D. Do not locate anything within the NEC required service areas required by existing electrical components.

SHOP AND ERECTION DRAWINGS AND SAMPLES

A. Submit required and/or requested shop drawings and erection drawings, and obtain written approval of same before ordering or installing any equipment or material. Equipment or material ordered or installed without written approval may not be accepted.

B. Shop drawings shall consist of manufacturer's scale drawings, cuts or catalogs, including descriptive literature, which shall clearly indicate the construction, material, physical dimensions, and complete operating data clearly marked for each item. Data of general nature will not be accepted.

C. Erection drawings shall consist of scale drawings of the work including foundations in plan and elevation. These drawings shall show clearances between units and relation of equipment to space assigned. Make erection drawings when requested by the Architect to supplement his diagrammatic drawings.

D. Normally, with the exception of drawings for ductwork, erection drawings are required only in mechanical equipment rooms and the congested areas. The drawings shall also show the work of all other trades in the immediate vicinity of such areas. Ductwork drawings are required throughout and shall be a minimum of 1/4" scale. Drawing sheets shall be of the same size as the contract set sheets. They shall show wall partitions, lights, room numbers, and match lines with drawing references.

E. The ductwork layout shall show all apparatus such as diffusers, registers, grilles, turning vanes, splitter dampers, volume dampers, fire and smoke dampers, duct and ceiling access panels (where required), acoustical insulation, duct sizes and bottom elevations of each duct.

F. These drawings shall become part of the final as-built records. Coordinate with structural and architectural drawings for available ceiling clearance.

G. Submit samples requested for approval. The sample shall be properly tagged and will remain in the Architect's possession until final acceptance of the work.

H. Indication of "No Exceptions Taken" on the shop drawing review does not relieve the contractor of the responsibility to comply with all requirements of this specification.

SUBMITTAL REQUIREMENTS

A. Submittal data is required for each Division 15 section.

B. Submittals for this section:

1. Firm qualifications for this project at time of bid.
2. Foreman's resume and experience for this project.
3. List of subcontractors.
4. Schedule of values broken out by Section, labor and material.
5. Mechanical system identification.
6. Access doors.

C. All data shall be submitted to the Engineer at one time; partial submittals will not be accepted. Submit in individual vinyl-covered 3-ring binders. The front cover of the binder shall contain the project name and the Coburn & Associates, Inc. job number from the drawings. Index each section using the format from the Project Specifications. Each section of the submittal shall begin with a "Submittal Identification Sheet" (last page of this specification section) with a complete list of all items in that section. Failure to follow this procedure shall result in rejection of the submittal by the Engineer. This list shall also contain the following information:
1. Model numbers and summary descriptions.
2. The number of pages submitted for each item.
3. Space for Engineer's review stamp for each item.
4. Names of Project, Contractor, Sub-Contractors and Suppliers of Equipment.

The submittal shall be formatted in this manner in order to facilitate timely review by the Engineer. Engineer shall review submittal data no more than two times. Additional submittal review time shall be paid by Contractor.

D. Refer to Division 1 for administration of submittals. For mechanical work, the following quantities are required for each category of submittal, unless otherwise indicated in Division 1 or individual work sections.
1. Shop Drawings: 6 sets, including 2 for maintenance manuals.
2. Product Data: 6 sets, including 2 for maintenance manuals.
3. Welding Certifications: 6 copies for each welder.
4. Test and Balance Reports: 6 copies, including 2 for maintenance manuals.
5. Warranties (Guarantees): 6 copies, including 2 for maintenance manuals.
6. Manuals: 2 final copies, including flow diagrams, maintenance instructions, operating instructions, parts listings, and copies of other submittals indicated for inclusion.
7. Start-up/Commissioning Data Sheets: 6 sets.

MAINTENANCE MANUALS

Thirty days prior to Substantial completion, furnish two operation and maintenance manuals with index and thumb-tab marker for each section of information; bind in 3-ring, vinyl-covered binder. Label binder with "OPERATION AND MAINTENANCE MANUAL," the name and location of the project, the name of the Contractor, and the contract number. Include the names, addresses, and telephone numbers of each subcontractor installing the equipment. Include a list of all equipment and the supplier with address and telephone number. Include a table of contents and

assemble to conform to the Project Manual (specifications) with the tab sheets before instructions covering the subject. Instructions shall be legible and easily read, fold large sheets of drawings. The manual shall include: wiring and control diagrams, detailed explanation of operation and control of each item of equipment; description of the function of each principal item of equipment; installation instructions; maintenance instructions; lubrication schedule including type, grade, temperature range and frequency; safety precautions, diagrams and illustrations; test procedures; performance data; and parts lists. The manual shall be complete, including all equipment, controls, accessories and associated appurtenances.

RECORD DRAWINGS

A. Subcontractor is instructed to refer to section covering General Conditions of this specification.

B. During the course of construction the subcontractor shall keep an accurate record of all deviations and changes of the work as indicated on the drawings and its actual installation.

C. Prepare one set of "as-built" reproducible drawings indicating a record of construction revisions and changes from the contract drawings.

D. Upon completion of the work and within 30 days after acceptance by the Architect, the subcontractor shall furnish to the Owner a revised and final set of reproducible and a set of CADD diskette and prints showing all work as installed.

REGULATORY REQUIREMENTS

A. Intended for use as guidelines and are supplied to aid in equipment identification.

B. Because Catalog Numbers are subject to manufacturers change, it is the contractors' responsibility to coordinate the equipment and material with specified capacity, duty rating, voltage, etc.
   1. Do not take precedence over specific ratings or duty or written specifications.

C. Are not intended to give priority of one manufacturer over another providing "or equal" requirements are met.

SHOP DRAWINGS AND PRODUCTS DATA

A. Shop drawings and product data shall be submitted on all equipment, fixtures, etc., as required in the individual Section.
   1. Submittals shall include all equipment to be installed by the subcontractor and all submittals must be made at same time.
   2. One "Package" will be accepted from each subcontractor as follows:
      a. HVAC
      b. Plumbing
      c. Fire Protection
   3. Each package must have the General Contractors review stamp prior to submittal.

4. The Engineer will review one submittal and one re-submittal; subsequent resubmittals may require a review charge to be paid by subcontractor.

A. Shop drawings shall be labeled in the same designation as individual piece of equipment for which they are being submitted; the proper designation shall be the designation used on the various equipment schedules and/or in other Sections of these Specifications, i.e. MDP, PANEL A, FIXTURE A, ETC
   1. All items and accessories shall be clearly marked on Submittals. Marking shall be by underlining use of arrows or circles. i.e. If contractor is submitting "White" finish, then "White" must be clearly designated.
   2. If a submittal is approved and an accessory list is not clearly marked not included, then all listed accessories will be required to be supplied.

CERTIFICATES

A. Upon completion of the work and before making the final request for payment, submit a "Final Certificate of Approval" or its equivalent stating that:
   1. All work has been inspected and approved.
   2. All work has been completed.
   3. No further inspection will be required.

PART 2 - PRODUCTS

PART 3 - EXECUTION

INSPECTION

A. Job condition shall be determined prior to bidding in the following manner:
   1. Site visit to determine:
      a. Existing conditions
      b. How and where materials will be delivered and stored.
      c. Special problems encountered during construction.

B. Failure to determine existing conditions or nature of construction and existing will not be considered as a basis for granting additional compensation.

CUTTING AND PATCHING

Comply with required Divisions of the Contract Specifications for the cutting and patching of other work to accommodate the installation of mechanical work. Except as individually authorized by the Architect/Engineer, cutting and patching of mechanical work to accommodate the installation of other work is not permitted, other than necessary penetrations of mechanical sheet metal work for electrical conduit and similar purposes.

COORDINATION WITH OTHER TRADES

A. This subcontractor shall coordinate his/her work with other trades to avoid interferences and delays. He/she shall assist in working out space requirements to make a satisfactory installation.

B. If the subcontractor installs his/her work before coordinating with other trades, or so as to cause any interference with work of other trades, he/she shall make the necessary changes in his/her work to correct the condition without extra charge.

C. This subcontractor shall furnish to other trades, as required, all necessary templates, patterns, settings plans, and shop details for the proper installation of work and for the purpose of coordinating adjacent work.

INSTALLATION

A. General
   1. Contract Drawings show the arrangements and sizes of principal apparatus and devices to be provided under this Contract and connection thereto these shall be followed as closely as actual building construction will permit.
   2. Dimensions of work as indicated on Plans are not guarantee to be as-built dimensions.
   3. No measurements shall be scaled from Drawings and used as definite dimensions for layout or fitting work in place.
   4. Layout of equipment, as shown on the plan, shall be checked and exact location determined by dimension of equipment approved by the Architect.
   5. Consult the Drawings for all dimensions, locations of partitions, sizes of structural member, foundations etc.
   6. Do not make final layouts until shop or equipment drawings are approved and job conditions verified.
   7. Electrical reference symbols are given on the electrical legend on the drawings.

FIELD QUALITY CONTROL

A. Coordination:
   1. Work shall be coordinated between all Contractors, Subcontractors, Installers, Suppliers, Trades, etc. to:
      a. Insure a neatly fitted installation.
      b. Determine the nature and extent of the work of others.
      c. Eliminate interferences.
      d. Maintain maximum headroom and clearances.
   2. Any interference which develops or field condition which interferes with the installation as drawn shall be handled as follows:
      a. Cease installation of that portion of the work which is in conflict as no additional compensation will be allowed for any relocation, etc.
      b. Continue work only on other portions of the work which are not in conflict.
      c. Notify the Engineer and Owner immediately.
      d. Owners decision shall be final as to any relocation, rerouting, removal, etc.
      e. No additional compensation will be allowed for removal, relocation, repairs or changes required by interferences.

DISCREPANCIES

A. In the event of discrepancy, work shall cease and the Architect/Engineer shall be notified immediately.

CLOSING-IN OF UNINSPECTED WORK

A. Do not allow or cause any of the work in this Section to be covered up or enclosed until it has been inspected, tested, and approved by the Architect/Engineer and by all authorities having jurisdiction.

ADJUSTING AND CLEANING

A. Clear away all debris, surplus materials, etc. resulting from work on operations, leaving job and equipment in clean first-class condition.

B. Clean all panel board, switches, boxes, etc., and leave them in a ready-to-use condition.

C. Install with proper screws or bolts, all panelboard and junction box covers.

D. Where factory finish is provided on equipment, all marred or damaged surfaces shall be touched-up or refinished hereunder as approved.

GUARANTEES AND CERTIFICATIONS

A. All work shall be guaranteed to be free from leaks or defects. Any defective materials or workmanship as well as damage to the work of all trades resulting from same shall be replaced or repaired as directed for the duration of stipulated guarantee periods.

B. The duration of guarantee periods following the date of beneficial use of the system shall be one year. Beneficial use is defined as operation of the system to obtain its intended use.

C. The date of acceptance shall be the date of final payment for the work or the date of a formal notice of acceptance, whichever is earlier.

D. Certification shall be submitted attesting to the fact that specified performance criteria are met by all items of heating and air conditioning equipment.

ENGINEER'S UNDERGROUND OBSERVATION

A. Contractor preparation: The Contractor shall have all underground utilities, conduit and piping installed on the site in trenches. All pipe and conduit shall be left uncovered.

B. The Contractor shall contact the Engineer in writing to schedule a site observation 72 hours prior to the day of observation.

C. The Contractor shall walk the site with the Architect/Engineer and assist in providing access to underground work.

D. At the successful conclusion of the observation, the Contractor and Engineer shall sign the Observation Form on the As-Built drawings.

ENGINEER'S PRE-CONCEALMENT OBSERVATION

A. Contractor Preparation:
   1. All equipment, ductwork, piping, controllers, conduit, wire, and accessories shall be installed in plain visible view without any walls, ceiling tiles, or ceilings installed. Stud walls with one exposed wall may be installed. Ceiling grids and ceiling light fixtures may not be installed. All ductwork and piping shall be non-insulated.
   2. The Contractor shall contact the Architect/Engineer to schedule a pre-concealment site observation. The Engineer shall perform the observation within 72 hours of the notice of observation. It is the Contractor's sole responsibility to plan for and schedule this observation.

B. The Contractor shall walk the site with the Architect/Engineer and assist in providing ladders, flashlights, and access to equipment.

C. The Contractor shall have a red lined set of AS-BUILT information that has been edited as equipment is installed.

D. At the successful conclusion of the walk-through, the Contractor and Architect/Engineer shall sign the observation form on the AS-BUILT drawings.

ENGINEER'S SUBSTANTIAL COMPLETION OBSERVATION

A. Contractor Preparation:
   1. All equipment and systems shall be operational. Systems commissioning and start up forms shall be completed and submitted to Architect/Engineer. Contractor's initial handwritten test and balance report shall be submitted. All smoke detectors and fire alarm hook-ups shall be operated and tested.
   2. The Contractor shall contact the Architect/Engineer to schedule a substantial completion site observation. The Engineer shall perform the observation within 72 hours of the notice of observation. It is the Contractor's sole responsibility to plan for and schedule this observation.

B. The Contractor shall walk the site with the Architect/Engineer and assist in providing ladders, flashlights, and access to equipment.

