable system only to make switchovers and connections. Notify Owner Architect/Engineer and local fire service at least 24 hours before partially or completely disabling system. Minimize outage duration. Make temporary

connections to maintain service in areas adjacent to work area.

F. Existing Telephone System: Maintain existing system in service until new system is complete and ready for service or new system is accepted. Disable system only to make switchovers and connections. Notify Owner, Architect/Engineer and Telephone Utility Company at least 24 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area.

G. Existing Intercom System: Maintain existing system in service until new system is complete and ready for service. new system is accepted. Disable system only to make switchovers and connections. Obtain permission from Notify the Owner and Architect/Engineer at least 24 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area.

H. Existing Television System: Maintain existing system in service until new system is complete and ready for service. New system is accepted. Disable system only to make switchovers and connections. Obtain permission from Notify the Owner and Architect/Engineer at least 24 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area.

I. Existing Data System: Maintain existing system in service until new system is complete and ready for service. New system is accepted. Disable system only to make switchovers and connections. Obtain permission from Notify the Owner and Architect/Engineer at least 24 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area.

3.03 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

A. Remove, relocate, and extend existing installations to accommodate new construction.

B. Remove abandoned wiring to source of supply.

C. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.

D. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets which are not removed.

E. Disconnect and remove abandoned panelboards and distribution equipment.

F. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.

G. Disconnect and remove abandoned luminaires. Remove brackets, stems, hangers,

and other accessories.

H. Repair adjacent construction and finishes damaged during demolition and extension work.

I. Maintain access to existing electrical installations which remain active. Modify installation or provide access panel as appropriate.

J. Extend existing installations using materials and methods compatible with existing electrical installations, or as specified.

3.04 CLEANING AND REPAIR

A. Clean and repair existing materials and equipment which remain or are to be reused.

B. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangement.

C. Luminaires: Remove existing luminaires for cleaning. Use mild detergent to clean all exterior and interior surfaces; rinse with clean water and wipe dry. Replace lamps, ballasts, and broken electrical parts.

3.05 INSTALLATION

G. Install relocated materials and equipment under the provisions found in other sections of the specifications.

END OF SECTION

SECTION 16110
RACEWAYS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

B. This section is a Division 16 Electrical section, and is part of each Division 16 section making reference to electrical raceways specified herein.

1.02 DESCRIPTION OF WORK

A. Extent of raceway work is indicated by drawings and schedules.

B. Types of raceway specified in this section include the following:

1. Rigid metal conduit.
2. Intermediate metal conduit.
3. PVC coated metal conduit.
4. Flexible metal conduit.
5. Liquid tight flexible metal conduit.
6. Electrical metallic tubing (EMT).
7. Rigid nonmetallic conduit (PVC).
8. Surface Metal Raceway

C. Electrical nonmetallic tubing (ENT) is not acceptable.

1.03 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in manufacture of raceway systems of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Installer's Qualifications: Installer shall have at least 3 years of successful installation experience on projects with electrical raceway work similar to that required for this project.

1.04 CODES AND STANDARDS

A. NEMA Compliance: Comply with applicable requirements of NEMA Standards Publications pertaining to raceways.

B. UL Compliance and Labeling: Comply with applicable requirements of UL safety standards pertaining to electrical raceway systems. Provide raceway products and components which have been UL listed and labeled.

C. NEC Compliance: Comply with applicable requirements of NFPA-70 pertaining to

construction and installation of raceway systems.

1.05 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data, including specifications and installation instructions for each type of raceway system required. Include data substantiating that materials comply with requirements.

PART 2 - PRODUCTS

2.01 GENERAL

A. Provide raceways and fittings, of types, sizes, and weights (wall thickness) for each installation indicated. Where types are not indicated, provide proper selection determined by installer to fulfill installation requirements and comply with applicable portions of NFPA-70 for raceways.

B. All conduits and fittings shall bear the U.L. label or seal.

C. Minimum trade size raceway shall be 1/2".

D. Where conduit size is not indicated on plan, size conduit in accordance with NFPA-70, except no conduit smaller than 3/4" shall be embedded in concrete or masonry or installed below grade.

2.02 RIGID METAL CONDUIT

A. Provide zinc coated or hot-dipped galvanized type rigid steel conduit conforming to Federal Specification WW-C-581, ANSI C80 and U.L.6.

B. Provide threaded type zinc plated or hot-dipped galvanized malleable iron or steel fittings conforming to Federal Specification W-F-408.

1. Use Type 1 fittings for raintight connections.
2. Use Type 2 fittings for concrete tight connections.
3. Use Type 3 fittings for other miscellaneous conditions.

C. Provide insulated bushings on all rigid steel conduits terminating in panels, boxes, wire gutters, or cabinets.

D. Provide zinc plated or hot-dipped galvanized, malleable iron conduit bodies with removable cover, corrosion resistant screws, threaded hubs and complying with ANSI/NEMA FB1.

2.03 INTERMEDIATE METAL CONDUIT

A. Provide zinc coated or hot-dipped galvanized type intermediate steel conduit conforming to Federal Specification WW-C-581 and U.L. 1242.

B. Provide threaded type zinc plated or hot-dipped galvanized, malleable iron or steel fittings.

C. Provide insulated bushings on all intermediate steel conduits terminating in panels, boxes, wire gutters, or cabinets.

D. Provide zinc plated or hot-dipped galvanized malleable iron conduit bodies with removable cover, corrosion resistant screws, threaded hubs and complying with ANSI/NEMA FB1.

2.04 PVC COATED METAL CONDUIT

A. Provide hot-dipped galvanized type rigid steel conduit with external PVC coating (20 mil. thick) conforming to Federal Specification WW-C-581, ANSI C80.1, U.L. 6, and NEMA RN1.

B. Provide threaded type zinc plated or hot-dipped galvanized, malleable iron or steel fittings with external PVC coating (20 mil. thick).

C. Provide insulated bushings on all PVC coated metal conduits terminating in panels, boxes, wire gutters, or cabinets.

D. Provide zinc plated or hot-dipped galvanized, malleable iron conduit bodies with removable cover, corrosion resistant screws, threaded hubs and complying with ANSI/NEMA FB1.

2.05 FLEXIBLE METAL CONDUIT

A. Provide flexible steel conduit formed from continuous length of spirally wound, interlocked zinc coated strip steel and conforming to Federal Specification WW-C-56 and U.L. 1.

B. Provide threadless hinged clamp type fittings for use with flexible steel conduit.

1. Straight Terminal Connectors: One piece body, female end with clamp and deep slotted machine screw for securing conduit, male threaded end provided with locknut, and insulated throat connections for terminations.
2. 45 deg. Or 90 deg. Angle Terminal Connectors: Two piece body construction with removable upper section, female end with clamp and deep slotted machine screw for securing conduit, male threaded end provided with locknut, and insulated throat connections for terminations.

2.06 LIQUID TIGHT FLEXIBLE METAL CONDUIT

A. Provide liquid tight flexible metal conduit constructed from a continuous, flexible, interlocked, single strip and double wrapped steel, galvanized inside and outside, coated with liquid tight jacket of flexible polyvinyl chloride (PVC), and conforming to U.L. 360.

B. Provide compression type cadmium plated, malleable iron fittings with neoprene gasket sealing rings, and complying with ANSI/NEMA FB1 and U.L. 5148.

C. Provide insulated throat connectors for terminations.

2.07 ELECTRICAL METALLIC TUBING

A. Provide galvanized steel tubing conforming to Federal Specification WW-C-563, ANSI C80.3, and U.L. 797.

B. Provide set screw or compression type zinc plated or hot-dipped galvanized, malleable iron or steel fittings conforming to Federal Specification W-F-408.

1. Use Type 1 fittings for raintight connections.
2. Use Type 2 fittings for concrete tight connections.
3. Use Type 3 fittings for miscellaneous connections.

C. Provide insulated throat connectors for terminations.

D. Provide zinc plated or hot-dipped galvanized, malleable iron conduit bodies with removable cover, corrosion resistant screws, threaded hubs and complying with ANSI/NEMA FB1.

2.08 RIGID NONMETALLIC CONDUIT

A. Provide rigid nonmetallic conduit conforming to Federal Specification WC1094A, NEMA TC-2 and U.L. 651.

1. Heavy Wall Conduit: Schedule 40, 90C, U.L. rated, constructed of polyvinyl chloride, for direct burial or normal above ground use.
2. Extra Heavy Wall Conduit: Schedule 80, U.L. rated, constructed of polyvinyl chloride, for direct burial or above ground use.

B. Provide fittings which mate and match to conduit type and material and comply with NEMA TC-3 and U.L. 514.

C. Provide threaded terminal adapters on all rigid nonmetallic conduits terminating in panels, boxes, wire gutters, or cabinets. Adapters to have male threads on one end, socket end on other.

D. Provide zinc plated or hot-dipped galvanized, malleable iron conduit bodies with removable cover, corrosion resistant screws, threaded hubs and complying with ANSI/NEMA FB1.

2.09 EXPANSION FITTINGS

A. Expansion fittings shall be:

1. U.L. Listed, hot-dipped galvanized inside and outside, providing a 4" expansion chamber, external braided grounding and bonding jumper with approved clamps and U.L. listed for the application.
2. U.L. Listed, polyvinyl chloride, providing a 6" expansion chamber, and meet requirements for rigid nonmetallic conduit.

