

SECTION 16010 - BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL:

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections apply to work of this section and all subsequent Division 16 sections.

1.2 SUMMARY:

- A. This Section specifies the basic requirements for electrical installations and includes requirements common to more than one section of Division 16. It expands and supplements the requirements specified in sections of Division 1 through 15.

1.3 ACCESSIBILITY:

- A. Install equipment and materials to provide required code clearances and access for servicing and maintenance. Coordinate the final location with piping, ducts, and equipment of other trades to insure proper access for all trades. Coordinate locations of concealed equipment, disconnects, and boxes with access panels and doors. Allow ample space for removal of parts, fuses, lamps, etc. that require replacement or servicing.
- B. Extend all conduits so that junction and pull boxes are in accessible locations.
- C. Provide access panel or doors where equipment or boxes are concealed behind finished surfaces.

1.4 ROUGH-IN:

- A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.
- B. Refer to equipment specifications in Divisions 2 through 15 for rough-in requirements.

1.5 REQUIREMENTS OF REGULATORY AGENCIES:

- A. Execute and inspect all work in accordance with Underwriters Laboratories (UL), and all local and state codes, rules and regulations applicable to the trade affected as a minimum, but if the plans and/or specifications call for requirements that exceed these rules and regulations, the more stringent requirement shall be followed. Follow application sections and requirements and testing procedures of NFPA, IEEE, NEMA, CBM, ANSI, NECA, ICEA and NETA.
- B. Comply with standards in effect at the date of these Contract Documents, except where a standard or specific date or edition is indicated.
- C. All material used on this project shall be UL listed and labeled and be acceptable to the authority having jurisdiction as suitable for the use intended.
- D. After entering into contract, Contractor will be held to complete all work necessary to meet these requirements without additional expense to the Owner.

1.6 REQUIREMENTS OF LOCAL UTILITY COMPANIES:

- A. Coordinate connection of electrical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.

1.7 PERMITS AND FEES:

- A. Contractor shall pay all fees required for connection to municipal and public utility facilities.
- B. Contractor shall arrange for and pay for all inspections, licenses and certificates required in connection with the work.

1.8 ELECTRICAL INSTALLATIONS:

- A. Drawings are diagrammatic in character and do not necessarily indicate every required conduit, box, fitting, etc.
- B. Drawings and specifications are complementary. Whatever is called for in either is binding as though called for in both.
- C. Drawings shall not be scaled for rough-in measurements or used as shop drawings. Where drawings are required for these purposes or have to be made from field measurement, take the necessary measurements and prepare the drawings.
- D. Before any work is begun, determine that equipment will properly fit the space and that conduit can be run as contemplated without interferences between systems, with structural elements or with the work of other trades.
- E. Coordinate the installation of electrical materials and equipment above and below ceilings with suspension system, luminaires and other building components. Ductwork and piping shall not be installed above electrical panelboards, switchboards, motor control centers, and transformers.
 - 1. Coordinate ceiling cavity space carefully with all trades. In the event of conflict, space for mechanical and electric systems within the cavity shall be allocated in the following order:
 - a. Plumbing waste, vent piping and roof drain mains and leaders.
 - b. Supply, return and exhaust ductwork.
 - c. Fire sprinkler mains and leaders.
 - d. Electrical conduit.
 - e. Domestic hot and cold water.
 - f. Pneumatic control piping.
 - g. Fire sprinkler branch piping and sprinkler run-outs.
- F. Verify all dimensions by field measurements.
- G. Arrange for chases, slots, and openings in other building components to accommodate electrical installations.
- H. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.