C. Documents: The Contractor shall have a red lined set of AS-BUILT information that has been edited as equipment is installed.

D. At the successful conclusion of the walk-through, the Contractor and Architect/Engineer shall sign the observation form on the AS-BUILT drawings. It is the Contractor's sole responsibility to plan for and schedule this observation.

FINAL ACCEPTANCE OBSERVATION

A. Contractor shall carefully read all applicable sections of these specifications and prepare and assemble necessary test reports, maintenance manuals, certificates, guarantees, letters of instruction, etc. that are required.

B. These documents shall be delivered to the Architect's / Engineer's office at least 48 hours before requesting final acceptance observation for work covered under this division of the specifications.

C. Contractor's representatives responsible for work under this division shall be present at time of acceptance observations and shall furnish required mechanics, tools and ladders to assist in the inspection.

D. A list of items to be corrected as a result of acceptance observation will be furnished to the contractor. Notify Architect / Engineer in writing of any items appearing on list of correction that are disputed by Contractor. When ready, request in writing a re-observation of work.

PROTECTION

A. All equipment and materials stored at Site shall be covered to exclude dust and moisture; and protected from weather from entry of foreign materials.

END OF SECTION

ELECTRICAL CONTRACTOR'S QUALIFICATION FORM

INSTRUCTIONS: COMPLETE THIS FORM AND SUBMIT WITHIN 24 HOURS OF THE BID OPENING.

1. Contractor's name and Address

_____

_____

_____

2. Contractor's Person to Contact

Name:_____

Phone Number:_____

Fax Number:_____

3. Electrical Contractor's License Number:_____

4. Electrical Contractor's Experience Project Examples:

_____

_____

PROJECT A - Project Title:_____
Location:_____

General Contractor:_____
Address:_____
Phone Number:_____
Contact:_____

Project Type: Educational_ Industrial___ Commercial ____ Health Care____

Size: Sq. Ft._____Construction Cost: $_____ Construction Duration_____

Completed on Schedule: YES__ NO____

Brief Project Description:_____
_____
_____
_____

Owner's Representative: Name_____
Phone Number:_____

ELECTRICAL CONTRACTOR'S QUALIFICATION FORM

INSTRUCTIONS: COMPLETE THIS FORM AND SUBMIT WITHIN 24 HOURS OF THE BID OPENING.

1. Contractor's name and Address
_____
_____
_____

2. Contractor's Person to Contact
Name:_____
Phone Number:_____
Fax Number:_____

3. Electrical Contractor's License Number:_____

4. Electrical Contractor's Experience Project Examples:
_____
_____

PROJECT B - Project Title:_____
Location:_____

General Contractor:_____
Address:_____
Phone Number:_____
Contact:_____

Project Type: Educational_ Industrial___ Commercial ____ Health Care____

Size: Sq. Ft._____Construction Cost: $_____ Construction Duration_____

Completed on Schedule: YES__ NO____

Brief Project Description:_____
_____
_____
_____

Owner's Representative: Name_____
Phone Number:_____

ELECTRICAL CONTRACTOR'S QUALIFICATION FORM

INSTRUCTIONS: COMPLETE THIS FORM AND SUBMIT WITHIN 24 HOURS OF THE BID OPENING.

1. Contractor's name and Address
_____
_____
_____

2. Contractor's Person to Contact
Name:_____
Phone Number:_____
Fax Number:_____

3. Electrical Contractor's License Number:_____

4. Electrical Contractor's Experience Project Examples:
_____
_____

PROJECT C - Project Title:_____
Location:_____

General Contractor:_____
Address:_____
Phone Number:_____
Contact:_____

Project Type: Educational_ Industrial___ Commercial ____ Health Care___

Size: Sq. Ft._____Construction Cost: $_____ Construction Duration_____

Completed on Schedule: YES__ NO____

Brief Project Description:_____
_____
_____
_____

Owner's Representative: Name_____
Phone Number:_____

SECTION 16100

BASIC MATERIALS & METHODS

PART 1 - GENERAL

SCOPE

A. Conduit for power, telephone, fire alarm, communication, control, and miscellaneous functions which are shown on the drawings or described in these specifications.
   1. All boxes for wiring and devices and special systems.
   2. Wiring for all power, communication, fire alarm and auxiliary equipment, roll-up door photo beams, controls and other devices.
   3. All panels for power, lighting, and distribution of electricity as shown on the Drawings and panel schedules.
   4. All circuit breakers shown on lighting, power, distribution and main distribution panels.
   5. All disconnects and starters as described herein.
   6. All fuses as shown and specified.

RELATED WORK SPECIFIED ELSEWHERE

A. Section 16140 - Wiring Devices
B. Section 16500 – Lighting
C. Section 16112 – Fuses 600 volts and below
D. Section 16120 – Circuit breaker enclosures
E. Section 16125 – Circuit breakers, molded cases
F. Section 16140 – Wiring devices
G. Section 16145 – Motor starters
H. Section 16150 – Contractors
I. Section 16155 - Relays

DESCRIPTION

A. Conduit:
   1. All conduit and fittings shall be in new, unused condition free from rust, excessive dirt and moisture, kinks, flats, cuts, or other distortions of shape caused by impact, crushing or bending.
   2. Concealed conduit in building, above slab shall be EMT conduit with compression fittings.
   3. Exposed conduit in building, above slab shall be EMT conduit with compression fittings.
   4. Conduit embedded in or penetrating slab shall be PVC with waterproof joints.
   5. Exposed conduit outside building, above grade shall be rigid galvanized steel with threaded waterproof fittings.
   6. Underground conduit shall be PVC with waterproof joints.

7. Final elbows through slab shall be rigid galvanized long radius elbows with bitumastic coating.

BOXES

A. All wiring devices shall be installed in metallic boxes. Provide outlet boxes, receptacle boxes, junction boxes, etc., where shown on the drawings and/or required by the National Electrical Code.

B. Provide pull boxes as shown on the Drawings, as required by code or as needed for ease of construction.

WIRES AND CABLES

A. All wiring shall be installed in conduit.
B. Conductors shall be sized according to the National Electrical Code or as shown on the drawings whichever is greater.
C. Minimum size for 20A receptacle and lighting circuits shall be No. 12 AWG- where distance from panel board to load exceeds 65 feet, use No. 10 AWG minimum; over 100 feet, use No. 8 AWG, stranded.

PANELBOARDS – SEE ALSO SECTION 16420

A. Furnish and install electrical system as described on Drawings, panel schedules and electrical riser diagram.
B. Panels shall be surface mounted or recessed as specified on the panel schedule.
C. All panelboards shall be circuit breaker type unless noted otherwise.
D. Voltage, phase, wires as specified on schedules.
E. Solid neutral.
F. Panels rated at 10,000 AIC shall have stab-in breakers.
G. Panels rated greater than 10,000 AIC shall have bolt on breakers.
H. Breakers size and quantity as shown on Schedules.
I. Breakers listed as "spare" shall be furnished and installed.
J. Panel listed with "space" shall be provided with extra space for future breakers.
   1. Each "space" shall be on one single pole.
K. Panels rated 225 amps. or less shall be provided as full 42 space panels unless specifically noted otherwise.

CIRCUIT BREAKERS – SEE ALSO SECTINS 16120 AND 16125

A. Furnish and install all circuit breakers as described on the panel schedules and drawings.

FUSES – SEE ALSO SECTIN 16112

A. Furnish and install all fuses where shown on drawings.

DISCONNECTS – SEE ALSO SECTION 16110

A. Supply and install a disconnecting means for each motor where required by

N.E.C. shown on drawings.

B. Locate disconnect as shown or as near as possible to motor.
C. Disconnects furnished as an integral part of any piece of equipment shall be acceptable in lieu of a safety switch.
D. Switches shall be fused where shown on drawings.
E. Motor rated switches shall be acceptable as disconnects for motors of 1/3 HP or less.

STARTERS – SEE ALSO SECTION 16145

A. Supply and install magnetic motor starters with appropriate control buttons or switches for each piece of equipment unless other specifications call for starter to be furnished with equipment.
B. Contractor shall coordinate with both general contractor and mechanical contractor to assure that a starter has been provided for all equipment.

COMBINATION STARTERS – SEE ALSO SECTION 16145

A. Where both a disconnect switch and motor starter are required, a combination starter shall be acceptable in lieu of individual components.

PART 2 - PRODUCTS

CONDUIT

A. Rigid metal conduit shall be steel, hot dip galvanized. Minimum size shall be 3/4".
B. Electrical Metallic Tubing (EMT) shall be steel, electro or hot dip galvanized.
C. Flexible Metallic Tubing shall be galvanized steel.
D. Sealtite type UA or EF shall be used for all motor connections.
E. Below Grade - Rigid Non-metallic conduit shall be listed for use as electrical raceways. All PVC shall be high density Type I Schedule 40.

BOXES

A. Pull boxes inside buildings shall be code gauge and size, galvanized steel with screw type cover.
B. Pull boxes outside building above grade shall be code gauge and size, galvanized steel with enamel finish and screw type cover. Boxes shall be rainproof and waterproof
C. Pull boxes outside building in slab type gasket cover and completely weatherproof.
D. Switch and outlet boxes in standard stud wall thicknesses shall be galvanized steel, 2 1/8 inch deep.
E. Switch and receptacle boxes in furred wall or wall less than standard stud depth shall be galvanized steel, 1 1/2 inch deep.
F. Wall boxes in four inch block shall be galvanized steel 2 1/8 inch deep.
G. In walls larger than four inch block-galvanized steel 3 1/2 inch deep.
H. Boxes may be ganged as required for multiple switches, etc.

I. Through-wall boxes are prohibited.
J. Lighting outlet boxes and specified junction boxes shall be galvanized steel, 4" octagon with cover 2 – 1/8" deep.
K. Floor boxes shall be standard depth-cast steel, flush mounted cover with brass. Furnish with threaded brass receptacle covers.
L. Telephone boxes shall be standard gauge galvanized steel, 4 inch square.
M. Boxes for paddle fans shall be the type required by code.

WIRE AND CABLES

A. All wire used throughout work shall be soft drawn copper of not less than 98% conductivity.
B. Wire and cable shall be new; and manufacturer's name permanently marked on the outer covering at regular intervals.
C. Conductors AWG No. 10 or smaller shall be solid larger sizes shall be stranded.
D. All conductors for general wiring shall be insulated with THW insulation.
E. Conductor markings and color coding shall be in accordance with the latest edition of the N.E.C.
F. Green color coding is required by the N.E.C. for conductors used for grounding.

PANELBOARDS

A. The panelboards shall be of dead-front construction with code gauge galvanized steel box, and hinged front finished in gray lacquer.
B. Doors shall be provided with a plate tumbler lock with flush handle and typed directory card and holders.
C. Panels rated 225 amp or less and 10,000 AIC shall be Square D, type NQO, or equal.
D. Panels rated 225 amp or less and greater than 10,000 A.I.C. shall be Square D, Type NQOB, or equal.
E. Panel rated 400 to 800 amp shall be Square D, "I-Line" or equal. Panels greater than 800 amps are considered to be Distribution Switchboards. Refer to Section 16470.

CIRCUIT BREAKERS

A. Breakers shall be of the size specified on the Panel Schedules.
B. Breakers rated at 10,000 AIC shall be plug-on.
C. Breakers rated greater than 10,000 AIC shall be bolt-on.

D. Breakers shall have visual trip indicators.
E. Breakers sizes shall be verified against equipment it serves.
F. Current limiting breakers shall be used where shown on panel schedules.
G. On three-phase panel, breakers shall alternate consecutively between busses to provide a balance load.
H. Breakers type (Square D listed for reference only).
I. For Type NQO and NQOB Panels, the breakers shall be equal to the Square D numbers as listed below:
Main Breakers:
1. 10,000 AIC - Q1B, Q2, KA, LA
2. 22,000 AIC - Q1B-VH, Q2-H, KA, LA
3. 42,000 AIC - KH, LA
4. 65,000 AIC - KH, LH
Branch Breakers:
1. 10,000 AIC - QO, QOH, Q1-H
2. 22,000 AIC - QO-VH, Q1-VH
3. 42,000 AIC - Q1H
4. 65,000 AIC - QH
J. For I-Line panels, the main breaker shall be 65,000 AIC rated, and equal to Square D Models FA, FH, KA, LA, LH, MA, MH.
K. The branch breakers shall be rated at 65,000 AIC and equal to Square D Models FA, FH, FY, IF, Q2, Q2-H, Q2H, KA, KH, IK, Q4, LA, LH, MA, MH, ME.
L. Breakers listed as current limiting breakers shall be equal to Square D - I - Limiter, in IF or IK frame sizes.

FUSES

A. General duty fuses shall be equal to Bussman 250 volt, Tron, JJN Fuses.
B. Motor circuit fuses and compressor fuses shall be equal to Bussman 250V, "Fusetron FRN" dual element fuses.
C. Current limiting fuses shall be equal to Bussman KTN-R fast acting fuses.