2.10 Available Conduit Bodies Manufacturers: Subject to compliance with requirements,

manufacturers offering conduit bodies which may be incorporated in the work include, but are not limited to the following:

A. Appleton Electric; Div. of Emerson Electric Co.
B. Arrow Hart Div.; Crouse Hinds Co.
C. Bell Electric Div.; Square D Co.
D. Killark Electric Mfg. Co.
E. O-Z/Gedney Div.; General Signal Co.
F. Spring City Electrical Mfg. Co.

PART 3 - EXECUTION

3.01 INSTALLATION

A. General: Install raceways as indicated; in accordance with manufacturer's written installation instructions, and in compliance with NFPA-70, and NECA's "Standards of Installation".

B. Coordinate with other work including wires/cables, boxes and panel work, as necessary to interface installation of electrical raceways and components with other work.

C. Install conduits concealed in either wall, slabs, or above hung ceilings. Where conduits cannot be concealed, route conduits exposed on wall or ceiling.

D. Mechanically fasten together metal conduits, enclosures and raceways for conductors to form continuous electrical conductor. Connect to electrical boxes, fittings and cabinets to provide electrical continuity and firm mechanical assembly.

E. Avoid use of dissimilar metals throughout system to eliminate possibility of electrolysis. Where dissimilar metals are in contact, coat surfaces with corrosion inhibiting compound before assembling.

F. Install miscellaneous fittings such as reducers, chase nipples, 3 piece unions, split couplings, and plugs that have been specifically designed and manufactured for their particular application. Install expansion fittings in raceways every 200' linear run or wherever structural expansion joints are crossed.

G. Use roughing-in dimensions of electrically operated unit furnished by supplier. Set conduit and boxes for connection to units only after receiving review of dimensions and after checking location with other trades.

H. Provide nylon pull cord in all empty conduits. Test conduits required to be installed, but left empty, test with ball mandrel. Clear any conduit which rejects ball mandrel. Pay costs involved for restoration of conduit and surrounding surfaces to original condition.

3.02 CONDUIT INSTALLATION

A. Use electrical metal tubing conduit in mechanical equipment rooms, electrical

equipment rooms and for main feeder circuits.

B. Use EMT in offices, corridors and toilets for branch circuits.

C. Use flexible metal conduit in movable partitions and from outlet boxes to recessed lighting fixtures, and final 24" of connections to motors, or control items subject to movement or vibration and in cells of precast concrete panels.

D. Use liquid tight flexible metal conduit where subject to one or more of the following conditions:

1. Exterior location.
2. Moist or humid atmosphere where condensate can be expected to accumulate.
3. Corrosive atmosphere.
4. Subjected to water spray or dripping oil, water or grease.

E. Cut conduits straight, properly ream, and cut threads for heavy wall conduit deep and clean.

F. Field bend conduit with benders designed for purpose so as not to distort nor vary internal diameter.

G. Size conduits to meet NFPA-70, except no conduit smaller than 3/4" shall be embedded in concrete or masonry or install below grade.

H. Where penetrating grade or floor in an exposed location from underground or in slab, a black mastic coated or PVC coated galvanized rigid steel conduit shall be used.

I. Provide rigid 90 degree elbows when turning conduit up in slab or turning conduit up above grade.

J. Fasten conduit terminations in sheet metal enclosures by 2 metal locknuts, and terminate with bushing. Install locknuts inside and outside enclosure.

K. Conduits are not to cross pipe shafts, or ventilating duct openings.

L. Keep conduits a minimum distance of 6" from parallel runs of flues, hot water pipes, or other sources of heat. Wherever possible, install horizontal raceway runs above water and steam piping.

M Support riser conduit at each floor level with clamp hangers.

N. Use of running threads at conduit joints and terminations is prohibited. Where required, use 3 piece union or split coupling.

O. Complete installation of electrical raceways before starting installation of cables/wires within raceway.

3.03 CONCEALED CONDUITS

A. Raceways installed in floors or outside shall be PVC Schedule 40.

B. Where penetrating a floor in a location concealed in a block wall and acceptable by applicable codes, PVC Schedule 40 rigid non-metallic raceways may be used up to the first outlet box, provided outlet height above finished floor does not exceed 48".

3.04 EXPOSED CONDUITS

A. Install exposed conduits and extensions from concealed conduit systems neatly, parallel with, or at right angles to walls of building.

B. Install exposed conduit work as not to interfere with ceiling insets, lights, or ventilation ducts or outlets.

C. Support exposed conduits by use of hangers or clamps. Support conduits on each side of bends and on spacing not to exceed following: up to 1": 6'-0"; 1-1/4" and over: 8'-0".

D. Exposed conduits shall be painted to match the color of walls, ceilings, canopies, etc., as indicated on drawings, or as directed by the Architect.

3.05 NON-METALLIC CONDUITS

A. Make solvent cemented joints in accordance with recommendations of manufacturer.

B. Install PVC conduits in accordance with NFPA-70 and in compliance with local utility practices.

3.06 CONDUIT FITTINGS

A. Construct locknuts for securing conduit to metal enclosure with sharp edge for digging into metal, and ridged outside circumference for proper fastening.

B. Insulated bushing for terminating conduits smaller than 1-1/4" are to have flared bottom and ribbed sides, with smooth upper edges to prevent injury to cable insulation.

C. Insulated bushings for terminating conduits 1-1/4" and larger are to have flared bottom and ribbed sides. Upper edge to have phenolic insulating ring molded into bushing.

D. Bushing off or insulated type to have screw type grounding terminal.

E. Miscellaneous fittings such as reducers, chase nipples, 3 piece unions, split couplings, and plugs to be specifically designed for their particular application.

END OF SECTION

SECTION 16120
WIRES AND CABLES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specifications sections, apply to work of this section.

B. This section is a Division 16 Electrical section and is part of Division 16 section making reference to electrical wires and cables specified herein.

1.02 DESCRIPTION OF WORK

A. Extent of electrical wires and cable work is indicated by drawings and schedules.

B. Types of electrical wire, cable, and connectors specified in this section include the following:

1. Copper conductors.
2. Service entrance cable.
3. Split-bolt connectors.
4. Wirenut connectors.

C. Applications of electrical wire, cable, and connectors required for project are as follows:

1. For power distribution circuits.
2. For lighting circuits.
3. For appliance and equipment circuits.
4. For motor branch circuits.

1.03 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in the manufacture of electrical wire and cable products of types, sizes, and ratings required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Installer's Qualifications: Firm with at least 3 years of successful installation experience with projects similar to that required for this project.

C. NFPA-70 Compliance: Comply with NFPA-70 requirements as applicable to construction, installation and color-coding of electrical wires and cables.

D. UL Compliance: Comply with applicable requirements of UL Std. 83, "Thermoplastic Insulated Wires and Cables" and Std. 486A, "Wire Connectors and Soldering for Use With Copper Conductors".

E. UL Compliance: Provide wiring/cabling and connector products which are UL listed

and labeled.

F. NEMA/ICEA Compliance: Comply with NEMA/ICEA Std. Pub/No's WC5, Thermoplastic Insulated Wires and Cable for the "Transmission and Distribution of Electrical Energy", and WC30, "Color Coding of Wires and Cables", pertaining to electrical power type wires and cables.

G. IEEE Compliance: Comply with applicable requirements of IEEE Stds. 82, "Test Procedures for Impulse Voltage Tests on Insulated Conductors", and Std. 241, "IEEE Recommended Practice for Electric Power Systems in Commercial Buildings" pertaining to wiring.

H. ASTM Compliance: Comply with applicable requirements of ASTM B1, 2, 3, 8, and D-573. Provide copper conductors with conductivity of not less than 98% at 20 degrees C. (68 deg. F.).

I. FOIST Compliance: Comply with Federal Specifications J-C-30, "Electrical Cable and Wire (Power, Fixed, Installation)", and W-S-610, "Splice Conductor".

1.04 SUBMITTALS

A. Product Data: Submit manufacturer's data on electrical wires, cables, and conductors.

B. DELIVERY, STORAGE, AND HANDLING:

1. Deliver wire and cable properly packaged in factory fabricated type containers, or wound on NEMA specified type wire and cable reels.
2. Store wire and cable in clean dry space in original containers. Protect products from weather, damaging fumes, construction debris and traffic.
3. Handle wire and cable carefully to avoid abrasing, puncturing, and tearing wire and cable insulation and sheathing. Ensure that dielectric resistance integrity of wires/cables is maintained.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

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

1. Wire and Cable:

a. Apex Wire and Cable Corp.
b. American Insulated Wire Corp.
c. American Wire and Cable Co.
d. Anaconda-Ericson Inc., Wire and Cable Div.
e. Beldon Div.; Cooper Industries.
f. Brand-Rex Div.; Pyle National Co.
g. Cerro Wire and Cable Corp.

h. Cleveland Insulated Wire Co.
j. Phelps Dodge Cable and Wire Co.
k. Rome Cable Corp.
l. Southwire Corp.
m. Triangle PWC, Inc.