- I. Sequence, coordinate, and integrate installations of electrical materials and equipment for efficient flow of the work. Give particular attention to large equipment requiring an access path for positioning prior to closing-in the building or space.
 - J. Coordinate the cutting and patching of building components to accommodate the installation of electrical equipment and materials.
 - K. Where mounting heights are not detailed or dimensioned, install electrical conduits, boxes, and overhead equipment to provide the maximum headroom possible. In general, keep installations tight to structure.
 - L. Install electrical equipment to facilitate maintenance and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting and removal with minimum of interference with other installations.
 - M. Installation shall comply with the local seismic requirements for the area of installation. Provide restraints, bracing, anchors, vibration isolation, seismic snubbers, and all other components required for the installation.
 - N. All Journeymen shall be licensed and all apprentices shall be registered with the State of Colorado electrical board. They shall also show their license to the Littleton Public Schools district electricians upon request.
 - O. The contractor shall provide personnel with the ratio of Journeymen to apprentice as mandated by the State of Colorado.
 - P. All equipment and materials installed shall be new unless otherwise specified. Existing equipment and materials shall be reused where indicated. All major equipment and components shall have the manufacture's name, address, model number and serial numbers permanently attached.
 - Q. Equipment and materials shall comply with Littleton Public Schools Property Management Services Department's list of acceptable products. Any variations from this list, requires written approval from LPS Property Management Services.
 - R. Definitions: "Provide" shall mean "furnish and install", "Accept" or "acceptable" indicates only that the item is in "general conformance" with the design concept for the project.
 - S. All penetrations through any wall for any reason shall be sleeved and fire caulked.
- 1.9 METHODS OF PROCEDURE (MOP):
- A. Definition: Method of Procedure (MOP) is a written plan which describes the activities and procedures to safeguard the building's occupants and contents and to interface with the building's management, operations and security. Building occupants shall be defined as employees, and visitors.
 - B. Requirements:
 - 1. A MOP is required when a construction activity affects the safety of the occupants, equipment or valuable contents, or any supporting system; or essentially affects the building's management, operations or security.

2. A MOP is required for any shutdown or interruption of any system which affects the building occupants, including, but not limited to, infrastructure, life safety, electrical, and building management systems.
 3. A MOP is required when requested or deemed necessary by the Owner or Engineer.
- C. Development:
1. The Prime Contractor shall develop, submit, track and process the MOP. Any assistance required by the Subcontractors shall be provided. All MOP's shall be reviewed by the Prime Contractor prior to submitting the MOP to the Engineer.
 2. All MOP's Shall Be Typed.
 3. Contractor shall develop the MOP in a timely fashion prior to review and approval by all required parties.
 4. Contractor shall develop the MOP with input from the subcontractor, where necessary.
- D. Form: Each MOP shall be a written document in narrative, descriptive or outline form supplemented with drawings, diagrams and schedules as necessary. The detailed format included in the appendix shall be utilized.
- E. Review and Approval: Contractor shall submit each MOP to the Engineer for review and approval. All MOP's require Owner's approval.
- F. Implementation: Contractor shall implement the MOP when approved by the Engineer and Owner in writing. No construction activity which requires a MOP shall proceed until the MOP is approved.
- G. Compliance: Contractor shall comply with the approved MOP. The Owner and Engineer reserve the right to stop the work for non-compliance with the MOP. Any cost or time delay resulting from the work stoppage shall be borne by the Contractor.
- H. Posting: Work shall not proceed on any facet of the work involving any MOP if an approved and signed MOP is not posted in the work area.
- 1.10 ELECTRICAL COORDINATION DRAWINGS:
- A. Prepare and submit a set of coordination drawings showing major elements, components, and systems of electrical equipment and materials in relationship with other building components. Prepare 11"x17" (min) drawings to an accurate scale of 1/4"=1'-0" or larger. Indicate the locations of all equipment and materials, including clearances for servicing and maintaining equipment. Indicate movement and positioning of large equipment into the building during construction.
 - B. Prepare floor plans, reflected ceiling plans, elevations, sections, and details to conclusively coordinate and integrate all installations. Indicate locations where space is limited, and where sequencing and coordination of installations are of importance to the efficient flow of the Work, including (but not necessarily limited to) the following:
 1. Electric equipment room layouts
 2. Mechanical equipment room layouts

- C. Prepare coordination drawings for specific equipment installations, including, but not limited to the following:
1. Cable Tray
 2. Switchgear
 3. Motor control centers
 4. Generators and automatic transfer switches
 5. Pad mounted and/or dry type transformers
 6. Switchboards and panelboards
 7. Equipment connections
 8. Control panels
 9. Circuit and motor disconnects
 10. Feeder conduits
- D. Wiring Diagrams: Provide wiring diagrams indicating field installed electrical power and control wiring and cabling layouts, overcurrent protective devices, equipment, and equipment connections.
- 1.11 EQUIPMENT HOUSEKEEPING PADS:
- A. Provide 4" concrete housekeeping pad for all floor mounted equipment including, but not limited to: switchgear, switchboards, motor control centers, floor mounted distribution panelboards, floor mounted branch panelboards, and floor mounted dry type transformers. Fabricate pads as follows:
1. Coordinate size of equipment bases with actual unit sizes provided. Fabricate base 4" larger in both directions than the overall dimensions of the supported unit.
 2. Form concrete pads with framing lumber with form release compounds. Chamfer top edge and corners of pad.
 3. Place concrete and allow curing before installation of units. Use Portland cement that conforms to ASTM C 150, 4000-psi compressive strength, and normal weight aggregate.
 4. Anchor housekeeping pads to slab using #3 rebar bent in "L" or "Z" shape 12 inch on center on each side of slab.
- 1.12 EXCAVATING AND BACKFILLING:
- A. General:
1. Provide all necessary excavation and backfill for installation of electrical work in accordance with Division 2.
 2. In general, follow all regulations of OSHA as specified in Part 1926, Subpart P, "Excavations, Trenching and Shoring." Follow specifications of Division 16 as they refer specifically to the electrical work.
- B. Contact Owners of all underground utilities to have them located and marked, at least 2 business days before excavation is to begin. Prior to starting excavation, brief employees on marking and color codes and train employees on excavation and safety procedures for natural gas lines. When excavation approaches gas lines, expose lines by carefully probing and hand digging.