DISCONNECTS

A. Ampere rated for general disconnects.
B. Horsepower rated for motor disconnects.
C. Meet Federal Spec. W-S-865c for Heavy Duty Switches.
D. UL Listed.
E. Grey baked enamel finish.

F. Quick-break operating mechanism.
G. Visible handle.
H. Meets NEMA KSI-1975 for Type HD.
I. Indoor disconnects shall be NEMA 1.
J. Outdoor disconnects shall be NEMA 3R.

STARTERS

A. Provide magnetic or manual starters and associated equipment as required for each motor.
B. Each starter shall have properly sized thermal overload protection for the motor it serves.
C. Overloads shall be manual reset type.

PART 3 - GENERAL

EXCAVATION AND BACKFILL

A. Contractor shall be responsible for trenching, excavation, and backfill required to perform the work specified herein.
B. Excavation for conduits shall be of sufficient width to allow for proper jointing and alignment of the type conduit used. Minimum cover over conduits shall be 24 inches. Conduit shall be bedded on original ground. Where conduit is in solid rock a 6 inch earth cushion must be provided.
C. Conduits shall be laid in straight lines between pull boxes and\or structures unless otherwise noted on the plans.
D. The cost of solid rock excavation shall be included in the lump sum bid with no extra pay allowed.
E. Backfill shall be hand placed, loose granular earth for a height of 6 inches over the top of the largest conduit.
F. This material shall be free of rocks over 1 1/2 inch in size. Above this, large rocks may be included but must be mixed with sufficient earth to fill all voids.
G. Determine the route of the trenching to avoid interference with underground piping.

ROUGH-IN

A. Contractor shall rough-in for all equipment, fixtures, etc., in building whether or not such equipment is furnished by this Contractor or under other divisions of Specifications or by Owner.
B. Determine in advance the location and size of all openings and chases necessary for proper installation

of all work and have openings and chases provided during construction.

C. Install all inserts for hangers and supports of electrical work as general construction progresses.

D. Rough-in openings in masonry, brick, or stud walls shall be cut, not broken or chiseled.

E. Openings shall be smaller than the cover plate or box which fits over it.

F. Openings for recessed boxes shall not be larger than the cover plate which will cover the final opening

G. Sleeves shall be required at all points where exposed conduits pass through concrete walls, slabs or masonry walls. Sleeves installed below grade or where subject to high water conditions shall be installed water tight.

CONDUIT

A. All conduit shall be installed in a first-class workmanship manner.

B. All conductors shall be installed in conduit.

C. Fittings or symmetrical bends shall be required wherever right angle turns are made in exposed work.

D. Bends and offsets shall be avoided wherever possible, but where necessary, they shall be made with an approved conduit bending machine.

E. All conduit joints shall be cut square, reamed smooth and drawn up tight.

F. Conduit shall be installed in horizontal and vertical runs in such a manner as to insure against trouble from the collection of trapped condensation and shall be arranged so as to be devoid of traps.

G. Special care shall be used in insuring that exposed conduit runs are parallel or perpendicular to walls, structural members, or intersections of vertical planes and ceiling.

H. During construction, all conduit work shall be protected to prevent lodgment of dirt, plaster or trash in conduits, fittings or boxes.

I. Conduits which have been plugged shall be entirely freed of accumulations or be replaced.

J. All conduits in floors or below grade shall be swabbed free of debris and moisture before wires are pulled.

K. Conduit shall be properly supported as specified elsewhere in this Section.

L. Expansion fittings or other approved devices shall be used to provide for expansion and contraction where

conduits cross building expansion joints.

M. A flexible rounding strap shall bridge expansion joints and shall be bonded to conduit.

N. Conduit, boxes, devices, lights, etc., shall be located so that they will not interfere with intended use of eyebolts monorails, or other lifting equipment.

O. Conduit above slab shall be run concealed in the walls or ceilings unless specifically noted to be exposed.

P. Conduit under ground and\or slab shall be buried 24 inches minimum.

Q. Exact routing of conduit shall be determined in the field for ease of installation provided that the following criteria is met:
   1. All conduit, home runs, and circuits are made to the panel specified on the drawings and\or panel schedule. Any deviation in this regard shall be done only with written approval of the Architect.
   2. Conduits shall be run so as not to conflict with ductwork, diffusers, mechanical equipment and piping.
   3. Conduit is not noted or detailed to be specifically run in a particular location.
   4. Hangers and supports shall be attached to stud walls with wood screws.

R. Final connection to motors, etc., shall be made with either:
   1. The same type of conduit which leads up to the equipment or;
   2. Armored flexible conduit which shall be waterproof for any locations outside, in kitchens, or any inside area subject to water, heavy moisture, condensation, etc.

SUPPORTS AND HANGERS

A. All conduit shall be supported on structural building members, i.e. columns, beams, purlins, block, studs, etc.

B. Conduit shall be supported on galvanized or aluminum brackets, clamps, or straps.

C. Conduit hangers shall be attached to building steel by beam clamps or welding.

D. Hangers and supports shall be attached to stud walls with wood screws.

E. Hangers and supports shall be attached to masonry with expansion type anchors (shield).

F. Supports shall be channel type supports such as

manufactured by Uni-Strut, Globe, Kindorf, or equal.

OUTLET BOXES

A. Outlet shall be installed in the location shown on the drawings.

B. Contractor shall study the general building plans in relation to the space surrounding each outlet, in order that his work may fit all other work required by these Specifications.

C. All steel supports for outlet boxes shall be furnished and installed.

D. Outlets boxes for use with exposed steel conduit shall be cast steel. Cast metal fittings shall be cast steel. Cast metal fittings shall be Crouse-Hinds, Square D, Bryant, or equal.

E. Square boxes mounted in stud framing shall have support framing installed.

OPENINGS IN ELECTRICAL BOXES

A. All openings in electrical equipment, enclosures, cabinet, outlet and junction boxes shall be by means of welded bosses, standard knockouts, or shall be sawed, drilled, or punched with tools specially made for the purpose. The use of a cutting torch is prohibited.

CONNECTIONS TO ELECTRICAL BOXES

A. All conduit connections to electrical boxes shall be made with locknuts and nonmetallic bushings.

B. Locknuts shall be drawn down tight to make ground connection between the conduit and box.

PANELBOARDS

A. Unless otherwise indicated on Drawings, install all panels with the top of the trim 6'-3" above finished floor.

B. Install panelboards in location shown on the Drawings.

C. Panelboards shall be mounted with screws, bolts, or anchors as required.

D. Panels shall not be supported by conduit alone.

E. Where panels are installed on or near conductive surfaces as defined by the National Electrical Code, 3/4 inch ply boards shall be installed on walls behind and beside the panels to assure code compliance.
   1. Plywood shall be BC grade or better and painted with gray gloss fire resistant paint.

CONDUCTORS

A. All wiring shall be fully polarized throughout using white wires for neutral and making all switching connections in colored hot wires.

B. No conductors shall be drawn into conduits until all work which may cause damage is completed; only approved cable lubricants shall be used.

C. As far as practical, all feeder cables shall be continuous from origin to panel termination without running splices in intermediate pull boxes.

D. All cable terminals, taps and splices shall be made with solderless, pressure type connectors; connectors shall be Type QA-B or Q2A as manufactured by Burndy, Okonite, McJunkin or equal.

E. The minimum free length of conductor at each box for the connection of a fixture, switch or receptacle shall be 8".

END OF SECTION

SECTION 16110

DISCONNECT SWITCHES

PART 1

GENERAL

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 Basic Electrical Materials and Methods Sections apply to work of this Section.

C Submittals: Submit the producer's standard descriptive data sheets for each type of product being provided. Mark the data sheet for the product being provided with an identifying mark or arrow.

PART 2

PRODUCTS

A Acceptable Producers: General Electric. Square D, Cutler-Hammer, Gould, Westinghouse, Challenger, and Siemens ITE, or approved equal. Products shall be furnished by one provider.

B General: Provide NEMA Heavy Duty type H.D., Underwriters Laboratories listed safety switches of voltage, amperes, and number of poles as indicated on the Drawings. Provide UL rated for service entrance use where indicated on the Drawings.

C Mechanism: Switch operating mechanism shall be quick make, quick break. Switches shall have a dual interlock to prevent opening of door when switch is in "ON" position or closing of switch when door is in "OPEN" position.

D Switch Interior: Interior of switch shall have fully visible switch blades in 'OFF" position when door is open. Switches shall be dead front construction with permanently attached arc suppressors hinged or otherwise attached to permit easy access to line-side lugs, without removal of arc suppressor. Lugs shall be UL listed for copper conductors and shall be front removable. All current carrying parts shall be tin or silver plated by electrolytic processes. Provide ground lug in each switch for grounding conductor.

E Enclosures: Use NEMA 3R enclosures for all exterior locations and interior locations in wet or humid areas. Use NEMA 1 enclosures elsewhere, except as noted otherwise on the Drawings. Furnish NEMA 1 switches with knockouts. Enclosures for NEMA 1 switches shall be code gauge (UL 98) sheet steel with rust inhibiting phosphate treatment and baked enamel finish. NEMA 3R enclosures shall be of code gauge (UL 98) galvanized steel with rust inhibiting

phosphate and baked enamel finish.

F Safety Switches Safety switches for motors shall be horsepower rated for AC or DC as specified on the Drawings. All fusible switches rated 100 thru 600 amperes at 240 volts and shall have the capability of field conversion from standard Class H fuse spacing to Class J fuse spacing without affecting the UL listing. The switch also must accept Class R fuses and have field installable UL listed rejection feature to reject all fuses except Class R. UL listed short circuit ratings, when equipped with Class J or
Class R fuses shall be 200,000 ampere RMS symmetrical.

G Fuses: Fuses shall be provided where indicated and sized as shown on the drawings. See Section "Fuses."

PART 3

EXECUTION

A Provide unfused or fused disconnect switch as indicated on the Drawings at each motor which is out of sight of its controller or *50* or more feet away from the controller.

B Do not stack switches to touch each other, either horizontal or vertically. between enclosures.

C Switch symbols on electric Drawings do not indicate exact switch locations. Locate switches adjacent to motor or equipment unless shown otherwise. Coordinate locations with actual equipment providing code required clearances.

D Clean and touch-up paint on disconnect switches damaged or scratched during installation.

E Disconnects shall be identified with an engraved laminated plastic legend plate mechanically fastened.

END OF SECTION

SECTION 16112

FUSES 600 VOLTS AND BELOW

PART 1 GENERAL

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 Basic Electrical Materials and Methods Sections apply to work of this Section.

C Submittals: Submit the producer's standard descriptive data sheets for each type of product being provided. Mark the data sheet for the product being provided with an identifying mark or arrow.

PART 2 PRODUCTS

A Acceptable Producers: Bussman, General Electric, Gould & Brush Fuse, Littelfuse.

B General: Products listed herein are common to various Divisions and Specification Sections for this project and as shown on this project's Drawings.

C All fuses furnished shall be by the same producer.

D Voltage Rating:

1 Provide 250 volt fuses for 120 and 208 volt systems.

E Ampere Ratings: Ampere ratings of fuses shall be as indicated on the Drawings.

F Interrupting Ratings: Interrupting ratings of fuses shall be as indicated on the Drawings.

G Class of Fuses: Provide fuses of Class J, K, L or R.

PART 3 EXECUTION

A Coordinate fuse type and ampacity with fuse holder.

B Provide one set of fuses of each type and ampacity for spares. Voltage to correspond with circuit to be protected.

END OF SECTION

SECTION 16120

CIRCUIT BREAKER ENCLOSURES

GENERAL

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 Basic Electrical Materials and Methods Sections apply to work of this Section.

C Submittals: Submit the producer's standard descriptive data sheets for each type of product being provided. Mark the data sheet for the product being provided with an identifying mark or arrow.

PRODUCTS

A Acceptable Producers: Cutler-Hammer, General Electric, Gould, Square D, Westinghouse, Challenger and Siemens ITE or approved equal. Products shall be furnished by one producer.

B General: Products listed herein may be common to various of the Divisions and Specification Sections of the project.

C Enclosures shall be NEMA type with factory finish baked enamel or as indicated on drawings.

D NEMA 1 enclosures shall be furnished with knockouts and fabricated of steel.

E NEMA 3R enclosures, rainproof shall be furnished with raintight hubs sized for the conduit as shown on the Drawings. Enclosures shall be fabricated from zinc coated steel.

F Provide enclosure with ground bus or terminal and fully insulated neutral bar or terminals.

G Circuit breakers are specified in the Sections Circuit Breakers, Molded Case."

EXECUTION

A Individual circuit breaker enclosure shall be identified with an engraved laminated plastic legend plate mechanically fastened.

B Plastic (Dymo) type legend plates shall not be allowed.

C Install a wireway for wiring between multiple units. Wireway fill shall not exceed 20% of cross sectional area.

D Exterior units shall be in NEMA Type 3R raintight enclosure or as indicated on the Drawings.

END OF SECTION

SECTION 16125

CIRCUIT BREAKERS MOLDED CASE

GENERAL

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 Basic Electrical Materials and Methods Sections apply to work of this Section.

C Submittals: Submit the producer's standard descriptive data sheets for each type of product being provided. Mark the data sheet for the product being provided with an identifying mark or arrow.