2. Connectors;

a. AMP, Inc.
b. Appleton Electric Co.; Emerson Electric Co.
c. Burndy Corporation.
d. Brand-Rex Div.; Pyle National Co.
e. Electrical Products Div.; Midland Ross Corp.
f. General Electric Co.
g. Ideal Industries, Inc.
h. Leviton Mfg. Company.
i. 3M Company.
j. O-Z/Gedney Co.
k. Southport Industries Inc.
l. Square D Company.
m. Thomas and Betts Corp.

2.02 WIRES, CABLES, AND CONNECTORS

A. General: Provide electrical wires, cables, and connectors of manufacturer's standard materials, as indicated by published product information; designed and constructed as recommended by manufacturer, for a complete installation, and for application indicated. Except as otherwise indicated, provide copper conductors with conductivity of not less than 98% at 20 degrees C (68 degrees F.).

B. Building Materials: Provide factory-fabricated wires of sizes, ampacity ratings, and materials for applications and services indicated. Where not indicated, provide proper wire selection as determined by installer to comply with project's installation requirements, NFPA-70 and NEMA standards. Select from the following UL types, those wires with construction features which fulfill project requirements.

1. Type THWN: For dry or wet locations; max. operating temperature 75 deg. C. (167 deg. F.). Insulation, flame retardant, moisture and heat resistant, thermoplastic; outer covering, nylon jacket; conductor, annealed copper.
2. Type THHN: For dry and damp locations; max. operating temperature 90 deg. C. (194 deg. F.). Insulation, flame retardant, heat resistant thermoplastic conductor, annealed copper.

2.03 CONNECTORS

A. General: Provide Ul type factory fabricated, metal connectors of sizes, ampacity ratings, materials, types and classes for applications and for services indicated. Where not indicated, provide proper selection as determined by Installer to comply with project's installation requirements, NFPA-70 and NEMA standards. Select from the following, those types, classes, kinds and styles of connectors to fulfill project requirements:

1. Type: Pressure.
2. Type: Crimp.
3. Type: Threaded.
4. Class: Insulated.
5. Kind: Copper (for CU to CU connection).
6. Style: Butt connection.
7. Style: Elbow connection.
8. Style: Combined "T" and straight connection.
9. Style: "T" connection.
10. Style: Split-bolt parallel connection.
11. Style: Tap connection.
12. Style: Pigtail connection.
13. Style: Wirenut connection.

PART 3 - EXECUTION

3.01 INSTALLATION OF WIRES AND CABLES

A. General: Install electrical cables, wire and wiring connectors as indicated, in compliance with applicable requirements of NFPA-70, NEMA, UL, and NECA's "Standard of Installation" and in accordance with recognized industry practices.

B. Coordinate wire/cable installation work including electrical raceway and equipment installation work, as necessary to properly interface installation of wires/cables with other work.

C. Install UL type wiring in conduit, for feeders and branch circuits.

D. Pull conductors simultaneously where more than one is being installed in same raceway.

E. Use pulling compound or lubricant, where necessary; compound used must not deteriorate conductor or insulator.

F. Use pulling means including, fish tape, cable, rope and basket weave wire/cable grips which will not damage cables or raceways.

G. Keep conductor splices to a minimum.

H. Install splices and tapes which possess equivalent or better mechanical strength and insulation ratings than conductors being spliced.

I. Use splice and tap connectors which are compatible with conductor material.

J. Tighten electrical connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque tightening values. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Std 486A and B.

3.02 FIELD QUALITY CONTROL

A. Prior to energization of circuitry, check installed wires and cables with megohm meter to determine insulation resistance levels to ensure requirements are fulfilled.

B. Prior to energization, test wires and cables for electrical continuity and for short circuits.

C. Subsequent to wire and cable hook-ups, energize circuitry and demonstrate functioning in accordance with requirements. Where necessary, correct malfunctioning units, and then retest to demonstrate compliance.

END OF SECTION

SECTION 16135
ELECTRICAL BOXES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

B. This section is a Division 16 Electrical section, and is a part of each Division 16 making reference to electrical wiring boxes specified herein.

1.02 DESCRIPTION OF WORK

A. Extent of electrical box work is indicated by drawings and schedules.

B. Types of electrical boxes specified in this section include the following:

1. Outlet boxes.
2. Junction boxes.
3. Pull boxes.
4. In-ground hand hole.

1.03 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in manufacture of electrical boxes, of types, sizes, and capacities required, whose products have been in satisfactory use in similar service for not less than 3 years.

B. Installer's Qualifications: Firms with at least 3 years of successful installation experience on projects utilizing electrical boxes similar to those required for this project.

C. NFPA-70 Compliance: Comply with NFPA-70 as applicable to construction and installation of electrical wiring boxes.

D. UL Compliance: Comply with applicable requirements of UL 50, UL 514 Series, and UL 886 pertaining to electrical boxes which are UL listed and labeled.

E. NEMA Compliance: Comply with applicable requirements of NEMA Std. Pub. No.'s OS1, OS2, and Pub.250 pertaining to outlets and device boxes, covers and box supports.

1.04 SUBMITTALS

A. Product Data: Submit manufacturer's data on electrical boxes and fittings.

PART 2 - PRODUCTS

2.01 FABRICATED MATERIALS

A. Outlet Boxes: Provide galvanized coated flat rolled sheet steel outlet wiring boxes, of shapes, cubic inch capacities, and sizes, including box depths as indicated, suitable for installation at respective locations. Construct outlet boxes with mounting holes, and with cable and conduit size knockout openings in bottom and sides. Provide boxes with threaded screw holes, with corrosion resistant cover and grounding screws for fastening surface and device type box covers, and for equipment type grounding.

1. Outlet Box Accessories: Provide outlet box accessories as required for each installation, including box supports, mounting ears and brackets, wallboard hangers, box extension rings, fixture studs, cable clamps, and metal straps for supporting outlet boxes, which are compatible with outlet boxes being used to fulfill installation requirements for individual wiring situations. Choice of accessories is Installer's code compliance option.

B. Device Boxes: Provide galvanized coated flat rolled sheet steel gangable or non-gangable device boxes, of shapes, cubic inch capacities, and sizes, including box depths as indicated, suitable for installation at respective locations. Construct device boxes for flush mounting with mounting holes, and with cable size knockout openings in bottom and ends, and with threaded screw holes in end plates for fastening devices. Provide cable clamps, and for equipment type grounding.

1. Device Box Accessories: Provide device box accessories as required for each installation, including mounting brackets, device box extensions, switch box supports, plaster ears, and plaster board expandable grip fasteners, which are compatible with device boxes being utilized to fulfill installation requirements for individual wiring situations. Choice of accessories is installer's code compliance option.
2. Manufacturers: Subject to compliance with requirements, provide interior outlet boxes of one of the following:

a. Adalet-PLM Div., Scott Fetzer Co.
b. Appleton Electric; Emerson Electric Co.
c. Bell Electric; Square D Company.
d. Midland-Ross Corp.
e. OZ/Gedney; General Signal Co.
f. Pass and Seymor, Inc.
g. RACO Div; Harvey Hubbell Inc.
h. Thomas and Betts Co.

C. Raintight Outlet Boxes: Provide corrosion resistant cast metal raintight outlet wiring boxes, of types, shapes and sizes, including depth of boxes, with threaded conduit holes for fastening electrical conduit, cast metal face plates with spring-hinged watertight caps suitably configurated for each application, including face plate gaskets and corrosion resistant plugs and fasteners.

1. Manufacturers: Subject to compliance with requirements, provide raintight

outlet boxes of one of the following:

a. Appleton Electric; Emerson Electric Co.
b. Arrow Hart Div.; Crouse-Hinds Co.
c. Bell Electric; Square D Co.
d. Harvey Hubbell, Inc.
e. OZ/Gedney; General Signal Co.
f. Pass and Seymor, Inc.

D. Junction and Pull Boxes: Provide galvanized code-gage sheet steel junction and pull boxes, with screw-on covers; of types, shapes, and sizes to suit each respective location and installation; with welded seams and equipped with stainless steel nuts, bolts, screws and washers.

1. Manufacturers: Subject to compliance with requirements, provide junction and pull boxes of one of the following:

a. Adalet-PLM Div.; Scott Fetzer Co.
b. Appleton Electric; Emerson Electric Co.
c. Arrow Hart Div.; Crouse Hinds-Co.
d. Bell Electric; Square D Company.
e. OZ/Gedney Co.; General Signal Co.
f. Spring City Electrical Mfg. Co.

E. Knockout Closures: Provide corrosion resistant box knockout closures of types and sizes, to suit respective installation requirements and applications.

1. Manufacturers: Subject to compliance with requirements, provide knockout closures of one of the following:

a. Adalet-PLM Div.; Scott Fetzer Co.
b. AMP, Inc.
c. Arrow Hart Div.; Crouse-Hinds Co.
d. Appleton Electric Co.; Emerson Electric Co.
e. Bell Electric; Square D Co.
f. Midland Ross Corp.
g. Midwest Electric; Cooper Industries, Inc.
h. OZ/Gedney Co.; General Signal Co.
i. RACO Div.; Harvey Hubbell, Inc.
j. Thomas and Betts Co. Inc.