- C. Backfilling shall not be started until all work has been inspected, tested and accepted. All backfill material shall be accepted by the soils engineer. In no case shall lumber, metal or other debris be buried in with backfill.
- D. Trench Backfill
 - 1. Backfill to 4 inches above top of conduits with sand, the same as used for conduit bed, compact properly.
 - 2. Continue backfill to finish grade, using friable material free of rock and other debris. Install in 6 inch layers, each properly moistened and mechanically compacted prior to installation of ensuing layer. Compaction by hydraulic jetting is not permissible.
- E. After backfilling and compacting, any settling shall be refilled, tamped, and refinished at contractor's expense.
- F. This contractor shall repair and pay for any damage to finished surfaces.
- G. Backfill near manholes or hand holes using sand, installing it in 6 inch layers to 4 inches above the shallowest conduit. Use suitable excavated material to complete the backfill, installed in 6 inch layers and mechanically compacted to seal against water infiltration. Compact to 95% below paving and slabs and 90% elsewhere.

1.13 CUTTING AND PATCHING:

- A. This Article specifies the cutting and patching of electrical equipment, components, and materials to include removal and legal disposal of selected materials, components, and equipment.
- B. Refer to the Division 1 Section covering cutting and patching for general requirements.
- C. Do not endanger or damage installed Work through procedures and processes of cutting and patching.
- D. When coring is required or identified, an x-ray of the area is to be taken prior to the performance of the work operation. X-ray work requires an MOP and protection.
- E. Arrange for repairs required to restore other work, because of damage caused as a result of electrical installations.
- F. No additional compensation will be authorized for cutting and patching Work that is necessitated by ill-timed, defective, or non-conforming installations.
- G. Perform cutting, fitting, and patching of electrical equipment and materials required to:
 - 1. Uncover Work to provide for installation of ill-timed Work;
 - 2. Remove and replace defective Work;
 - 3. Remove and replace Work not conforming to requirements of the Contract Documents;
 - 4. Remove samples of installed Work as specified for testing;
 - 5. Install equipment and materials in existing structures;

6. Upon written instructions from the Architect/Engineer, uncover and restore Work to provide for Architect/Engineer observation of concealed Work.
- H. Cut, remove and legally dispose of selected electrical equipment, components, and materials as indicated, including, but not limited to removal of conductors, conduit, luminaires, boxes, devices and other electrical items made obsolete by the new Work.
- I. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.
- J. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.
- K. Locate identify, and protect mechanical and electrical services passing through remodel or demolition area and serving other areas required to be maintained operational.

1.14 TEMPORARY FACILITIES:

- A. Light, Heat, Power, Etc.
 1. Responsibility for providing temporary electricity, heat and other facilities shall be as identified in these specifications, as shown on drawings and as specified in Division 1.
- B. Building distribution equipment and devices (existing or new) shall not be used without written permission of the Owner. If used for temporary power, the equipment shall be properly maintained and any damage resulting from use shall be repaired by the Contractor. The warranty period for new equipment shall begin at the date of Substantial Completion.
- C. If AC power systems or their backup systems serving telecommunications, computer equipment, or their associated HVAC equipment and controls are taken out of service, for any reason, the Contractor shall be responsible for providing temporary systems during the period when the AC power systems or their backup systems are out of service. The Contractor shall be responsible for providing temporary power to all loads being interrupted.