PRODUCTS

A Acceptable Manufacturers: General Electric, ABB, *Siemens/ITE,* Challenger, Cutler-Hammer, Westinghouse, and Square D. Products shall be furnished by one producer.

B General: Products listed herein may be common to various Divisions and Specification Sections.

C Provide molded case circuit breakers with a minimum AIC rating of 10,000 amperes RMS symmetrical at 120/240 volts or with AIC rating as indicated on the Drawings. All circuit breakers shall be fully rated for the interrupting ratings indicated and shall not be series rated. Every overcurrent device provided shall be UL approved to individually interrupt its rated short circuit current and shall not depend upon operation of another overcurrent device to achieve its rating. Series rated devices are not acceptable.

D Individual circuit breakers shall be safety dead front units in NEMA Type enclosure.

E Molded case circuit breakers shall have overcenter, trip free, toggle-type operating mechanisms with quick-make, quick-break action and positive handle indication. All breakers shall be bolt-on type.

F Two and three pole circuit breakers shall have a common trip.

G Each circuit breaker shall have a permanent trip unit containing individual thermal and magnetic trip elements in each pole.

H The circuit breaker shall be constructed to accommodate the supply connections at either end.

I Circuit breaker operating handle shall assume a center position when tripped.

J Circuit breakers shall be calibrated for operation in an ambient temperature of 40 C.

EXECUTION

A Provide circuit breakers as specified in the Panelboard Schedules on the Drawings. Ampere ratings and the number of poles are indicated on the Panelboard Schedules.

B Circuit breakers shall be suitable for mounting and operating in any position.

C Circuit breakers shall be UL listed.

D Testing: Test all circuit breakers which are rated 200 amps or greater, both main and feeders, using standard tests to verify overcurrent and time delay settings and characteristics. Defective devices shall be replaced and the replacement device tested. All testing shall be performed by and independent electrical testing organization regularly involved in such work. Submit name of testing agency thirty days prior to test and advise engineer of test time and date at least two weeks in advance. Submit four copies of test results, including device operating characteristics plotted on log-log time-current paper and operating and maintenance manuals.

END OF SECTION

SECTION 16140

WIRING DEVICES

PART 1 - GENERAL

SCOPE

A. Provide general purpose receptacles, special purpose receptacles, and switches as shown on the drawings.

QUALITY ASSURACE

A. All devices shall be UL listed.

PART 2 - PRODUCTS

GENERAL

A. Model or part number listed below are for reference and establishing quality.
B. In so far as practical, all wiring devices shall be of the same manufacturer.
C. All catalog numbers listed are Hubbell unless noted.
D. Acceptable manufacturers shall be Hubbell, Pass and Seymour, Leviton, or Arrow-Hart.
E. General Purpose Receptacles
   1. General purpose receptacles shall be specification grade, 120 volt AC, 20 amp, NEMA 5-20R, grounding type, gray.
   2. Catalog numbers shall be:
      a. Duplex receptacle: HBL5362GY
F. Single appliance type
   1. Single appliance type receptacles shall be specification grade, 120 volt AC, NEMA 5-20r, 20 amp, grounding type, ivory.
   2. Catalog numbers shall be:
      a. Single receptacle: HBL5361GRY

G. Special purpose receptacle
   1. Special purpose receptacles shall be installed as required and as shown to match equipment and appliance cord.
   2. Catalog numbers for special purpose receptacles shall be as follows, based on voltage and amperage:

VOLT	AMPS	NEMA	COLOR	CAT. NO.
125	30	5-30R	Black	9308
125	50	5-50R	Black	9360
250	30	6-30R	Black	9330
250	50	6-50R	Black	9367

H. Switches
1. General lights switches shall be specification grade,125-277 volt, 20 amp, heavy duty, gray.
2. Catalog numbers shall be:
SPST HBL1221GY
DPST HBL1222GY
3-Way HBL1223GY
4-Way HBL1224GY
3. Motor rated switches shall be used for any switches controlling singles phase motors.
4. Motor rated switches shall be 120-277 volt and rated in accordance with the voltage and amperage of the motor.

I. Cover plates
1. All cover plates shall be stainless steel unless noted.
2. Catalog numbers:
a. Switches: Single gang--P1
Two gang-----P2
Three gang---P3
b. Single Receptacle 93091
c. Duplex Receptacle Single gang P8
Two gang P82
d. Television plate Single gang with coaxial connector for cable connection.
e. Special purpose outlets: Single gang P7882
Duplex 7423
f. Weatherproof covers: Weatherproof-in-use, Equal to:
1. Intermatic Model WP1100c.-single gang
2. Intermatic Model WP1220C-double gang

END OF SECTION

SECTION 16145

MOTOR STARTERS

GENERAL

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

B Division-16 Basic Electrical Materials and Methods Sections apply to work of this Section.

C Submittals: Submit the producer's standard descriptive data sheets for each type *of* product being provided. Mark the data sheet for the product being provided with an identifying mark or arrow.

PRODUCTS

A Acceptable Manufacturers: Mien-Bradley; General Electric Co., ABB, *Siemens/ITE,* Challenger, Westinghouse, Square D, and Furnas.

B General: Motor starters shall be magnetic type rated in accordance with NEMA Standards, sizes and horsepower. See Drawings for locations. Products shall be furnished by one producer.

C Enclosures: Indoors, starters shall be mounted in general purpose enclosures NEMA Type 1 unless otherwise indicated on the Drawings. For outdoor locations starters shall be mounted in NEMA Type 3R raintight or NEMA Type 4 watertight unless otherwise indicated on the Drawings.

D Contacts: Starters through NEMA size seven shall be equipped with double break silver-alloy contacts. Contacts shall be replaceable without removing power wiring or removing the starter from the enclosure. The starters shall have straight-through wiring.

E Coils: Starter coils shall be molded construction through NEMA size seven. Coils shall be replaceable from the front without removing the starter from the enclosure. Operating voltage shall be as indicated on the Drawings or required by the control system.

F Overload relays: Starter overload relays shall be the melting-alloy type with a replaceable control circuit module. Thermal units shall be of one piece construction and interchangeable. The starter shall be inoperative if the thermal unit is removed. Electronic implementation of the thermal overload function is permissible. Overload relay shall monitor current in each phase; overload of any phase shall cause tripping.

G Electrical Interlocks: NEMA size 0 through 7 starters shall be suitable for the addition of at least four external electrical interlocks normally open or normally closed type. Interlocks shall be field convertible.

H Magnetic motor starters shall have 'Hand-Off-Auto" selector switch on cover unless noted otherwise.

I Magnetic motor starters shall have 'Start-Stop" momentary push buttons on cover or as indicated on the Drawings.

J Magnetic motor starters shall have green "run" and red 'stop' pilot lights on the cover.

K Combination magnetic motor starters shall be manufactured in accordance with NEMA standards, sizes and horsepower ratings.

L Disconnect handle used in combination motor starters shall be in control of the disconnect device with the door opened or closed.

M The disconnect handle shall be clearly marked "ON" or "OFF."

N Combination magnetic motor starters shall be fusible type unless indicated otherwise on the Drawings.

O Starters shall be full voltage or reduced voltage type as indicated on the Drawings.

P Coordinate with trade supplying motor for the proper starter.

Q Provide a numbered terminal strip for connection of external control wiring of each starter.

R Provide a control circuit fuse holder and fuse for all motor starters where a separate control circuit is shown on the Drawings.

S Provide a 120-208124V control transformer with fused secondary in starters unless otherwise shown on the Drawings.

T Provide phase loss protection with adjustable trip points to de-energize starter upon phase loss or imbalance. Set per motor manufacturer's requirements.

EXECUTION

A General:

1 Motor Branch: Provide to each motor with separate circuit, unless otherwise

noted on electrical Drawings.

2 Equipment Wiring: Where connections to miscellaneous equipment are necessary or indicated on the Drawings, wire to equipment and make final connections to controllers. In general, connect to equipment where circuit is shown terminating in switch or circuit breaker.

3 Voltages and Capacities: Verify voltages and capacities shown on electrical drawings with the producer's shop drawing submittals for each item of equipment.

4 Locations: See Drawings for equipment locations. These locations may be changed to conform to equipment and connection conditions encountered in the field.

5 Mounting: Provide a slotted angle or channel bar with required hardware for securing motor starter to the wall for wall mounted units. Combustible materials are not permitted.

B Motor Connections: Make connections with flexible metal conduit, except connections shall be made with liquid tight flexible metal conduit where exposed to oil, grease, water or weather.

C Provide engraved laminated plastic identification plate, mechanically fastened for each starter.

END OF SECTION

SECTION 16150

CONTACTORS

GENERAL

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 Basic Electrical Materials and Methods Sections apply to work of this Section.

C Submittals: Submit the producer's standard descriptive data sheets for each type of product being provided. Mark the data sheet for the product being provided with an identifying mark or arrow.

PRODUCTS

A Acceptable Manufacturers: Allen-Bradley, ABB, Siemens/ITE, Challenger, Westinghouse, General Electric Co., Square D.

B General: See electrical Drawings, panelboard schedules and control diagrams for numbers and types of contactors required. Contactors shall be electrically held, unless indicated otherwise.

C Enclosures: Contactors shall be mounted in NEMA type 1 enclosures.

D Poles: Required by circuit controlled or as indicated on Drawings.

E Ratings: Contactors shall be rated 100 Amperes minimum for inductive and resistive load unless noted.

1. Exception: Lighting contractors- See Section 16930

F Contactors: Shall be rated for operation at voltage indicated on Drawings.

EXECUTION

A Mounting: For contactors outside panelboards, furnish contactors in enclosures and the enclosures shall be mounted on walls to slotted angles or channels with required hardware. Combustible materials for mounting are not permitted.

B Controls: Install as indicated on Drawings.

1 System is free from short circuits and other faults.
2 All equipment operates correctly and as specified.
3 Grounded equipment shall have maximum of 25 OHMS resistance to ground.

C Provide engraved laminated plastic, mechanically fastened for each contactor.

END OF SECTION

SECTION 16155

RELAYS

GENERAL

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 Basic Electrical Materials and Methods Sections apply to work of this Section.

C Submittals: Submit the producer's standard descriptive data sheets for each type of product being provided. Mark the data sheet for the product being provided with an identifying mark or arrow.

PRODUCTS

A Acceptable Manufacturers: Allen-Bradley, General Electric Co. and Square D.

B General: See electrical Drawings, Panelboard Schedules and Control Diagrams for numbers and types of relays required. Relays shall be electrically held, unless indicated otherwise on the Drawings.

C Enclosures: Relays may be mounted in panelboards or in NEMA type 1 enclosures adjacent to or above panelboard.

D Poles: Required by circuit controlled or as indicated on Drawings.

E Ratings: Rated for inductive and resistive load, or as indicated on Drawings.

EXECUTION

A Mounting: For relays outside panelboards, furnish relays in enclosures. The enclosures shall be mounted on walls to slotted angles or channels with required hardware. Combustible materials for mounting are not permitted.

B Controls: Install as indicated on Drawings.

C. Provide engraved laminated plastic identification plate mechanically fastened for each relay.

END OF SECTION

SECTION 16400

SERVICE ENTRANCE, METERING, GROUNDING AND GROUND FAULT PROTECTION

PART 1 - GENERAL

WORK INCLUDED

A. Underground or service entrance as shown on drawings.
B. All equipment and circuits shall be grounded in accordance with the National Electrical Code, Article 250.
C. Provide ground fault protection for all circuits noted on the drawings as GFI or in all receptacles in bathroom, and exterior location
D. Provide ground fault protection an all temporary construction circuits as required by OSHA or the Nation Electrical Code.

WORK INSTALLED BUT FURUNISHED BY OTHERS

A. Some components required for metering of service such as meter bases, current transformers, etc., may be supplied by the utility: coordination with utility will be required.

SYSTEM DESCRIPTION

A. Service Entrance
   1. Provide underground service from new transformer to new distribution panel as shown on drawings.
   2. Coordinate connections and power outages as noted in Section 16100.
   3. Route new feeders through existing current transformer in existing transformer
B. System Ground
   1. All conduits shall contain a continuous "green" ground wore which shall be sized in accordance with Table 250-95 of the National Electrical Code.
   2. The ground conductor shall be bonded to the conduit as the ground conductor.
   3. Provide a driven ground rod as close as possible to the service entrance location, sized as shown on the drawings or in accordance with N.E.C.
   4. Bond ground to nearest cold water supply pipe and to footer or slab steel with same size conductor as required for driven ground.
   5. Provide ground wire #8 Minimum to the telephone board.
C. Mechanical Equipment
   1. All mechanical equipment motors shall have grounded cases.
   2. All equipment shall have a ground wire bonded thru equipment cabinet fame, etc, to the system ground.
D. Ground Fault Protection
   1. Ground fault protection shall be provided for all receptacles labeled GFI or where required by of this section
   2. The designation GFI on the drawings denotes a ground fault protected receptacle.

3. Ground fault protection maybe provided by a ground fault receptacles or ground fault breaker.
4. Standard receptacles shall be considered ground fault protected if in series with an upstream GFI receptacle.