PART 3 - EXECUTION

3.01 INSTALLATION OF ELECTRICAL BOXES AND FITTINGS

A. General: Install electrical boxes and fittings as indicated, in accordance with manufacturer's written instructions, applicable requirements of NFPA-70 and NECA's "Standard of Installation", and in accordance with recognized industry practices to fulfill project requirements.

B. Coordinate installation of electrical boxes and fittings with wire/cable, wiring

devices, and raceway installation work.

C. Provide weathertight outlets for interior and exterior locations exposed to weather or moisture.

D. Provide knockout closures to cap unused knockout holes where blanks have been removed.

E. Install electrical boxes in those locations which ensure ready accessibility to enclosed electrical wiring.

F. Avoid installing boxes back-to-back in walls. Provide not less than 6" (150mm) separation.

G. Avoid installing aluminum products in concrete.

H. Position recessed outlet boxes accurately to allow for surface finish thickness.

I. Fasten electrical boxes firmly and rigidly to substrates, or structural surfaces to which attached, or solidly embed electrical boxes in concrete or masonry.

J. Provide electrical connections for installed boxes.

K. Subsequent to installation of boxes, protect boxes from construction debris and damage.

3.02 GROUNDING

A. Upon completion of installation work, properly ground electrical boxes and demonstrate compliance with requirements.

END OF SECTION

SECTION 16142
ELECTRICAL CONNECTIONS FOR EQUIPMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specifications sections, apply to work of this section.

B. This section is a Division 16 Electrical section, and is part of each Division 15 and 16 sections making reference to electrical connections for equipment specified herein.

1.02 DESCRIPTION OF WORK

A. Extent of electrical connections for equipment is indicated by drawings and schedules. Electrical connections are hereby defined to include connections used for providing electrical power to equipment.

B. Applications of electrical power connections specified in this section include the following, but not limited:

1. From electrical source to motor starters.
2. From motor starters to motors.
3. To lighting fixtures.

C. Electrical connections for equipment, not furnished as integral part of equipment, are specified in Division 15 and other Division 16 sections, and are work of this section.

D. Refer to Division 15 sections for motor starters and controller furnished integrally with equipment; not work of this section.

E. Junction boxes and disconnect switches required for connecting motors and other electrical units of equipment are specified in applicable Division 16 sections, and are work of this section.

F. Raceways and wires/cables required for connecting motors and other electrical units of equipment are specified in applicable Division 16 sections, and are work of this section.

G. Refer to Division 15 sections for control system wiring; not work of this section.

H. Refer to sections of other Divisions for specific individual equipment power requirements, not work of this section.

1.03 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in manufacture of electrical connectors and terminals, of types and rating required, and ancillary connection materials, including electrical insulating tape, soldering fluxes, and cable ties, whose products have been

in satisfactory use in similar service for not less than 5 years.

B. Installer's Qualifications: Installer shall have at least 3 years of successful installation experience with projects utilizing electrical connections for equipment similar to that required for this project.

C. NFPA-70 Compliance: Comply with applicable requirements of NFPA-70 as to type products used and installation of electrical power connections (terminals and splices), for junction boxes, motor starters and disconnect switches.

D. IEEE Compliance: Comply with Std. 241, "IEEE Recommended Practice for Electric Power Systems in Commercial Buildings" pertaining to connections and terminations.

E. ANSI Compliance: Comply with applicable requirement of ANSI/NEMA and ANSI/EIA standards pertaining to products and installation of electrical connections for equipment.

F. UL Compliance: Comply with UL Std.486A, "Wire Connectors and Soldering Lugs for Use with Copper Conductors" including, but not limited to, tightening of electrical connectors to torque values indicated. Provide electrical connection products and materials which are UL listed and labeled.

1.04 SUBMITTALS

A. Product Data: Submit manufacturer's data on electrical connections for equipment products and materials.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products of one of the following (for each type of product):

1. Adalet-PLM Div., Scott and Fetzer Co.
2. Allen-Stevens Conduit Fittings Corp.
3. AMP Incorporated.
4. Appleton Electric Co.
5. Arrow Hart Div., Crouse Hinds Co.
6. Burndy Corp.
7. General Electric Co.
8. Harvey Hubbell Inc.
9. Ideal Industries, Inc.
10. Pyle National Co.
11. Reliable Electric Co.
12. Square D Company.
13. Thomas and Betts Corp.

2.02 MATERIALS AND COMPONENTS

A. General: For each electrical connection indicated, provide complete assembly of materials, including but not necessarily limited to, pressure connectors, terminals (lugs), electrical insulating tape, heat-shrinkable insulating tubing, cables ties, solderless wire-nuts, and other items and accessories as needed to complete splices and terminations of types indicated.

2.03 METAL CONDUIT, TUBING AND FITTINGS

A. General: Provide metal conduit, tubing, and fittings of types, grades, sizes, and weights (wall thickness) indicated for each type service. Where types and grades are not indicated, provide proper selection to fulfill wiring requirements, and comply with NFPA-70 requirements for raceways. Provide products complying with Division 16 basic electrical materials and methods section "Raceways" and in accordance with the following listing of metal conduit, tubing and fittings.

1. Rigid metal conduit.
2. Rigid metal conduit fittings.
3. Electrical metallic tubing (EMT).
4. EMT fittings.
5. Flexible metal conduit.
6. Flexible metal conduit fittings.
7. Liquid tight flexible metal conduit.
8. Liquid tight flexible metal conduit fittings.
9. PVC coated metal conduit.
10. PVC coated metal conduit fittings.

2.04 WIRES, CABLES AND CONNECTORS

A. General: Provide wires, cables, and connectors complying with Division 16 basic electrical materials and methods section "Wires and Cables".

B. Wires/Cables: Unless otherwise indicated, provide wires/cables (conductors) for electrical connections which match, including sizes and ratings, of wires/cables which are supplying electrical power. Provide copper conductors with conductivity of not less than 98% at 20 deg. C. (68 deg. F.)

C. Connectors and Terminals: Provide electrical connectors and terminals which mate and match, including sizes and ratings, with equipment terminals and are recommended by equipment manufacturer for intended applications.

D. Electrical Connection Accessories: Provide electrical insulating tape, heat-shrinkable insulating tubing and boots, wirenuts and cable ties as recommended for use by accessories manufacturers for type services indicated.

PART 3 - EXECUTION

3.01 INSPECTION

A. Inspect area and conditions under which electrical connections for equipment are to be installed and notify Contractor in writing of conditions detrimental to proper completion of the work. Do not proceed with the work until unsatisfactory conditions

have been corrected in a manner acceptable to Installer.

3.02 INSTALLATION OF ELECTRICAL CONNECTIONS

A. Install electrical connections as indicated; in accordance with equipment manufacturer's written instructions and with recognized industry practices, and complying with applicable requirements of UL, NFPA-70, and NECA's "Standard of Installation" to ensure that products fulfill requirements.

B. Coordinate with other work, including wires/cables, raceways and equipment installation, as necessary to properly interface installment of electrical connections for equipment with other work.

C. Connect electrical power supply conductors to equipment conductors in accordance with equipment manufacturer's written instructions and wiring diagrams. Mate and match conductors of electrical connections for proper interface between electrical power supplies and installed equipment.

D. Cover splices with electrical insulating material equivalent to, or of greater insulation resistivity ratings, than electrical insulation rating of those conductors being spliced.

E. Prepare cables and wires, by cutting and stripping covering armor, jacket, and insulation properly to ensure uniform and neat appearance where cables and wires are terminated. Exercise care to avoid cutting through tapes which will remain on conductors. Also avoid "ringing" copper conductors while skinning wire.

F. Trim cables and wires as short as practicable and arrange routing to facilitate inspection, testing and maintenance.

G. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturers published torque tightening values for equipment connectors. Accomplish tightening by utilizing proper torquing tools, including torque screwdriver, bean-type torque wrench, and ratchet wrench with adjustable torque settings. Where manufacturer's torquing requirements are not available, tighten connectors and terminals to comply with torquing values contained in UL's 486A.

H. Provide flexible conduit for motor connections, and other electrical equipment connections, where subject to movement and vibration.

I. Provide liquid tight flexible conduit for connections of motors and other electrical equipment where subject to movement and vibration, and also where connections are subjected to one or more of the following conditions:

1. Exterior location.
2. Moist or humid atmosphere where condensate can be expected to accumulate.
3. Corrosive atmosphere.
4. Subject to water spray or dripping oil, grease, or water.

J. Fasten identification markers to each electrical power supply wire/cable conductor which indicates their voltage, phase and feeder number in accordance with Division

16 section "Electrical Identification". Affix markers on each terminal conductor, as close as possible to the point of connection.

3.03 FIELD QUALITY CONTROL

A. Upon completion of installation of electrical connections, and after circuitry has been energized with rated power source, test connections to demonstrate capability and compliance with requirements. Ensure that direction of rotation of each motor fulfills requirement. Correct malfunctioning units at site, then retest to demonstrate compliance.

END OF SECTION

SECTION 16143
WIRING DEVICES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

B. This section is a Division 16 Electrical section, and is part of each Division 16 section making reference to wiring devices specified herein.

1.02 DESCRIPTION OF WORK

A. The extent of wiring device work is indicated by drawings and schedules. Wiring devices are defined as single discrete units of electrical distribution systems which are intended to carry but not utilize electrical energy.