1.15 ELECTRICAL SUBMITTALS:

- A. Refer to the Conditions of the Contract (General and Supplementary) and Division 1 Section covering shop drawings, product data, and samples for submittal definitions, requirements, and procedures.
- B. The manufacturer's material or equipment listed first in the specifications or on the drawings are the types to be provided for the establishment of size, capacity, grade and quality. If alternates are used in lieu of the first names, the cost of any changes in construction required by their use shall be borne by this Contractor.
- C. All equipment shall conform to the State and/or local Energy Conservation Standards.
- D. Submittal of shop drawings, product data, and samples will be accepted only when submitted by the Contractor. Each submittal shall be reviewed for general conformance with contract requirements and stamped by the respective contractor prior to submittal to the Architect/Engineer. Data submitted from subcontractors and material suppliers directly to the Architect/Engineer will not be processed unless written prior approval is obtained by the Contractor.

- E. Before starting work, prepare and submit to the Architect/Engineer two (2) sets of all shop drawings, descriptive product data, and samples required for the project. Continue to submit two (2) sets, after each Architect/Engineer's action, until a "No Exception Taken" or "Make Correction Noted" action is received. Submittals shall include the following specified materials and, in addition, any materials not listed below but which are specified in the individual sections of Division 16 which follow.
1. Raceways including surface raceways and wireways.
 2. Cable trays or bridle ring assemblies.
 3. Cabinets, boxes, fittings, etc.
 4. Wiring devices, including tele/data/power poles.
 5. Electrical equipment signs and labels.
 6. Switchboards
 7. Grounding
 8. Transformers
 9. Panelboards
 10. Disconnect Switches
 11. Circuit breakers and fused switches for installation in existing panelboards or distribution centers.
 12. Motor control including motor control centers and individual manual and magnetic starters provided under this Division.
 13. Automatic and manual transfer switches including all ancillary equipment.
 14. Poles and Standards.
 15. Lighting
 16. Emergency power supplies including unit type equipment.
 17. Engine generator including transfer switches and all ancillary equipment.
 18. Fire alarm and detection system.
 19. Paging and background music system.
 20. Intercom system.
 21. Lighting control system including individual wall dimmers.
- F. Submit proposed changes to electrical room or other equipment room layouts when revised from contract documents prior to installation.
- G. Mark submittals with designations as shown on the drawings and identify as required by Specification Sections. Identification shall contain the information as required in details and each label shall be submitted in list form with disconnects, MCC's, panelboards, switchboards, overcurrent protection devices and utilization equipment.
- H. All electrical submittals shall be assembled into a single package after approval of all sections.
1. Submittals shall be provided in expandable, three-ring, hard back binders.
 2. Each submittal shall be tabbed by the electrical specification section it is specified in.
 3. An index shall be provided which includes:
 - a. Product
 - b. Plan Code (if applicable)
 - c. Specification Section
 - d. Manufacturer and Model Number
 4. Submittals shall be provided for review within four (4) working weeks from award of contract to successful bidder.

1.16 PRODUCT OPTIONS AND SUBSTITUTIONS:

- A. The burden of proof that proposed equipment is equal in size, capacity, performance, and other pertinent criteria for this specific installation, or superior to that specified is up to the Contractor. Substituted equipment will only be allowed where specifically listed in a written addendum. If substitutions are not granted, the specified materials and equipment must be installed. Where substituted equipment is allowed, it shall be the Contractor's responsibility to notify all related trades of the accepted substitution and to assume full responsibility for all costs caused as a result of the substitution.
- B. Unless otherwise specified, all materials and equipment shall be of domestic (USA) manufacture.

1.17 PRODUCT LISTING:

- A. Prepare a list of major electrical equipment and materials for the project. A sample schedule is included at the end of this Section to complete this requirement.
- B. Provide a product listing within one (1) week from award of contract to successful bidder.
- C. Submit this listing as a part of the submittal requirement specified in the Division 1 Section on Products and Substitutions.
- D. When two or more items of same material or equipment are required they shall be of the same manufacturer. Product manufacturer uniformity does not apply to raw materials, bulk materials, sheet metal, steel bar stock, welding rods, solder, fasteners and similar items used in Work, except as otherwise indicated.
- E. For conduit, wire and fittings, the Contractor shall select a prime and alternate manufacturer from the list of acceptable manufacturers provided in the appropriate sections of this Division. The prime and alternate manufacturers shall be identified in the product listing. The contractor shall make every effort to use the prime manufacturer for the entire project. If products from this manufacturer are unavailable, the Contractor shall use the listed alternate with the following provisions.
 - 1. Wire: All wire placed in a single conduit or installed in multiple conduits making up parallel feeders shall be of the same manufacturer.
 - 2. Conduit and Fittings: All conduits and fittings installed exposed within the same room or immediate area shall be of the same manufacturer.
- F. Provide products which are compatible within systems and other connected items.