PART 2 - PRODUCTS
PART 3 - EXECUTION

END OF SECTION

SECTION 16420

PANELBOARDS

GENERAL PROVISIONS

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 Basic Electrical Materials and Methods Sections apply to work of this Section.

C Submittals: Submit the producer's standard descriptive data sheets for each type of product being provided. Mark the data sheet for the product being provided with an identifying mark or arrow.

D Depth Coordination: Provide panelboards with depths coordinated with wall thicknesses in locations shown on electrical drawings. Refer to architectural drawings for all dimensions. Include cost of any accommodations for dimensions of proposed panelboards in bid; no adjustments will be made in contract amount for lack of coordination.

PRODUCTS

A Acceptable Producers: General Electric Co., AIBB, Siemens / ITE, Cutler-Hammer,Westinghouse, Challenger, and Square D. Products shall be furnished by one producer.

B General: Panelboards shall be UL listed, bolt-in circuit breaker type, with copper bus and door-in-door covers. See panel schedules on Drawings for electrical characteristics.

C Bus Assembly and Temperature Rise: Panelboard bus structure and main lugs or main breaker shall have current ratings as shown on the panelboard schedule. Ratings shall be established by heat rise tests in accordance with Underwriters Laboratories Standard UL 67. Provide copper bus assembly and copper only lugs for copper conductors. Bus bars shall be copper.

D Circuit Breakers: Circuit breakers shall be full module, bolt-on type, equipped with individually insulated, braced and protected connectors. The front faces of all circuit breakers shall be flush with each other. Large permanent, individual circuit numbers shall be affixed adjacent to each breaker in a uniform position. Trip indication shall be clearly shown by the breaker handle. Provisions for additional breakers shall be such that no additional connectors will be required to add circuit breakers.

E Equipment Short Circuit Rating: Each panelboard, as a complete unit, shall have a short circuit current rating equal to or greater than the equipment rating shown on the panelboard schedule on the Drawings, but under no circumstances less than 10,000 amperes. Panelboard and circuit breakers shall be fully rated for interrupting ratings indicated. Under no circumstances will series rated equipment be acceptable. Every overcurrent device provided shall be UL approved to individually interrupt its rated short circuit current and shall not depend upon operation of another overcurrent device to achieve its rating.

F Grounding Terminals: Provide each panelboard unit with a ground terminal bar and with lugs for equipment ground wires. Ampacity shall be the same as the full capacity of the main bus. Ground bar or lugs shall be copper.

G Neutral Terminals: Provide each panelboard unit with an insulated neutral terminal bar. Ampacity of neutral bar shall be the same as the full capacity of the main bus bars. Neutral bar shall be copper.

H Cabinet: Panelboard assembly shall be enclosed in a galvanized steel cabinet. The rigidity and gauge of steel shall be as specified in UL Standard 50 for cabinets. The size of wiring gutters shall be in accordance with UL Standard 67. Cabinet fronts shall be door-in-door type. Cabinets shall be equipped with latch and tumbler lock on door. Doors over 48" high shall be equipped with three point latch and vault lock. All locks shall be keyed alike. Minimum depth of cabinets shall be *5-3/4"* and minimum width shall be 20. Cabinet shall not have ventilating openings.

I Safety Barriers: The panelboard interior assembly shall be dead front with panelboard front removed. Main lugs or main breakers shall be barriered.

J UL Listing: Panelboards shall be listed by Underwriters Laboratories and shall bear the UL label. When indicated, panelboards shall be suitable for use as service equipment.

K Nameplates: Provide an engraved laminated phenolic identification plate 1 1" high by 3" wide with minimum 1/4" letters indicating the panelboard identification shown on the drawings. Nameplate shall be affixed to the exterior of the panelboard, visible with door closed.

In addition, panelboard shall bear a nameplate showing Manufacturer, Voltage, Ampacity, Type of Panelboard, Manufacturer's Order No. and Date, Interrupting Rating - RMS Sym.

L Ground Fault Protection: Provide ground fault protection as indicated on the Drawings. Ground fault protection provisions shall comply with NEC Article *230-95.*

EXECUTION

A Provide circuit breakers with I.C. Ratings, amperes and number of poles as specified in the schedules on the Drawings.

B Circuit breakers shall be UL listed.

C Mount adjacent panelboards so that they are aligned and do not touch each other.

D Provide a typewritten circuit directory with a protective covering in a frame inside the door. Show load type (REC, LTG. AHU-1, etc.) and room number(s) served for every branch circuit breaker and panelboard served for every feeder circuit breaker.

E Mount panelboards so maximum height of circuit breakers above finished floor does not exceed 78 inches.

F Wiring Gutters: Feeder and Branch circuit conductors are sized for circuit than the allowable ampacities in Table 310-16 of the NEC. Contractor shall provide cabinets with gutters sized to accommodate the conductors and connection actually being installed complying with Article 373-6 and Article 310.4.

END OF SECTION

SECTION 16521

LIGHTING FIXTURES

PART 1 GENERAL

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 Basic Electrical Materials and Methods Sections apply to work of this Section.

C Submittals:

1 Submit in brochure form, catalog sheet or cuts of all lighting fixtures. Mark each sheet to match "type" number as specified in Fixture Schedule on the Drawings. Fabricate no fixtures until approval of submittals and catalog cuts have been made.

2 Fixtures described do not include all stein hangers, frames and other necessary accessories. At each location, provide lighting fixture specified and all accessories necessary for proper installation and operation.

3 Provide lighting fixtures complete with lamps in accordance with the Fixture Schedule on the Drawings.

4 Where shown with dual switching, fluorescent fixtures shall be supplied with dual ballasts.

PRODUCTS

A Acceptable Producers: Ballasts produced by Advance, MagneTek, Osram, or approved equal are acceptable; and lamps may be produced by Phillips, Osram, or Sylvania. See Lighting Fixture Schedule on the Drawings for producers of lighting fixtures.

B Ballasts:

1 Ballasts shall be electronic, high frequency (at least 20 KHz), instant start type, and designed specifically for use with *265mA* T8 lamps.

2 Ballasts shall be UL listed (class P) with a class A sound rating, and they shall be CBM certified by ETh. Ballasts shall be the energy saving type and shall have a minimum starting temperature of $+50^{0}F$. Ballasts shall be serviceable while fixtures are in their normally installed position and shall not be mounted to removable reflectors or wireway covers.

3 Ballasts shall produce less than 20% current Total Harmonic Distortion (THD) and shall operate at a power factor of at least 90%.

4 Ballasts shall be capable of operating two, three, or four T8 lamps.

5 Qualifying manufacturers shall have been manufacturing electronic fluorescent ballasts for a minimum of five years with a satisfactory performance record. Ballasts shall be warranted by the manufacturer for a minimum of three years.

C Automatic Resetting Thermal Protectors: Furnish with each fluorescent ballast to provide protection against damage.

D Fixtures: See Lighting Fixture Schedule in the drawings.

E Fixture Wire: Type SF-i, SF-2, TF, TFF, TFN, TFFN or other approved wire.

F Gasket: Provide gaskets on all lenses to prevent light leaks. Provide gaskets on all fixtures located in damp and wet locations.

G Plaster Frames: Furnish with all fixtures installed in stucco or plaster surfaces.

H Plastic Accessories: Use 100% clear virgin methyl methacrylate. Lenses shall be male conical prismatic type, minimum .125 inch.

I Lamps: Fluorescent lamps shall be 4-foot, 32 watt, 265mA, T-8 Octron with 4100K color temperature and minimum Color Rendering Index (CR1) of *75,* unless otherwise noted in the Fixture Schedule on the Drawings. Lamps shall be Phillips, Sylvania, Osram, or approved equal. Lamps shall have a rated life of 15,000 hours with instant start ballast

J Lamp Sockets:

1 Fluorescent: Lampholder contacts shall be the biting edge type or phosphorous-bronze with silver flash contact surface type. Lampholders for bi-pin lamps shall be of the telescoping compression type, or the single slot entry type requiring a one-quarter turn of the lamp after insertion.

EXECUTION

A Where a fixture type is not designated on Electrical Drawings, install the fixture type used in a similar location.

B Locate fixtures to suit architectural detail of area involved. Where located in acoustic ceilings, coordinate placement with architectural reflected ceiling plan.

C Fixture Schedule on the Drawings shows type of fixture required. Determine modifications to make fixtures suitable for the ceilings in which they are installed and furnish fixtures adapted to ceiling.

1 Verify the types of ceiling construction before ordering fixture fabrication. Determine that suspension methods and flange arrangements for fixtures coordinate with ceiling types and their suspension systems.

D Determine exact inscription for exit signs.

E Interferences: In areas where industrial type fixtures are to be installed, such as equipment rooms, fixtures which are near obstructions such as ducts, large pipes, groups of pipes, etc., are to be suspended so that bottom of the fixture is not higher than bottom of duct, etc. Do not locate outlets until locations of these obstructions are determined. Install conduits and outlets exposed to insure accessibility.

F Protect all fixtures and lamps and replace broken parts including those for temporary lighting system.

G Clean all lenses and louvers after all other trades have completed their work in each area; or do not install lenses and louvers before that time.

END OF SECTION

SECTION 16551

LAMPS

PART 1 - GENERAL

WORK INCLUDED

A. Lamps shall be provided in all fixtures shown on the Drawings or listed in the Specifications

SYSTEM DESCRIPTION

A. The lamp size, voltage, and type is shown on the fixture schedule for each fixture to be installed.

SHOP DRAWINGS AND PRODUCTS DATA

A. Provide shop drawings and product data for each type of fluorescent and H.I.D. lamp shown on the Drawings.
   1. Submittals shall include photometric data.

PART 2 - PRODUCTS

ACCEPTABLE MANUFACTURERS

A. General Electric
B. Sylvania
C. Westinghouse

MATERIALS

A. Incandescent standard
   1. Medium base
   2. A-19 or A-21 configuration
   3. Watts as noted
B. Incandescent floods and spots
   1. Medium base
   2. R type or PAR type depending on wattage.
   3. Flood type to be supplied unless noted as spot.
C. Fluorescent lamps
   1. Medium bi-pin
   2. Deluxe cool white
   3. 20 watt
      a. Starter required
      b. Initial lumens - 875
      c. Length - 24 inch
      d. Lamp No. F20T8/41K

4. 40 watt
    a. Rapid start (no starter required)
    b. Initial lumens - 3025
    c. Length - 48 inch.
    d. Lamp No. F40T8/41K
5. 80 watt
    a. Single pin
    b. Instant start
    c. Slim line
    d. Length - 96 inch
    e. Initial lumens - 4200
    f. Lamp No. F96T8CW

D. Metal Halide
1. 175 watt
    a. Mogul base
    b. Phosphor coated, horizontal burn
    c. Initial lumens - 15000
    d. Model Sylvania "Super-Metalarc" MS175/C/HOR.
2. 250 watt
    a. Mogul base
    b. Phosphor coated
    c. Base up to horizontal
    d. Initial lumens - 20500
    e. Model Sylvania "Metalarc" M250/C-BU-HOR
3. 400 watt
    a. Mogul base
    b. Phosphor coated
    c. Initial lumens - 40,000
    d. Model - Horizontal only - Sylvania MS400/C/HOR
       Base-Up Vertical - Sylvania MS400/C/BU

E. High pressure sodium
1. Clear high pressure lamps
2. Suitable for all operating positions
3. Lamp wattage / initial lumens
    a. 50/3300
    b. 70/5800
    c. 100/9500
    d. 150/16000
    e. 200/27500
    f. 250/27500
    g. 400/50000
    h. 1000/140000

END OF SECTION

SECTION 16580

STANDBY ELECTRIC GENERATING SYSTEM

PART 1 - GENERAL

SYSTEM DESCRIPTION

A. Install an owner furnished complete emergency power system including a spark ignited natural gas driven generator set, 120/208 volt, 3 phase, 60 cycle
B. BASIS OF DESIGN
   1. CUMMINS POWER 75 GGHF
   2. Rating – 70 KW, 94 KVA, Standby
C. Unit is supplied with a quiet site sound attenuated steel enclosure.
   1. Rated for 150 mph wind speed rating.
D. Contractor shall be responsible for off-loading from delivery truck, setting on pad, all power wiring, control wiring, fuel piping and connections to all utilities.

RELATED WORK

A. AUTOMATIC TRANSFER SWITCH – SECTION 16582

PART 2 - PRODUCTS

BRUSHLESS ALTERNATOR

A. Alternator Design
   1. Revolving field, 4 pole, brushless alternator.
   2. Twelve leads brought out on 3 phase alternators for field connection to obtain required voltage
   3. Dynamically balanced.
   4. Flexible disc coupling to engine.
B. Exciter
   1. Exciter shall be 3 phase full wave rectified with silicon diodes.
C. Voltage Regulator
   1. Solid state voltage regulator with phase controlled sensing circuit.
D. Voltage Waveform
   1. Deviation less than 0.06 line to line and 0.06 line to neutral per NEMA MG-1-22.42.
E. Cooling
   1. Direct drive centrifugal blower cooling
F. Temperature Rise
   1. Within the limits of Class F insulation at rated load and power factor as defined by NEMA MG1-22.40

G. Insulation
   1. NEMA Class F as defined by NEMA MG1-1.65

ENGINE

A. Design shall be four-cycle, ten (10) cylinder engine, naturally aspirated, natural gas Fired, spark ignited engine.
   1. Displacement 412.5 cu. in.
   2. Electronic governing for precise speed regulation.