B. Types of electrical wiring devices in this section include the following:

1. Receptacles.
2. Ground fault circuit interrupters.
3. Switches.
4. Wallplates.

1.03 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in manufacture of electrical wiring devices, of types, sizes, and ratings required, whose products have been in satisfactory use in similar service for not less than 3 years.

B. Installer's Qualifications: Installer with at least 2 years of successful installation experience on projects utilizing wiring devices similar to those required for this project.

C. NFPA-70 Compliance: Comply with NFPA-70 as applicable to installation and wiring of electrical wiring devices.

D. UL Compliance: Comply with applicable requirements of UL 20, 486A, 498, and 943 pertaining to installation of
wiring devices. Provide wiring devices which are UL listed and labeled.

E. IEEE Compliance: Comply with applicable requirements of IEEE Std. 241, "Recommended Practice for Electric Power Systems in Commercial Buildings", pertaining to electrical wiring systems.

F. NEMA Compliance: Comply with applicable portions of NEMA Stds. Pub/No. WD 1, "General Purpose Wiring Devices", and WD 5 "Specific Purpose Wiring Devices".

1.04 SUBMITTALS

A. Product Data: Submit manufacturer's data on electrical wiring devices.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide wiring devices of one of the following (for each type and rating of wiring device):

1. Leviton Mfg. Co.
2. Arrow Hart Div., Crouse Hinds Co.
3. Harvey Hubbell Inc.
4. Pass and Seymour Inc.

2.02 FABRICATED WIRING DEVICES

A. General: Provide factory fabricated wiring devices, in types, colors, and electrical ratings for applications indicated and which comply with NEMA Stds. Pub/No. WD 1. Provide ivory color devices and wallplates except as otherwise indicated; color selection to be verified by Contractor with Architect/Engineer.

2.03 RECEPTACLES

A. General Duty Duplex: Provide duplex general duty type receptacles, 2 pole, 3 wire, grounding, with green hexagonal equipment ground screw, ground terminals and poles internally connected to mounting yoke, 20 amperes, 125 volts, with metal plaster ears; design for side and back wiring with spring loaded, screw activated pressure plate, with NEMA configuration 5-20R unless otherwise indicated.

B. Provide black colored receptacles with surge suppressors for computer equipment use where indicated.

2.04 GROUND FAULT INTERRUPTERS

A. Provide ground fault circuit interrupters, with heavy duty duplex receptacles, capable of being installed in a 2-3/4" deep outlet box without adapter, grounding type UL rated Class A, Group 1, rated 20 amperes, 120 volts, 60 Hz; with solid state ground fault sensing and signaling; with 5 milliamperes ground fault trip level; equip with NEMA configuration 5-20R.

2.05 SWITCHES

A. Snap: Provide general duty flush single pole toggle switches, 20 amperes, 120-277 volts AC, with mounting yoke insulated from mechanism, equip with plaster ears, switch handle, and side-wired screw terminals.

B. Double Snap: Provide general duty flush double pole AC quiet switches, 20 amperes, 120-277 volts, with mounting yoke insulated from mechanism, equip with

plaster ears, switch handles, side-wired screw terminals, with break-off tab features, which allow wiring with separate or common feed.

C. Three Way: Provide general duty flush 3 way AC switches, 20 amperes, 120-277 volts, with mounting yoke insulated from mechanism, equip with plaster ears, lock type switch handles, side wired screw terminals, with break-off tab features, which allows wiring with separate or common feed.

D. Four-Way: Provide general duty flush 4-way AC quiet switches, 20 amperes, 120-277 volts, with mounting yoke insulated from mechanism, equip with plaster ears, switch handles, side wired screw terminals, with break-off tab features, which allows wiring with separate or common feed.

2.06 WIRING DEVICE ACCESSORIES

A. Wallplates: Provide wallplates for single and combination wiring devices, of types, sizes and with ganging and cutouts as indicated. Select plates which mate and match wiring devices to which attached. Construct with metal screws for securing plates to devices; screw heads colored to match finish of plates; wallplates colored to match wiring devices. Provide plates possessing the following additional construction features:

1. Material and Finish: Stainless steel #302, smooth.

PART 3 - EXECUTION

3.01 INSTALLATION OF WIRING DEVICES

A. Install wiring devices as indicated, in accordance with manufacturer's written instructions, applicable requirements of NFPA-70 and NECA's "Standard of Installation" and in accordance with recognized industry practices to fulfill project requirements.

B. Coordinate with other work, including painting, electrical boxes and wiring work, as necessary to interface installation of wiring devices with other work.

C. Install wiring devices only in electrical boxes which are clean, free from excess building materials, dirt and debris.

D. Install wiring devices after wiring work is completed.

E. Install wallplates after painting work is completed.

F. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for wiring devices. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Stds. 486A and B. Use properly scaled torque indicating hand tool.

3.02 PROTECTION OF WALLPLATES AND RECEPTACLES

A. Upon installation of wallplates and receptacles, advise Contractor regarding proper

and cautious use of convenience outlets. At time of Substantial Completion, replace those items which have been damaged, including those burned and scored by faulty plugs.

3.03 GROUNDING:

A. Provide equipment grounding connections for wiring devices, unless otherwise indicated. Tighten connections to comply with tightening torques specified in UL Std. 486A to assure permanent and effective grounds.

3.04 TESTING:

A. Prior to energizing circuitry, test wiring for electrical continuity, and for short circuits. Ensure proper polarity of connections is maintained. Subsequent to energization, test wiring devices to demonstrate compliance with requirements.

END OF SECTION

SECTION 16170
CIRCUIT AND MOTOR DISCONNECTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

B. Division 16 Electrical General Provisions section apply to work of this section.

1.02 DESCRIPTION OF WORK

A. Extent of circuit and motor disconnect switch work is indicated on drawings and schedules.

B. Types of circuit and motor disconnect switches in this section include the following:

1. Equipment disconnects.
2. Motor circuit disconnects.

C. Refer to other Division 16 sections for wires/cables, raceways, and electrical boxes and fittings work required in connection with circuit and motor disconnect work; not work of this section.

1.03 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in manufacture of circuit and motor disconnect switches of types and capacities required, whose products have been in satisfactory use in similar service for not less than 3 years.

B. Installer's Qualifications: Installer with at least 3 years of successful installation experience with projects utilizing circuit and motor disconnect work similar to that required for this project.

C. NFPA-70 Compliance: Comply with NFPA-70 requirements pertaining to construction and installation of electrical circuit and motor disconnect devices.

D. UL Compliance: Comply with requirements of UL 98, "Enclosed and Dead Front Switches". Provide circuit and motor disconnect switches which have been UL listed and labeled.

E. NEMA Compliance: Comply with applicable requirements of NEMA Stds. Pub. No. KS 1, "Enclosed Switches" and 250 "Enclosures for Electrical Equipment" (1000 volts maximum).

1.04 SUBMITTALS

A. Product Data: Submit manufacturer's data on circuit and motor disconnect switches.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Manufacturer: Subject to compliance with requirements, provide circuit and motor disconnects of one of the following (for each type of switch):

1. Square D.
2. General Electric Co.
3. Siemens (ITE).

2.02 FABRICATED SWITCHES

A. Heavy Duty Safety Switches: Provide surface mounted, heavy duty type, sheet steel enclosed safety switches, of types, sizes and electrical characteristics indicated; fusible and non-fusible type, and incorporating quick-make, quick-break type switches; construct so that switch vacu-break mechanism is visible in the OFF position. Equip with operating handle which is integral part of enclosure base and whose operating position is easily recognizable, and is pad lockable in OFF position; construct current carrying parts of high conductivity copper, with silver tungsten type switch contacts, and positive pressure type reinforced fuse clips. Provide NEMA type enclosures as required and rejection clips.

B. Coordinate the required size of all safety switches feeding equipment, (i.e. motors, HVAC, kitchen equipment, special purpose outlets, elevators, owner furnished equipment, etc.) with approved equipment shop drawings and owner representatives prior to ordering disconnects. Safety switches shall be sized per the NEC, the equipment name plate and manufactures recommendations.

2.03 FUSES

A. Provide fuses for safety switches, as recommended by switch manufacturer, of classes, types, and ratings needed to fulfill electrical requirements for service indicated.

PART 3 - EXECUTION

3.01 INSTALLATION OF CIRCUIT AND MOTOR DISCONNECT SWITCHES

A. Install circuit and motor disconnect switches as indicated complying with manufacturer's written instructions, applicable requirements of NFPA-70, NEMA and NECA's "Standard of Installation", and in accordance with recognized industry practices.

B. Coordinate circuit and motor disconnect switch installation work with electrical raceway and cable work, as necessary for proper interface.

C. Install disconnect switches for use with motor driven appliances, and motors and controllers within 6'-0" of controller position unless otherwise indicated.

3.02 GROUNDING

A. Provide equipment grounding connections, sufficiently tight to assure a permanent and effective ground, for electrical disconnect switches.

3.03 FIELD QUALITY CONTROL

A. Subsequent to completion of installation of electrical disconnect switches, energize circuitry and demonstrate capability and compliance with requirements. Where possible, correct malfunction units at project site, then retest to demonstrate compliance; otherwise remove and replace with new units and retest.

END OF SECTION

SECTION 16180
OVERCURRENT PROTECTIVE DEVICES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

B. This section is a Division 16 Electrical section, and is part of each Division 16 section making reference to overcurrent protective devices specified herein.

1.02 DESCRIPTION OF WORK

A. Extent of overcurrent protective device work is indicated by drawings and schedules.

B. Types of overcurrent protective devices in this section include the following:

1. Circuit Breakers:

a. Molded case.

C. Refer to other Division 16 sections for cable/wire and connector work required in conjunction with overcurrent protective devices; not work of this section.

1.03 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in manufacture of overcurrent protective devices, of types, sizes, and ratings required, whose products have been in satisfactory use in similar services for not less than 5 years.

B. Installer: Qualified with at least 5 years of successful installation experience on projects with electrical installation work similar to that required for projects.

C. NFPA-70 Compliance: Comply with NFPA-70 requirements as applicable to construction and installation of overcurrent protective devices.

D. UL Compliance: Comply with applicable requirements of UL 489, "Molded Case Circuit Breakers and Circuit Breaker Enclosures. Provide overcurrent protective devices, which are UL, listed and labeled.

E. NEMA Compliance: Comply with applicable requirements of NEMA Std. Pub. Nos. AB 1, AB 2, and SG 3 pertaining to molded case and low voltage power type circuit breakers.

1.04 SUBMITTALS

A. Product Data: Submit manufacturer's data on overcurrent protective devices, including: amperes, voltages, and current ratings, interrupting ratings, current

limitations, internal inductive and non-inductive loads, time current trip characteristic curves, and mounting requirements.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products of one of the following (for each type and rating of overcurrent protective device).

1. Circuit Breakers:

a. Square D Co.
b. General Electric Co.
c. Siemens (ITE).

2.02 CIRCUIT BREAKERS

A. General: Except as otherwise indicated, provide circuit breakers and ancillary components, of types, sizes, ratings and electrical characteristics indicated, which comply with manufacturer's standard design, materials, components, and construction in accordance with published product information and as required for a complete installation.

B. Molded Case Circuit Breakers: Provide factory assembled, molded case circuit breakers of frame size indicated. Provide breakers with permanent thermal and instantaneous magnetic trips in each pole, and with fault current limiting protection, ampere rating as indicated. Construct with overcenter, trip free, toggle type operating mechanisms with quick-make, quick-break action and positive handle trip indication. Provide push-to-trip button on cover for mechanical tripping circuit breakers. Construct breakers for mounting and operating in any physical position and operating in an ambient temperature of 40 deg. C. Provide breakers with mechanical screw type removable connector lugs, AL/CU rated.

C. Coordinate the required size of all circuit breakers feeding equipment, (i.e. motors, HVAC, kitchen equipment, special purpose outlets, elevators, owner furnished equipment, etc.) with approved equipment shop drawings and owner representatives prior to ordering circuit breakers. Breakers shall be sized per NFPA-70, the equipment nameplate, and per manufacturer’s recommendations.

PART 3 - EXECUTION

3.01 INSTALLATION OF OVERCURRENT PROTECTIVE DEVICES

A. Install overcurrent protective devices as indicated, in accordance with manufacturer's written instructions and with recognized industry practices to ensure that protective devices comply with requirements. The arrangements of overcurrent protective devices have been worked out for phase balancing and the like and shall be followed as closely as actual construction will permit. Comply with NFPA-70 and NEMA standards for installation of overcurrent protective devices.

B. Coordinate with other work, including electrical wiring work, as necessary to interface installation of overcurrent protective devices with other work.

C. Fasten circuit breakers without causing mechanical stresses, twisting or misalignment being exerted by clamps, supports, or cabling.

D. Set field adjustable circuit breakers for trip settings as indicated, subsequent to installation of units.

3.02 ADJUST AND CLEAN

A. Inspect circuit breakers operating mechanisms for malfunctioning and, where necessary, adjust units for free mechanical movement.

3.03 FIELD QUALITY CONTROL

A. Prior to energization of overcurrent protective devices, test devices for continuity of circuitry and for short circuits. Correct malfunction units, and then demonstrate compliance with requirements.

END OF SECTION

SECTION 16190
SUPPORTING DEVICES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions, and Division 1 Specification sections, apply to work of this section.

B. This section is a Division 16 Electrical section, and is a part of each Division 16 section making reference to electrical supporting devices specified herein.

1.02 DESCRIPTION OF WORK

A. Extent of supports, anchors, sleeves and seals is indicated by drawings and schedules and/or specified in other Division 16 sections.

B. Types of supports, anchors, sleeves and seals specified in this section include the following:

1. C-clamps.
2. I-Beam clamps.
3. One-hole conduit straps.
4. Two-hole conduit straps.
5. Round steel rods.
6. Lead expansion anchors.
7. Toggle bolts.
8. Wall and floor seals.
9. Bridle Rings.

C. Conduit supporting devices of the spring or tension type, such as conduit clips manufactured by Caddy Corporation, are not acceptable.

1.03 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in manufacture of supporting devices, of types, sizes, and ratings required whose products have been in satisfactory use in similar service for not less than 3 years.

B. Installers Qualifications: Installer with at least 3 years of successful installation experience with projects utilizing electrical supporting device work similar to that required for this project.

C. NFPA-70 Compliance: Comply with NFPA-70 requirements as applicable to construction and installation of electrical supporting devices.

D. NECA Compliance: Comply with National Electrical Contractors Association's "Standard of Installation" pertaining to anchors, fasteners, hangers, supports, and equipment mounting.

E. UL Compliance: Provide electrical components which are UL listed and labeled.

1.04 SUBMITTALS

A. Product Data: Submit manufacturer's data on supporting devices including catalog cuts, specifications, and installation instructions, for each type of support, anchor, sleeve and seal.

PART 2 - PRODUCTS

2.01 MANUFACTURED SUPPORTING DEVICES

A. General: Provide supporting devices which comply with manufacturer’s standard materials, design, and construction in accordance with published product information, and as required for complete installation; and as herein specified. Where more than one type of supporting device meets indicated requirement, selection is Installer's option.

B. Supports: Provide supporting devices of types, sizes and materials indicated; and having the following construction features:

1. C-Clamps: Black malleable iron; 1/2" rod size; approximately 70 pounds per 100 units.
2. I-Beam Clamps: Black steel, 1-1/4" x 3/16" stock; 3/8" cross bolt; flange width 2"; approximately 52 pounds per 100 units.
3. One-Hole Conduit Straps: For supporting 3/4" rigid metal conduit; galvanized steel; approximately 7 pounds per 100 units.
4. Two-Hole Conduit Straps: For supporting 3/4" rigid metal conduit, galvanized steel; 3/4" strap width; and 2-1/8" between center of screw holes.
5. Hexagon Nuts: For 1/2" rod size; galvanized steel; approximately 4 pounds per 100 units.
6. Round Steel Rod: Black steel; 1/2" dia.; approximately 67 pounds per 100 feet.
7. Offset Conduit Clamps: For supporting 2" rigid metal conduit; black steel; approximately 200 pounds per 100 units.

C. Anchors: Provide anchors of types, sizes, and materials indicated, with the following construction features:

1. Lead Expansion Anchors: 1/2"; approximately 38 pounds per 100 units.
2. Toggle Bolts: Springhead; 3/16" x 4"; approximately 5 pounds per 100 units.
3. Manufacturers: Subject to compliance with requirements, provide anchors of one of the following:

    a. Ideal Industries, Inc.
    b. Joslyn Mfg. and Supply Co.
    c. McGraw Edison Co.
    d. Star Expansion Co.
    e. U.S. Expansion Bolt Co.

D. Sleeves and Seals: Provide sleeves and seals of types, sizes and materials

indicated, with the following construction features:

1. Wall and Floor Seals: Provide factory assembled watertight wall and floor seals, of types, and sizes indicated; suitable for sealing around conduit, pipe, or tubing passing through concrete floors and wall. Construct seals with steel sleeves, malleable iron body, neoprene sealing grommets and rings, metal pressure rings, pressure clamps, and cap screws.
2. U-Channel Strut Systems: Provide U-channel strut system for supporting electrical equipment, 12 gage hot dip galvanized steel, of types and sizes indicated; construct with 9/16" dia. holes, 8" o.c. on top surface, with standard green finish, and with the following fittings which mate and match with U-channel.

    a. Fixture hangers.
    b. Channel hangers.
    c. End caps.
    d. Beam clamps.
    e. Wiring studs.
    f. Thinwall conduit clamps.
    g. Rigid conduit clamps.
    h. Conduit hangers.
    i. U-bolts.

3. Manufacturers: Subject to compliance with requirements, provide channel systems of one of the following:

    a. Allied Tube and Conduit Corp.
    b. B-Line Systems, Inc.
    c. Greenfield Mfg. Co., Inc.
    d. Midland Ross Corp.
    e. OZ/Gedney Div.; General Signal Corp.
    f. Power Strut Div.; Van Huffel Tube Corp.
    g. Unistrut Div.; GTE Products Corp.