B. Battery Charging
   1. Direct drive 12 volt, 65 amp alternator

C. Cooling System
   1. Radiator cooled with prelubricated cooling pump and high cooling temperature shut down.

D. Fuel
   1. Natural gas

E. Starting System
   1. Remote 12 volt, 2 wire, negative ground, starting system with positive shift, gear engaging starter and cranking limiter.

F. Valves
   1. Overhead intake and exhaust valves with replaceable seats.

H. Muffler
   1. Residential silencing muffler with flexible exhaust connections if shown on drawings.

K. Battery
   1. 12-volt dry-battery (725 cold cranking amps) with rack.

ELECTRONIC CONTROL AND MONITORING SYSTEM

A. Alternator
   1. Protection
      a. Overcurrent and short circuit shutdown
      b. Overcurrent warning
      c. Single and 3 phase fault protection
      d. Over and under voltage shutdown
      e. Over and under frequency shutdown
      f. Overload warning with alarm contact
      g. Reverse power and reverse VAR shutdown
      h. Excitation fault
   2. Data
      a. Line to line and line to neutral AC volts
      b. Frequency
      c. Total and individual phase KW and KVA

3. Governing
    a. Integrated digital electronic isochronous governor
    b. Temperature dynamic governing
    c. smart idle speed mode
4. Voltage Regulation
    a. Integrated digital electronic voltage regulator
    b. 3 phase line to neutral sensing
    c. Single and three phase fault regulation
    d. Configurable torque matching

B. Engine
1. Protection
    a. Overspeed shutdown
    b. Low oil pressure warning and shutdown
    c. High coolant temperature warning
    d. Low coolant level warning or shutdown
    e. High oil temperature warning
    f. Low coolant level warning and shutdown
    g. Low coolant temperature warning
    h. High and low battery voltage warning
    i. Weak battery warning
    j. Dead battery shutdown
    k. Fail to start (overcrank) shutdown
    l. Fail to crank shutdown
    m. Redundant start disconnect
    n. Cranking lockout
    o. Sensor failure indication
2. Data
    a. DC voltage
    b. Lube oil pressure
    c. Coolant temperature
    d. Lube oil temperature

C. Operator interface
1. OFF/MANUAL/AUTO switch mode.
2. Manual RUN/STOP switch
3. Panel lamp test switch
4. Emergency stop switch
5. Alpha numeric display with pushbutton access, for viewing engine And alternator data and providing setup, controls and adjustments
6. Indicator lamps indicating genset running, not in auto, common warning Common shutdown.

D. Model number
   1. Control panel shall be a Cummins Power "Power Command" Control with Amp Sentry Protection
   2. NEMA 3R enclosure unless noted otherwise

END OF SECTION

SECTION 16582

AUTOMATIC TRANSFER SWITCHES

PART 1 GENERAL

SYSTEM DESCRIPTION

A. Contractor shall be responsible for receiving, storing and completely installing an owner furnished automatic transfer switches (ATS) with number of poles, amperage, voltage, and withstand current ratings as shown on the plans. Each automatic transfer shall consist of an inherently double throw power transfer switch unit and a microprocessor controller, interconnected to provide complete automatic operation. All transfer switches and control panels shall be the product of the same manufacturer.

B. Furnish an enclosure for the ATS that is for service entry. It shall provide all of the proper disconnecting, protection, grounding and bonding required for service entrance equipment.

Acceptable Manufacturers

Service Entrance Automatic transfer switches shall be equal to a Cummins OTEC. No alternates will be accepted.

Codes and Standards

The automatic transfer switches and accessories shall conform to the requirements of:

A. UL 1008 - Standard for Automatic Transfer Switches

B. NFPA 70 - National Electrical Code

C. NFPA 110 - Emergency and Standby Power Systems

D. IEEE Standard 446 - IEEE Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications

E. NEMA Standard ICS10-1993 (formerly ICS2-447) - AC Automatic Transfer Switches

F. NEC Articles 700, 701, 702

G. International Standards Organization ISO 9001

H. UL 891 According to this UL standard the equipment shall be labeled: "Suitable for use only as service equipment."

I. UL 508 Industrial Control Equipment

PART 2 PRODUCTS

Mechanically Held Transfer Switch

A. The transfer switch unit shall be electrically operated and mechanically held. The electrical operator shall be a single-solenoid mechanism, momentarily energized. Main \ operators which include overcurrent disconnect devices will not be accepted. The switch shall be mechanically interlocked to ensure only one of two possible positions, normal or emergency.

B. The switch shall be positively locked and unaffected by momentary outages so that contact pressure is maintained at a constant value and temperature rise at the contacts is minimized for maximum reliability and operating life.

C. All main contacts shall be silver composition. Switches rated 600 amperes and above shall have segmented, blow-on construction for high withstand current capability and be protected by separate arcing contacts.

D. Inspection of all contacts shall be possible from the front of the switch without disassembly of operating linkages and without disconnection of power conductors. A manual operating handle shall be provided for maintenance purposes. The handle shall permit the operator to manually stop the contacts at any point throughout their entire travel to inspect and service the contacts when required.

E. Designs utilizing components of molded-case circuit breakers, contactors, or parts thereof which are not intended for continuous duty, repetitive switching or transfer between two active power sources are not acceptable.

F. Where neutral conductors must be switched, the ATS shall be provided with fully-rated neutral transfer contacts.

G. Where neutral conductors are to be solidly connected, a neutral terminal plate with fully-rated AL-CU pressure connectors shall be provided.

Microprocessor Controller with Membrane Interface Panel

A. The controller shall direct the operation of the transfer switch. The controller's sensing and logic shall be controlled by a built-in microprocessor for maximum reliability, minimum maintenance, and inherent serial communications capability. The controller shall be connected to the transfer switch by an interconnecting wiring harness. The harness shall include a keyed disconnect plug to enable the controller to be disconnected from the transfer switch for routine maintenance.

B. The controller shall be enclosed with a protective cover and be mounted separate from the transfer switch unit for safety and ease of maintenance. Sensing and control logic shall be provided on printed circuit boards. Interfacing relays shall be industrial grade plug-in type with dust covers.

C. The controller shall meet or exceed the requirements for Electromagnetic Compatibility (EMC) as follows:

1. ANSI C37.90A/IEEE 472 Voltage Surge Test
2. NEMA ICS – 109.21 Impulse Withstand Test
3. IEC801-2 Electrostatic discharge (ESD) immunity
4. ENV50140 and IEC 801 – 3 Radiated electromagnetic field immunity
5. IEC 801 – 4 Electrical fast transient (EFT) immunity
6. ENV50142 Surge transient immunity
7. ENV50141: Conducted radio-frequency field immunity
8. EN55011: Group 1, Class A conducted and radiated emissions
9. EN61000 –4 – 11 Voltage dips and interruptions immunity

Enclosure

A. The ATS shall be furnished in a NEMA type 1 enclosure unless otherwise shown on the plans.

B. Provide strip heater with thermostat for Type 3R enclosure requirements.

C. Controller shall be flush-mounted display with LED indicators for switch position and source availability. It shall also include test and time delay bypass switches.

D. The complete assembly shall be degreased, and thoroughly cleaned through a five-stage aqueous process. The finish shall be ANSI-61, light gray, electrostatically-charged polyester powder paint over a phosphate coating, at a minimum of 2.0 mils in density. Finish shall be suitable for indoor and outdoor environments.

E. For those automatic transfer switches that are less than 1000 amperes, the connection between the normal disconnecting device and the ATS shall be made with the appropriate size cable. For those automatic transfer switches that are greater than 1000 amperes, the connection between the normal disconnecting device and the ATS shall be made with the appropriate size bus. Bus shall be silver plated copper rated no less than 1000 amps per square inch.

F. A pressure disconnect link shall be provided to disconnect the normal source neutral connection from the emergency and load neutral connections for 4-wire applications. A ground bus shall be provided for connection of the grounding conductor to the grounding electrode. A pressure disconnect link for the neutral to ground bonding jumper shall be provided to connect the normal neutral connection to the ground bus.

G. Control wiring shall be rated for 600 volt, UL 1015. Wires shall be placed in wire duct or harnessed, and shall be supported to prevent sagging or breakage from weight or vibration. All wiring to hinged doors shall be run through door terminal blocks or connection plugs.

Disconnecting and Overcurrent Protection Device

A. For those automatic transfer switches less than 1000 amperes, the normal connection shall be provided with a thermal magnetic rated molded case circuit breaker with current ratings as shown on the plans. It shall have a thermal magnetic trip unit.

B. For those automatic transfer switches rated above 1000 amperes, the normal connection shall be provided with a stationary mount, insulated case circuit breaker with a solid-state trip unit. The trip unit shall have an adjustable long time, short time, instantaneous, and ground fault trip settings. The insulated case circuit breaker shall trip open when the ground fault setting is exceeded.

PART 3 OPERATION

Voltage and Frequency Sensing

A. The voltage of each phase of the normal source shall be monitored, with pickup adjustable to 95% of nominal and dropout adjustable from 70% to 90% of pickup setting.

B. Single-phase voltage and frequency sensing of the emergency source shall be provided.

Time Delays

A. An adjustable time delay shall be provided to override momentary normal source outages and delay all transfer and engine starting signals.

B. An adjustable time delay shall be provided on transfer to emergency, adjustable from 0 to 5 minutes for controlled timing of transfer of loads to emergency.

C. An adjustable time delay shall be provided on retransfer to normal, adjustable to 30 minutes. Time delay shall be automatically bypassed if emergency source fails and normal source is acceptable.

D. A 5-minute cooldown time delay shall be provided on shutdown of engine generator.

E. All adjustable time delays shall be field adjustable without the use of tools.

Additional Features

A. A set of gold-flashed contacts rated 10 amps, 32 VDC shall be provided for a low-voltage engine start signal. The start signal shall prevent dry cranking of the engine by requiring the generator set to reach proper output, and run for the duration of the cool down setting, regardless of whether the normal source restores before the load is transferred.

B. A push-button type test switch shall be provided to simulate a normal source failure.

C. A push-button type switch to bypass the time delay on transfer to emergency, the engine exerciser period on the retransfer to normal time delay whichever delay is active at the time the push-button is activated.

D. Auxiliary contacts, rated 10 amps, 250 VAC shall be provided consisting of one contact, closed when the ATS is connected to the normal source and one contact, closed, when the ATS is connected to the emergency source.

E. Indicating lights shall be provided, one to indicate when the ATS is connected to the normal source (green) and one to indicate when the ATS is connected to the emergency source (red). Also provide indicating lights for both normal and emergency source availability.

F. Terminals shall be provided to indicate actual availability of the normal and emergency sources, as determined by the voltage sensing pickup and dropout settings for each source.

G. Engine Exerciser - An engine generator exercising timer shall be provided, including a selector switch to select exercise with or without load transfer.

H. Inphase Monitor - An Inphase monitor shall be inherently built into the controls. The monitor shall control transfer so that motor load inrush currents do not exceed normal starting currents, and shall not require external control of power sources. The inphase monitor shall be specifically designed for and be the product of the ATS manufacturer.

I. Selective Load Disconnect - A double throw contact shall be provided to operate after a time delay, adjustable to 20 seconds prior to transfer and reset 0 to 20 seconds after transfer. This contact can be used to selectively disconnect specific load(s) when the transfer switch is transferred. Output contacts shall be rated 6 amps at 28 VDC or 120 VAC.

PART 4 ADDITIONAL REQUIREMENTS

Withstand and Closing Ratings

A. The ATS shall be rated to close on and withstand the available rms symmetrical short circuit current at the ATS terminals with the type of overcurrent protection shown on the plans. WCR ATS ratings as be as follows when used with specific circuit breakers:

ATS Size	Withstand & Closing Rating MCCB	W/CLF
150 – 200	22,000A	200,000
225 – 400	42,000A	200,000
600 – 1200	65,000A	200,000
1600 – 2000	85,000A	200,000
2600 – 3000	100,000A	200,000

Tests and Certification

A. The complete ATS shall be factory tested to ensure proper operation of the individual components and correct overall sequence of operation and to ensure that the operating transfer time, voltage, frequency and time delay settings are in compliance with the specification requirements.

B. Upon request, the manufacturer shall provide a notarized letter certifying compliance with all of the requirements of this specification including compliance with the above codes and standards, and withstand and closing ratings. The certification shall identify, by serial number(s), the equipment involved. No exceptions to the specifications, other than those stipulated at the time of the submittal, shall be included in the certification.

C. The ATS manufacturer shall be certified to ISO 9001 International Quality Standard and the manufacturer shall have third party certification verifying quality assurance in design/development, production, installation and servicing in accordance with ISO 9001.