2.02 FABRICATED SUPPORTING DEVICES

A. Pipe Sleeves: Provide pipe sleeves of one of the following:

1. Sheet Metal: Fabricate from galvanized sheet metal; round tube closed with snaplock joint, welded spiral seam, or welded longitudinal joint. Fabricate sleeves from the following gage metal: 3" and smaller, 20 gage; 4" to 6", 16 gage; over 6", 14 gage.
2. Steel Pipe: Fabricate from Schedule 40 galvanized steel pipe; remove burrs.
3. Iron Pipe: Fabricate from cast-iron or ductile iron pipe; remove burrs.

PART 3 - EXECUTION

3.01 INSTALLATION OF SUPPORTING DEVICES

A. Install hangers, anchors, sleeves and seals as indicated, in accordance with manufacturer's written instructions and with recognized industry practices to insure supporting devices comply with requirements. Comply with requirements of NECA and NFPA-70 for installation of supporting devices.

B. Coordinate with other electrical work, including raceway and wiring work, as necessary to interface installation of supporting devices with other work.

C. Install hangers, supports, clamps, and attachments to support piping properly from building structure. Arrange for grouping of parallel runs of horizontal conduits to be supported together on trapeze type hangers where possible. Install supports with spacing indicated and in compliance with NFPA-70 requirements.

D Torque sleeve seal nuts, complying with manufacturer's recommended values. Ensure that sealing grommets expand to form watertight seal.

END OF SECTION

SECTION 16195
ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

B. Division 16 Electrical General Provisions section apply to work specified in this section.

1.02 DESCRIPTION OF WORK

A. Extent of electrical identification work is indicated by drawings and schedules.

B. Types of electrical identification work specified in this section include the following:

1. Electrical power, control and communication conductors.
2. Operational instructions and warnings.
3. Danger signs.
4. Equipment/system identification signs.

C. Refer to Division 1 general requirements section "Identification Systems", for equipment and system nameplates, and performance data, not work of this section.

1.03 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in manufacture of electrical identification products of types required, whose products have been in satisfactory use in similar service for not less than 3 years.

B. NFPA-70 Compliance: Comply with NFPA-70 as applicable to installation of identifying labels and markers for wiring and equipment.

C. UL Compliance: Comply with applicable requirements of UL Std.969, "Marking and Labeling Systems" pertaining to electrical identification systems.

D. NEMA Compliance: Comply with applicable requirements of NEMA Std. No's. WC-1 and WC-2 pertaining to identification of power and control conductors.

1.04 SUBMITTALS

A. Product Data: Submit manufacturer's data on electrical identification materials and products.

B. Samples: Submit samples of each color, lettering style and other graphic representation required for each identification material or system.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide electrical identification products of one of the following (for each type marker):

1. Alarm Supply Co., Inc.
2. Brady, W.H. Co.
3. Calpico Inc.
4. Cole Flex Corp.
5. Direct Safety Co.
6. George Ingraham Corp.
7. Griffolyn Co.
8. Ideal Industries, Inc.
9. LEM Products, Inc.
10. Markal Co.
11. National Band and Tag Co.
12. Panduit Corp.
13. Seton Name Plate Co.
14. Tesa Corp.

2.02 ELECTRICAL IDENTIFICATION MATERIALS

A. General: Except as otherwise indicated, provide manufacturer's standard product of categories and types required for each application. Where more than single type is specified for an application, selection is Installer's option, but provide single selection for each application.

B. Color Coded Plastic Tape:

1. General: Provide manufacturer's standard self-adhesive vinyl tape not less than 3 mils thick by 1-1/2" wide.

C. Cable/Conductor Identification Bands:

1. General: Provide manufacturer's standard vinyl cloth self adhesive cable/conductor markers of wrap-around type, either pre-numbered plastic coated type, or write-on type with clear plastic self-adhesive cover flap; numbered to show circuit identification.

D. Baked Enamel Danger Signs:

1. General: Provide manufacturer's standard "DANGER" signs of baked enamel finish on 20 gage steel, of standard red, black, and white graphics; 14" x 10" size except where 10" x 7" is the largest size which can be applied where needed, and except where larger size is needed for adequate vision; with recognized standard explanation wording, e.g., HIGH VOLTAGE, KEEP AWAY, BURIED CABLE, DO NOT TOUCH SWITCH.

E. Engraved Plastic Laminate Signs:

1. General: Provide engraving stock melamine plastic laminate, complying with FS L-P-387, in sizes and thickness indicated, engraved with engraver's standard letter style of sizes and wording indicated, black face and white core plies (letter color) except as otherwise indicated, punched for mechanical fastening except where adhesive mounting is necessary because of substrate.
2. Thickness: 1/16" except as otherwise indicated.
3. Thickness: 1/8" except as otherwise indicated.
4. Thickness: 1/16" for units up to 20 sq. in. or 8" length; 1/8" for larger units.
5. Fasteners: Self tapping stainless steel screws, except contact type permanent adhesive where screws cannot or should not penetrate substrate.

2.03 LETTERING AND GRAPHICS:

A. General: Coordinate names, abbreviations and other designations used in electrical identification work, with corresponding designations shown, specified or scheduled. Provide numbers, lettering and wording as indicated or, if not otherwise indicated, as recommended by manufacturer or as required for proper identification and operation/maintenance of electrical system and equipment. Comply with ANSI A13.1 pertaining to minimum sizes for letters and numbers.

PART 3 - EXECUTION

3.01 APPLICATION AND INSTALLATION

A. General Installation Requirements:

1. Install electrical identification products as indicated, in accordance with manufacturer's written instructions, and requirements of NFPA-70.
2. Coordination: Where identification is to be applied to surfaces which require finish, install identification after completion of painting.
3. Regulations: Comply with governing regulations and requests of governing authorities for identification of electrical work.

B. Conduit Identification:

1. General: Where electrical conduit is exposed in spaces with exposed mechanical piping which is identified by color-coded method, apply color coded identification on electrical conduit in manner similar to piping identification. Except as otherwise indicated, use white as coded color for conduit.

C. Cable/Conductor Identification:

1. General: Apply cable/conductor identification, including voltage, phase and feeder number, on each cable/conductor in each box/enclosure/cabinet where wires of more than one circuit or communication/signal system are present, except where another form of identification (such as color-coded conductors) is provided. Match identification with marking system used in panelboards, shop drawings, contract documents, and similar previously

established identification for project's electrical work.

D. Operational Identification and Warnings:

1. General: Wherever reasonably required to ensure safe and efficient operation and maintenance of electrical systems, and electrically connected mechanical systems and general systems and equipment, including prevention of misuse of electrical facilities by unauthorized personnel, install self-adhesive plastic signs or similar equivalent identification, instruction or warnings on switches, outlets, and other controls, devices and covers of electrical enclosures. Where detailed instructions or explanations are needed, provide plasticized tags with clearly written messages adequate for intended purposes.

E. Danger Signs:

1. General: In addition to installation of danger signs required by governing regulations and authorities, install appropriate danger signs at locations indicated and at locations subsequently identified by Installer of electrical work as constituting similar dangers for persons in or about project.
2. High Voltage: Install danger signs wherever it is possible under any circumstances, for persons to come into contact with electrical power of voltages higher than 110-120 volts.

F. Equipment/Systems Identification:

1. General: Install engraved plastic-laminate signs on each major unit of electrical equipment in building; including central or master unit of each electrical system including communication/ control/signal systems, unless unit is specified with its own self-explanatory identification or signal system. Except as otherwise indicated, provide single line of text, 1/2" high lettering on 1-1/2" high sign (2" high where 2 lines are required), white lettering in black field. Provide text matching terminology and numbering of the contract documents and shop drawings. Provide signs for each unit of the following categories of electrical work:

a. Panelboards, electrical cabinets and enclosures.
b. Access panel/doors to electrical facilities.
c. Major electrical switchboard.
d. Fire alarm control panel.
e. Disconnect switches

G. Install signs at locations indicated or, where not otherwise indicated, at location for best convenience of viewing without interference with operation and maintenance of equipment. Secure to substrate with fasteners, except use adhesive where fasteners should not or cannot penetrate substrate.

END OF SECTION

SECTION 16450
GROUNDING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

B. Division 16 Electrical sections apply to work of this section.

1.02 DESCRIPTION OF WORK

A. Extent of grounding work is indicated by drawings and schedules.

B. Types of grounding specified in this section include the following:

1. Solid Grounding.

C. Applications of grounding work in this section include the following:

1. Underground metal water piping.
2. Grounding electrodes.
3. Grounding rods.
4. Service equipment.
5. Enclosures.
6. Equipment.
7. Ground Test Well.

1.03 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in manufacture of electrical connectors, terminals and fittings, of types and ratings required, and ancillary grounding materials, including stranded cables, copper brain and bus, ground rods and plate electrodes, whose products have been in satisfactory use in similar service for not less than 3 years.

B. Installer: Qualified with at least 3 years of successful installation experience on projects with electrical grounding work similar to that required for project.

C. NFPA-70 Compliance: Comply with NFPA-70 requirements as applicable to materials and installation of electrical grounding systems, associated equipment and wiring. Provide grounding products which are UL listed and labeled.

D. UL Compliance: Comply with applicable requirements of UL Standards Nos.467 and 869 pertaining to electrical grounding and bonding.

E. IEEE Compliance: Comply with applicable requirements of IEEE Standard 142 and 241 pertaining to electrical grounding.

1.04 SUBMITTAL

A. Product Data: Submit manufacturer's data on grounding systems and accessories.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

A. Manufacturers: Subject to compliance with requirements, provide grounding products of one of the following:

1. B-Line Systems, Inc.
2. Burndy Corp.
3. Crouse-Hinds Co.
4. Electrical Components Div.; Grould, Inc.
5. General Electric Supply Co.
6. Ideal Industries, Inc.
7. Thomas and Betts Corp.
8. Western Electric Co.

2.02 GROUNDING SYSTEMS

A. Materials and Components:

1. General: Except as otherwise indicated, provide electrical grounding systems indicated; with assembly of materials, including, but not limited to, cables/wires, connectors, terminals (solderless lugs), grounding rods/electrodes, and plate electrodes, bonding jumper braid, surge arrestors, and additional accessories needed for complete installation. Where more than one type unit meets indicated requirements, selection is Installer's option. Where materials or components are not indicated, provide products complying with NFPA-70, UL, IEEE, and established industry standards for applications indicated.
2. Provide raceways, and electrical boxes and fittings complying with Division 16 Basic Materials and Methods sections "Raceways" and "Electrical Boxes and Fittings", in accordance with the following listing:
   a. Rigid steel conduit.
   b. Electrical metallic tubing.
   c. Flexible metal conduit, Type 2.
   d. Liquid-tight flexible metal conduit.
   e. Rigid metal conduit fittings.
   f. EMT Fittings, Type 1.
   g. Flexible metal conduit fittings.
   h. Liquid-tight flexible metal conduit fittings.

B. Conductors: Unless otherwise indicated, provide electrical grounding conductors for grounding connections matching power supply wiring materials and sized according to NFPA-70.

C. Bonding Jumper Braid: Copper braided tape, constructed of 30-gage bare copper wires and properly sized for indicated applications.

D. Flexible Jumper Strap: Flexible flat conductor, 480 strands of 30-gage bare copper wire; 3/4" wide, 9-1/2" long; 48,250 cm. Protect braid with copper bolthole ends with holes sized for 3/8" dia. bolts.

E. Ground Rods: Steel with copper welded exterior. Each ground rod shall consist of a 40 ft. ground rod, 5/8” driven vertically. Top of ground rod shall be at least one (1) foot deep below grade.

F. Electrical Grounding Connection Accessories: Provide electrical insulating tape, heat-shrinkable insulating tubing, welding materials, bonding straps, as recommended by accessories manufacturers for type services indicated.

G. Ground Test Well: Plastic 10" diameter x 10" high body with two pipe slots; plastic snap-lock cover with lifting holes and shall read “Ground”. Provide test well at each ground rod location. Cover shall be flush with grade.

H. Grounding Bars: Ground bars shall be copper of the size and description as shown on the drawings, or shall be 1/4" x 2" bus grade copper, spaced from wall on insulating 1" high supports, of 6" or greater O.A. length, allowing 2" length per lug connected thereto.

PART 3 - EXECUTION

3.01 GENERAL

A. Grounding conductors shall be provided with every circuit.

B. Grounding conductors shall; be so installed as to permit shortest and most direct path from equipment to ground; be installed in metal conduit with both conductor and conduit bonded at each end; have connections accessible for inspection and made with approved solderless connectors brazed (or bolted) to the equipment or structure to be grounded. The main grounding electrode conductor shall be exothermically welded to ground rods and water pipe.

C. All contact surfaces shall be thoroughly cleaned before connections are made to insure good metal-to-metal contact.

D. All exterior grade mounted equipment shall have their enclosures grounded directly to a separate driven ground at the equipment in addition to the building ground connection.

3.02 BONDING

A. Where available on the premises, bond the following items together:

1. Metal water pipe.
2. Building metal frame.

B. A main ground, bare copper conductor, NEC sized but in no case less than #2/0, shall be run in conduit from the Main Switchgear of each building to the building steel in respective building. This ground conductor shall also be run individually and be bonded to the main water service ahead of any union in pipe and must be metal pipe of length as acceptable by authorities having jurisdiction. Provide properly sized bonding shunt around water meter and/or dielectric unions in the water pipe. Also required is the same size ground wire to minimum 5/8" x 20 ft. copperweld driven ground rod.

C. Install ground bushings on all conduits entering enclosures where the continuity of grounding is broken between the conduit and enclosure (i.e. conduit stub-up into a motor control center enclosure). Provide an appropriately sized bond jumper from the ground bushing to the equipment ground bus.

3.03 INSTALLATION AND METHODS - 120 THROUGH 480 VOLT SYSTEMS

A. Except as otherwise indicated, each feeder raceway on the load side of the service entrance shall contain a ground conductor sized as indicated and where not shown shall be sized in accordance with Table 250-95 of the NEC. Conductor shall be connected to the equipment grounding bus in switchboards and panelboards, to lighting fixtures, motors and other types of equipment and outlets. The ground shall be in addition to the metallic raceway and shall be properly connected thereto, using a lug device located within each item enclosure at the point of electric power connections to permit convenient inspection.

B. Each feeder metallic conduit shall be bonded at all discontinuities, including at switchboards and all sub-distribution and branch circuit panels with conductors in accordance with Table 250-95 of NEC for parallel return with respective interior grounding conductor.

C. Provide green insulated ground wire for all grounding type receptacles and for equipment of all voltages. In addition to grounding strap connection to metallic outlet boxes, a supplemental grounding wire and screw equal to Raco No. 983 shall be provided to connect receptacle ground terminal to the box.

D. All plugstrips and metallic surface raceway shall contain a green insulation ground conductor from supply panel ground bus connected to grounding screw on each receptacle in strip and to strip channel. Conductor shall be continuous.

3.04 GROUNDING FOR LIGHTING FIXTURES SHALL BE AS FOLLOWS

A. All fixtures in building interior, and exterior fixtures shall be provided with green grounding conductor, solidly connected to unit. Individual fixture grounds shall be with lug to fixture body, generally located at point of electrical connection to the fixture unit.

B. All suspended fixtures and those supplied through flexible metallic conduit shall have green ground conductor from outlet box to fixture. Cord connected fixtures shall contain a separate green ground conductor.

C. Except as otherwise indicated, freestanding, pole mounted, lighting fixtures shall each have a Copperweld, or equal, rod located within or adjacent to the concrete base and projecting a minimum of 4 feet below base bottom. An NEC sized grounding conductor shall be used to connect rod to pole base and an NEC sized conductor also shall be provided from pole to supply panel ground bus. Conductor shall be thermowelded to rod.

3.05 MOTORS AND EQUIPMENT

A. All motors, all heating coil assemblies, and all building equipment requiring flexible connections shall have a green grounding conductor properly connected to the

frames and extending continuously inside conduit with circuit conductors to the supply source grounding bus with approved connectors regardless of conduit size or type. This shall include Food Service equipment, Laundry equipment, and all other "Equipment By Owner" to which an electric conduit is provided under this Division.

3.06 TRANSFORMER GROUNDING

A. Grounding of transformers and enclosures of 120/208V and 277/480V "separately derived systems" shall be to the nearest grounding electrode, grounded structural steel (when accessible), effectively grounded metal water pipe, or other approved electrodes when the former are not available as required by the N.E.C. (Where ground electrode per N.E.C. is the grounded structural steel, all additional ground wire (sized per N.E.C.) shall be connected to effectively grounded metal water pipe.

B. In addition, work shall include a conduit with an N.E.C. sized grounded conductor to main building ground system except where specifically rejected by Local Inspection Authority. Verify during construction procedures.

3.07 MISCELLANEOUS GROUNDING CONNECTIONS

A. Required connections to building steel shall be with approved terminals and bolted in accessible locations.

B. Where reinforced concrete is utilized for building grounding system (UFER ground), proper reinforced bonding shall be provided to secure low resistance to earth with "thermite" type devices, and #10AWG wire ties shall be provided to not less than ten (10) full length rebars which contact the connected rebar (by Division 16 contractor).

C. All surfaces to which grounding connections are made shall be thoroughly cleaned to maximum conductive condition immediately before connections are made thereto. Exposed bare metal at the termination point shall be painted.

D. Welded or Brazed Connections: Joints in ground conductors shall be welded or brazed. The welding or brazing processes shall be an exothermic type.

3.08 TESTING AND REPORTS

A. Raceway Continuity: Metallic raceway system as a component of the facilities ground system shall be tested for electrical continuity. Resistance to ground throughout the system shall not exceed NEC specified limits.

B. Ground resistance measurements shall be made on each grounding system utilized in the project. The ground resistance measurements shall include building structural steel, driven grounding system, and other approved systems as may be applicable. Ground resistance measurements shall be made in normally dry weather, not less than 24 hours after rainfall, and with the ground under test isolated from other grounds. Resistances measured shall not exceed specified limits.

C. Upon completion of testing, the testing conditions and results shall be certified by the Contractor and submitted in writing on Contractor's letterhead to the Architect/Engineer.

3.09 GROUND RESISTANCE

A. Grounding resistance measure at main service shall not exceed 10 ohms.

B. Resistance to ground of all non-current carrying metal parts shall not exceed 25 ohms, measured at motors, panels, grounding busses, cabinets, etc.

END OF SECTION