Service Representation

A. The ATS manufacturer shall maintain a national service organization of company-employed personnel located throughout the contiguous United States. The service center's personnel must be factory trained and must be on call 24 hours a day, 365 days a year.

B. The manufacturer shall maintain records of each switch, by serial number, for a minimum of 20 years.

C. For ease of maintenance and parts replacement, the switch nameplate shall include drawing numbers, part numbers for main coil and control.

SECTION 16601

TELEPHONE/DATA/CATV SYSTEMS

PART 1 - GENERAL

WORK INCLUDED

A. Telephone
   1. Provide a completely wired system for Telephone /Data / CATV including boxes and wiring as shown on drawings.
   2. Conduit and outlets shall be as shown on the drawings and the telephone riser. Conduit is only used from box to stub-out above the ceiling.
   3. Consult the local utility representative for any special requirements prior to starting the work.
   4. Provide a Telephone / Data /CATV enclosure with 120V receptacle and #6 ground with ground bar on plywood mounted inside cabinet. Provide components as listed below.
   5. Install new 25 pair PE89 cable from Utility connection to the Telephone / Data / Cable TV combination box.
      a. Terminate the cable in lighting protection.
   6. Provide raceways from Telephone Board to property line as shown on Electrical Site Plan.

SHOP DRAWINGS AND PRODUCTS DATA

A. Provide shop drawings and product data in accordance with the General Conditions for all devices to be furnished.

GENERAL

A. Data Outlets and Cables
   1. Data outlets shall be Panduit CJ588EI, CAT 5E Modules.
   2.. Data cables shall be CAT 5E.
   3. Provide four (4) CAT 5E cables from each Telephone/Data Location to the Telephone / Data / CATV Terminal Board in Data./Comm Room as shown on drawings.
   4. At each Data/Comm outlet furnish and install (2) CAT 5E modules Panduit CJ588EI. Provide (2) blank modules, Panduit CMBE1-X, one cover plate Panduit CFPE4EIY and one in wall box adapter Panduit MIWBAE1.

B. Conduit
   1. Provide conduit from each data outlet to stub above the ceiling.
   2. Provide conduit for each CATV stubbed above ceiling.
   3. Provide a 4" X 4" X 2 1/8" wall box with double gang plaster ring for each Data/Telepone and each CATV outlet.

C. TV CABLE

1. Provide video grade coaxial cable from splitter to each TV outlet shown on the drawings.
2. Provide a cover plate with coaxial connector at each location.
3. Connect cable to cover and connector at each TV outlet.
4. Connect each TV outlet to splitter in combination Telephone/Data/CATV cabinet.
5. Label each end of the cable for future identification.

PART 2 PRODUCTS

TELEPHONE / DATA / CATV BOARD

A. Provide two 4' X 8' X 3/4" plywood sheets for Telephone/Data Backboard, painted Gloss Gray with fire retardant paint.
   1. Mount quad receptacle and extend #6 ground to board.

B. CATV Splitters
   1. Provide a passive CATV Splitter with one input and four outputs for coaxial cable.

END OF SECTION

SECTION 16603

CARBON MONOXIDE MONITORING SYSTEM

PART 1 – GENERAL

WORK INCLUDED

A. CARBON MONOXIDE TRANSDUCERS

1. Provide wall mounted carbon monoxide transducers as shown on the drawings.
2. Monitors shall be mounted no higher than 60" aff. OR in accordance with Manufacturers recommendations if different.
3. Each monitor shall be mounted on a 4" X 4" X 2 1/8" wall box and a single gang plaster ring.
4. Sensors shall be solid state type using metal oxide semi-conductor type to measure the concentration of CO as it builds up on the sensing element.
5. Unit shall be supervised and have a test cycle of 2.5 minutes.
6. Unit shall have continuous internal supervision and shall upon sensing a malfunction go to maximum level.
7 Units shall be equal to a Mancurco Model CS102A

B. CARBON MONOXIDE MONITOR CONTROL PANEL

1. Provide wall mounted carbon monoxide monitoring control panel as shown on the drawings.
2. Control panel shall monitor all transducers and upon alarm provide output control relays to start exhaust fans
3. Control panel shall control two (2) exhaust fans and be equal to a Mancurco model SS103-3A. Macurco mfgr. - www.mancurco.com

C. CABLE

1. Provide wiring from each transducer to each additional transducer and then to control panel..
2. Provide a wiring from control panel to the motor starters for the exhaust fan(s) as noted on the drawings.

.

D. POWER AND GROUNDING

1. Provide a 120V outlet and #6 ground for the control/monitoring panel.

END OF SECTION

SECTION 16610

SURGE SUPPRESSION

GENERAL PROVISIONS

PART 1 GENERAL

WORK INCLUDED

A. The work required under this division shall include all materials, labor and auxiliaries required to furnish and install complete surge suppression for the protection of building electrical and electronic systems from the effects of line induced transient voltage surge and lighting discharge as indicated on drawings or specified in the section.

B. Related work specified elsewhere:
   1. Section 16010 - Electrical general provisions.
   2. Section 16050 - Electrical basic materials and methods.
   3. Section 16450 - Electrical systems grounding.

QUALITY ASSURANCE

A. All surge suppressions devices shall be manufactured by a company normally engaged in the design, development, and manufacture of such devices for electrical and electronics systems equipment. The said firm shall offer a five - year (5) Warranty.

B. The surge suppression manufacturer shall offer technical assistance through support by a factory representative and local stocking distributor.

C. Submittals: Surge suppression submittal shall include:
   1. Manufacturer's performance data on each suppressor type.
   2. Dimensioned drawing of each suppressor type.

D. To establish the type and operating characteristics of the surge suppression devices, equipment manufactured by Leviton Manufacturing Company is used as a guide in determining the functions of the surge suppression system. Other equipment will be considered for approval provided the following is submitted in writing to the engineer prior to bid date.
   1. Manufacturer qualifications (As listed above; Para. 1.02-A).
   2. Complete submittals (As listed above; Para. 102-C).

E. Equipment certification: Items shall be listed by underwriters' laboratories, shall bear the UL seal and be marked in accordance with referenced standard.

F. Surge suppressions devices shall be installed and located in accordance with requirements of all applicable National Fire Protection Association (NFPA) codes.

WARRANTY

A. All surge suppression devices shall be warranted to be free from defects in materials and workmanship under normal use in accordance with the instructions provided for a period of five (5) years.

B. Any suppressor which shows evidence of failure or incorrect operation during the warranty period shall be repaired or replaced by the manufacturer and installer.

CODES AND STANDARDS

A. The following standards and publications are referenced in various parts of this specification and shall apply.

1. UL 1449-1987 - Standard for safety, transient voltage surge suppressors.
2. UL 1363-1986 - Standard for temporary power taps.
3. ANSI/IEEE C62.41-1991 (IEEE 587) - Guide for surge voltages in low-voltage AC power circuits.
4. ANSI/IEEE C62.45-1982 - Standard test specifications for various surge protection devices.
5. ANSI/IEEE C62.45-1987 - IEEE guide for surge testing for equipment connected to low-voltage AC power circuits.
6. NEMA LSI - 1992 - Surge protective devices (SPDs).
    a. Panel M
    b. Panel L
    c. Panel 'KB'
    d. Panel 'KP'
    e. Panel 'KC'

REQUIRED SUPPRESSORS

A. Provide surge suppression for the equipment described herein:
1. On main electrical service entrance panels as noted on drawings.
2. On distribution and branch circuit panels as required as noted on drawings.
3. On 120 volt power connections for fire alarm control panel, intercom, television and sound equipment, telephone power supplies and other dedicated circuits as identified in the project drawings. Use plug-in units.
4. At point of use locations (receptacles, plug-in units) as required.

PART 2 - PRODUCTS

A. The surge suppressor manufacturer shall offer a complete line of surge suppression products to support the requirements for main service

entrance panels, secondary and or branch panels, transfer switches, fire alarm panels, and point of use locations, etc., as described in above.

B. Suppressors shall be designed for the specific type and voltage of electrical service and shall provide clamping action for both normal (L-N) and common (L-N-G) mode protection.

C. Suppressors shall be a hybrid design, and include circuit with tight, wave-tracking clamping characteristics.

D. Suppressors shall be designed to withstand a maximum continuous operating voltage of not less than 115% of normal RMS line voltage.

E. Suppressors shall contain internal safety fusing, when required, to disconnect the suppressor from the electrical source if the suppressor fails, in order to prevent catastrophic failure modes.

F. Suppressors shall be fail-safe, shall allow no follow-thru current, shall have repeated surge capability, shall be solid state, shall be self-restoring, and shall be automatic.

G. Suppressors shall contain a visual indication at the suppressor to verify that either he suppressor has failed or that the suppressor is in operational and functional.

H. Suppressors shall be UL 1449 listed and shall be approved for the location in which they are installed.

I. Suppressors shall have an operating temperature range of -40 degrees C to +85 degrees C.

SUPPRESSOR CRITERIA

A. Suppressors shall meet or exceed the following criteria:

1. Service entrance:
   Leviton Manufacturing 32000 series or approved equal.
   a. 120/208 volt, 3 phase 4 wire, WYE
   b. Leviton model 32120-DY3
   c. Surge capacity of 75,000 amps
   d. Suppressors shall be tested as per IEEE C62.41-1991 to determine clamping voltages using category C3 test criteria.
2. Suppressors shall be sequential surge tested as per IEEE C62.45 - 1987, and shall withstand 1000 test cycles at 10KA, CAT. C3 test criteria.

B. Distribution secondary and/or subpanels: Leviton Manufacturing 42000 series or approved equal.

1. 120/208 volt, 3phase 4 wire, WYE
   a. Leviton model 42120-DY3
   b. Surge capacity of 50,000 amps
   c. Suppressors shall be tested as per IEEEC62.41-1991 to determine clamping voltage using Cat. B3 test criteria.

C. The UL 1449 suppression rating for any mode shall not exceed:

VOLTAGE	PHASE	MAXIMUN SUPPRESSION RATING
120	1	600V
120/208	3	600V
240	3	1200V
277/480	3	1200V

D. Dedicated 120 volt, 20 amp power connection to circuits as per paragraph reference on Codes and Standards Leviton Manufacturing model 51020-WM. Provide hardwire or receptacle type device to match equipment when required.

ACCEPTABLE MANUFACTURERS

A. Leviton

PART 3 - EXECUTION

INSTALLATION OF SUPPRESSORS

A. Suppressors shall be installed as close as practical to the electric panel or electronic equipment to be protected, constant with available space. Suppressors shall be close nipple to the device being protected in a position near the neutral bus which will minimize lead length between suppressor leads shall not extend beyond the suppressor manufacturer's recommended maximum lead without specific approval of the engineer.

B. Suppressors shall be installed in a neat, workmanlike manner that allows simple replacement. Lead dress shall be as short and as straight as possible and be in consistent with recommended industry practices for the system on which these devices are installed.

C. Supplementary grounding and bonding connections required between the bonding bus or ground plane for each equipment cluster and other locations as indicated herein shall be accomplished using #6 AWG core copper conductor and approved connections unless otherwise noted. Referenced to a common earth ground.

D. Suppressors shall be installed with a means of disconnecting the suppressor at the panel. At the main service entrance location, provide a dedicated 30 amp, 3P-cb, 100,000 A.I.C. for the TVSS device. At distribution secondary and/or sub panels location, provide dedicated 30 amp, 3P-CB, for the TVSS device. Label disconnect or CB "surge protector". Fused disconnects may be substituted for the CB, with the approval of the engineer.

END OF SECTION

SECTION 16720

FIRE DETECTION AND ALARM SYSTEMS

GENERAL

WORK INCLUDED

A. Includes But Not Limited To:
   1. Furnish and install alarm and detection system as described in Contract Documents.
   2. Furnish and install raceway, cable and conductors, boxes, and miscellaneous items necessary for complete system.

B. Related Sections:
   1. Section 16100 Basic Materials and Methods.

SYSTEM DESCRIPTION

A. Automatic fire alarm system consisting of control panel, power supplies, alarm initiating devices, notification appliances, and off-site communicating devices. System shall be non-coded, zoned or addressable, and monitored for integrity of conductors.

B. Class B (Style B) initiating device circuits and Class A (Style Z) notification appliance circuits including end-of-line devices.

C. Performance Requirements:

   1. Operation of manual station or automatic activation of any smoke detector, heat detector, or sprinkler flow device shall:
      a. Cause system notification appliances to operate. Indicate zone in alarm on control panel.
      b. Initiate off-site alarm notification system.
      c. Indicate zone or device in alarm on remote annunciator (future requirement).
      d. Initiate HVAC shutdown.

   2. Alarm may be silenced by switch in control panel.
      a. When alarms are silenced, zone indicating red LEDs on control panel and remote annunciator shall remain indicated until operated device is returned to normal and control panel is manually reset.

   3. Green pilot LED, or other visual annunciation, shall normally be on indicating that system is receiving normal power. In addition, failure of normal power be annunciated.

4. Trouble alarm and annunciation, operating together, shall signal trouble condition.
    a. Following conditions shall signal trouble condition:
        (1) Failure of normal power.
        (2) Opens or short circuits on indicating circuits.
        (3) Disarrangements in system wiring.
        (4) Control panel circuit board removal.
        (5) Ground faults.

5. Trouble silencing switch shall silence trouble alarm, but visual annunciation shall remain on until system is restored to normal. As ring-back feature, trouble alarm shall resound as reminder to return silencing switch to normal position.

6. Supervisory LED, separate from trouble LED, and alarm, operating together, shall signal operation of supervisory device, such as control valve tamper, low air pressure, and low temperature switches. Alarm silence switch shall operate in same manner as trouble alarm.

SUBMITTALS

A. Shop Drawings:
    1, Prepared by authorized factory representative and including:
        a. Single line diagram of actual system. Typical riser diagrams are not acceptable
        b. Complete wiring diagrams.
    2. Manufacturer's original catalog data and descriptive information on each piece of equipment to be used.

B. Quality Assurance / Control: Certificate of completion, from Manufacturer's Representative, in accordance with NFPA 72 requirements.

C. Closeout:
    1. Operations And Maintenance Manual Data:
        a. Provide operating and maintenance instructions for each item of equipment submitted under Product Data. Provide instruction manual from Manufacturer that explains what is to be done in event of various indications.
        b. Include copy of approved shop drawings.

QUALITY ASSURANCE

A. Regulatory Requirements:
    1. System shall meet approval of authority having jurisdiction (AHJ). NEC and local ordinances and regulations shall govern unless more stringent requirements are specified.
B. Equipment, devices, and cable shall be UL or Factory Mutual listed for use in fire alarm systems.

OWNER'S INSTRUCTIONS

A. Instruct Owner's representative in proper operation and maintenance procedures.

PART 2 PRODUCTS

COMPONENTS

A. Equipment and accessories furnished under this Specification shall be standard products of single manufacturer, or include written statement by Control Panel Manufacturer confirming compatibility of components and inclusion of these components under system warranty.

B. Control Panel:
   1. Listed under UL Standard 864.
   2. Solid-state modular design with flush or semi-flush mounting.
   3. Control functions shall be behind locked door with annunciating devices visible through door. Single key shall operate all keyed functions in system. Provide three keys.
   4. Each zone shall be electrically supervised in accordance with wiring style specified.
   5. Provide integral surge protection.
   6. Make provisions for connection to off-site alarm notification system. Provide separate dry contacts for alarm and supervisory/trouble alarms.
   7. Power Supply:
      a. Provide indication of normal power supply.
      b. Loss of normal power shall activate trouble alarm.
      c. Meet requirements of and size in accordance with UL Standard 1481 and NFPA 72.
      d. Include standby batteries, charger, and automatic transfer equipment.
   8. Visual Annunciation:
      a. Separate indication on each zone for alarm, trouble, or supervisory conditions.
      b. Visual indication shall be by LED lights or other easily identifiable method.
      c. On zoned system, permanently custom label zones by zone name, not number.
      c. Fault or trouble condition on any zone shall not affect any other zone.
   9. Audible Horn Alarm Annunciation:
      a. Provide separate and distinct alarm signals for alarm and trouble conditions.
      b. Alarm signal shall also operate strobe lights, if specified.
      c. Provide alarm silence switches at control panel.
      d. Trouble alarm shall be horn integral to control panel.
   10. Supervisory alarm may be same audible alarm as trouble alarm, but with separate visual annunciation.

   12. Off-Site Alarm Notification System
      a. Provide two telephone lines from telephone terminal board to fire alarm control panel. Owner will arrange for monitoring connection contract.

C. Alarm Initiating Devices:

1. Smoke Detectors (including Duct Smoke Detectors):
   a. Photoelectric type.
   b. Listed under UL Standard 268.
   c. Provide visual indication of alarm on unit when normally pulsed supervisory LED glows continuously.
   d. Sampling tube for duct detectors shall extend across entire width of duct.
2. Heat Detectors:
   Non-settable 200 deg F fixed temperature.
   Provide visible indication that device has operated.
   Listed under UL Standard 521.
3. Manual Fire Alarm Boxes:
   a. Non-coded and double-action requiring two actions to initiate alarm. Breakable glass type is not approved.
   b. Box shall mechanically latch when actuated and require key to reset. Key shal match control panel door lock.
   c. Provide STI lexan covers.

D. Notification Appliances:
1. Combination Horn / Strobe:
   a. Wall mounted flush or semi-flush.
   b. Non-coded audible output of 90 dB minimum at 10 feet.
   c. Integrally mounted flashing light unit with block letters 'FIRE.' Minimum light intensity of 15/75 candela and flash rate between one and three Hertz.
   d. Listed under UL Standards 464 and 1971.

2. Strobe Only:
   a. Wall mounted flush or semi-flush.
   b. Integrally mounted flashing light unit with block letters 'FIRE.' Minimum light intensity of 15/75 candela and flash rate between one and three Hertz.
   c. Listed under UL Standard 1971.
   d. Color: White

E. Accessory Devices:
1. Notification Appliance Protective Devices: Provide wire guard covers for appliances installed in Apparatus Bay.
2. HVAC shut-down relays.
3. Remote indicator light for each duct detector.

ACCEPTABLE MANUFACTURERS

A. Contact Information:
1. Bosch Security Systems, Fairport, NY (800) 538-5807. www.radionicsinc.com
2. Cerebrus Pyrotronics, Florham Park, NJ (973) 593-2600. www.cerbpyro.com
3. Digital Monitoring Products, Springfield, MO (800) 641-4282. www.dmp.com
4. Edwards Systems Technology, Sarasota, FL (800) 226-2333 or (941) 793-4200. www.est.net
5. Faraday Inc, Tecumseh, MI (517) 423-2111.

6. Mirtone, Sarasota, FL (800) 232-6593. www.mirtone.com
7. Notifier, Northford, CT (800) 454-9779 or (203) 484-7161. www.notifier.com
8. Silent Knight Security Systems, Maple Grove, MN (800) 446-6444 or (612) 493-6400. www.silentknight.com
9. Simplex, Westminster, MA (800) 221-7336 or (978) 731-2500. www.simplexnet.com
10. Equal as approved by Architect before bidding. See Section 01600.

EXECUTION

INSTALLATION

A. Install fire alarm and detection systems as indicated, in accordance with Equipment Manufacturer's written instructions, and complying with applicable portions of NEC, NFPA, and NECA's 'Standard of Installation.'
B. Mounting Heights:
    1. Unless otherwise indicated, mount center of outlets or boxes at following heights above finish floor:
        a. Fire alarm horns speaker/strobes: 90 inches
        b. Fire alarm pull stations: 54 inches.
        c. Remote annunciator panel: 60 inches.
        d. Remote duct detector indicator light – 48".
        e. Locate fire alarm manual stations 24 inches minimum away from any light switch.
    2. Identification:
        a. Label zone indicators on control unit indicating location and type of initiating device, i.e., CORRIDOR SMOKE, VALVE TAMPER, AIR SYSTEM SMOKE, etc. Labels shall be engraved plastic laminate, or other permanent labeling system as supplied by Control Unit Manufacturer.
        b. Post copy of wire identification list inside fire alarm panel door or other area accessible to fire alarm service personnel.
        c. Print location of circuit disconnecting means inside panel.
C. Conductors:
    1, Install conductors in conduit.
    2. Fire alarm system conductors from different zones may be combined in common conduit. Make certain that raceway size and wire quantity, size, and type are suitable for equipment supplied and is within NEC standards. Label pull and junction boxes 'FIRE ALARM.' All fire alarm conduit and junction boxes shall be painted red.
    3. Install conductors and make connections to water flow switches, valve tamper switches, low air pressure switches, and duct smoke detectors.
    4. Loop wires through each device on zone for proper supervision. Tee-taps not permitted.
    5. Minimum conductor size shall be 14 AWG unless otherwise specified.
    6. Do not install ceiling mounted detectors within 36 inches of air discharge grilles.
    7. Do not install manual fire alarm boxes close to light switches. Coordinate with other trades as required.

8. Mount Duct Smoke detectors in return air ducts of each HVAC unit as shown on the drawings.

FIELD QUALITY CONTROL

A. Manufacturer's Field Service:
   1. Provide factory-trained representative to perform complete system testing in presence of Owner's representative and local fire department personnel upon completion of installation.
      a. Test each initiating and annunciating device for proper operation, except fixed temperature heat detectors.
      b. Test operation of trouble annunciation on each circuit.
      c. Perform complete testing of control panel functions.

PROTECTION

1. Provide dust protection for installed smoke detectors until finish work is completed and building is ready for occupancy.
2. Protect conductors from cuts, abrasion and other damage during construction.

END OF SECTION

SECTION 16773

PUBLIC ADDRESS SOUND SYSTEM

PART 1 – GENERAL

DESCRIPTION OF WORK

A. Furnish and install speakers and wiring as shown on drawings.
   1. Terminate the speakers wiring in the Data/Comm Room for final connections by the owner.

SUBMITTALS:

A. Submit the producers' standard descriptive data sheets for each type of product being provided. Mark the data sheet for the product being provided with an identifying mark or arrow.

GUARANTEE AND INSTRUCTIONS:

A. Contractor shall furnish written guarantee covering all materials and workmanship for a period of one (1) year after final acceptance of work, and shall repair or replace faulty work without coast to the Owner during the guarantee period. Service and adjustment shall also be provided during this period without charge.

B. Contractor shall instruct operating personnel in care and operation of all equipment furnished by him and shall furnish operating manuals and instructions on equipment items.

PART 2 – EQUIPMENT

CEILING SPEAKERS WITH MOUNTING BRACKETS:

A. General Specifications:

<u>INTERIOR SPEAKERS</u>

1. Hi-efficiency 8" driver
2. Built-in Volume Control
3. 5 watt speaker, 502 magnet
4. 25 or 70 volt speaker lines
5. Frequency response 65 HZ to 17 KHZ
6. SPL: 95db@ 1 meter
7. Equal in all features to Valcom VC-S-500VC

<u>EXTERIOR & APPARATUS BAYS SPEAKERS/HORNS</u>

1. 7.38"H X 10"W X 10.5"D ABS plastic horn
2. Externally Accessible Volume Control
3. 5 watt amplified horn
4. -24VDC positive ground power supply

5. Frequency response 225 HZ to 14 KHZ
6. SPL: 116db@ 4'
7. White.
8. Equal in all features to Valcom model V-1030M.

CABLES:

A. Provide speaker cables, size and type per sound system producer recommendations.

PART 3 EXECUTION

WIRING

A. Shall be in conduit. Coordinate with exact equipment location prior to rough-in and provide junction boxes as required. Install and connect in conformance with the producers' recommendations and wiring diagrams. Conductor sizes not shown shall be sized by system producer according to line load, length, and permissible voltage drop.

B. All wiring shall be identified by being tagged, numbered and terminated on terminal blocks in the cabinets, in boxes, at equipment and at devices.

C. Cable runs shall be continuous between outlets without splices. Joints shall be soldered, be with soldered lugs on cable ends at screw terminals or with standard connectors.

END OF SECTION

SECTION 16931

LIGHTING CONTROL EQUIPMENT

PART 1 - GENERAL

WORK INCLUDED

A. Lighting Control
   1. Lighting control of exterior lighting shall be accomplished by photo cells or time clocks as shown on the drawings.
      a. Photocells shall be supplied as an integral part of the fixture if possible.

B. Lighting Dimmers and controls.

SYSTEM DESCRIPTION

A. Lighting shall be controlled by time clocks, photocell either directly or in combination with a lighting contractor.
   1. Detail of control is given on the drawings.
B. Any light fixture designated to be photocell controlled shall be supplied as an integral part of the fixture.
C. Lighting shall be controlled by dimmers where and as shown on the drawings.

SHOP DRAWINGS AND PRODUCT DATA

A. Submit shop drawings and product data in accordance with General and Special Conditions for all photocells and time clocks to be supplied.

PART 2 - PRODUCTS

TIME CLOCKS

A. General Specifications
   1. Three (3) pole, single throw.
   2. 120 volt/40 amp. per pole
   3. 24 hour dial
   4. Can be set for different on/off times each day
   5. Skip selected days

B. Model number
   1. Equal to Tork Model 7300

PHOTO CELLS

A. General Specifications
   1. SPST
   2. 120 Volt
   3. 200 watts or rated for fixture if integral part
   4. Temp range - 60 F. to 150 degrees F.

B. Model number
   1. Per individual manufacturer if supplied as integral part of fixture; equal to Tork Model 2100, if supplied separately.

LIGHTING CONTRACTOR

A. General Specifications
   1. Convertible contacts with N.O./N.C. indicators
   2. Silver alloy double break contacts
   3. Two to twelve poles as per drawings
   4. NEMA 1 enclosure
   5. 120 Volt control coil

B. Model number
   1. Square D type LG Series

DIMMING CONTROLS - INCANDESCENT

A. Incandescent Lighting Controller
   1.120 Volt
   2. 2000 Watt
   3. Single gang or double gang box
   4. Slide operated
   5. Square law dinning
   6 Equal to Lutron Model N-2000
   7. White unit with white faceplate

PART 3 EXECUTION

END OF SECTION