1.18 SCHEDULE OF VALUES:

- A. Provide preliminary schedule of values to Engineer according to the following descriptions:
 - 1. Demolition
 - 2. Service/Distribution
 - 3. Lighting - Interior
 - 4. Lighting - Exterior
 - 5. Basic Materials/Devices/Equipment Connections (Mechanical)
 - 6. Emergency Generator
 - 7. Fire Alarm (Material/Installation)
 - 8. Building F.A. System

- 9. P.A./Sound/Intercom
 - 10. Miscellaneous
- B. Provide Preliminary Schedule of Values to Engineer with product data submittal or within three (3) weeks from award of contract to successful bidder.
- 1.19 NAMEPLATE DATA:
- A. Provide equipment with permanent operational data nameplate on each item of power operated equipment, indicating manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and similar essential data. Install equipment so that nameplate is readily visible.
- 1.20 DELIVERY, STORAGE AND HANDLING:
- A. Refer to the Division 1, Sections on Transportation and Handling and Storage and Protection.
 - B. Deliver products to project properly identified with names, model numbers, types, grades, compliance labels, and similar information needed for distinct identifications; adequately packaged and protected to prevent damage during shipment, storage, and handling.
 - C. Store equipment and materials at the site, unless off-site storage is authorized in writing. Protect stored equipment and materials from damage and weather.
 - D. Coordinate deliveries of electrical materials and equipment to minimize construction site congestion. Limit each shipment of materials and equipment to the items and quantities needed for the smooth and efficient flow of installations.
- 1.21 RECORD DOCUMENTS:
- A. Refer to the Division 1 Section on Project Closeout or Project Record Documents for requirements. The following paragraphs supplement the requirements of Division 1.
 - B. Mark Drawings to indicate revisions to conduit size and location both exterior and interior; actual equipment locations, dimensioned from column lines; concealed equipment, dimensioned to column lines; distribution and branch electrical circuitry; fuse and circuit breaker size and arrangements; support and hanger details; Change Orders; concealed control system devices, and any other relevant deviations from the Contract Documents.
 - C. Mark shop drawings to indicate approved substitutions; Change Orders; actual equipment and materials used.
 - D. Mark luminaire schedule on drawings to indicate manufacturer and complete catalog numbers of installed equipment.
 - E. Mark schedules including panelboard, switchboard, motor control center, mechanical, kitchen and similar equipment schedules on drawings to indicate installed equipment and materials used, and any deviations or revisions to electrical load data and calculations.
 - F. During construction, the contractor shall maintain at the job site a set of updated construction documents for the singular purpose of recording the above information. All record drawings shall be completed in erasable pencil. These changes shall be updated weekly.
 - G. Revisions to the Contract Documents shall be legible and shall be prepared using the following color scheme.

1. Red shall indicate new items, deviations and routing.
2. Green shall indicate items removed or deleted.
3. Blue shall be used for relevant notes and descriptions.

H. At the completion of the project, submit these documents to the Architect/Engineer. This contract will not be considered completed until these record documents have been received and reviewed by the Architect/Engineer.

1.22 OPERATION AND MAINTENANCE DATA:

- A. Refer to the Division 1 Section on project closeout or operation and maintenance data for procedures and requirements for preparation and submittal of maintenance manuals.
- B. In addition to the information required by Division 1 for Maintenance Data, include the following information:
1. Description of function, normal operating characteristics and limitations, fuse curves, engineering data and tests, and complete nomenclature and commercial numbers of all replaceable parts.
 2. Manufacturer's printed operating procedures to include start-up, break-in, routine and normal operating instructions; regulation, control, stopping, shut-down, and emergency instructions; and summer and winter operating instructions.
 3. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, reassembly; aligning and adjusting instructions.
 4. Servicing instructions, lubrication charts, and schedules.
 5. Complete list of parts and wiring diagrams.
 6. Names, addresses and telephone numbers of the Contractor, Sub-contractors and local company responsible for maintenance of each system or piece of equipment.
 7. All information shall be permanently bound in a 3-ring binder. The job name and address and contractor's name and address shall be placed on the cover and spine of each binder in a permanent manner. Dymo-tape is not acceptable.
 8. Copies of all test reports shall be included in the manuals.
 9. Provide manuals with dividers for major sections and special equipment. Mark neatly in ink the individual equipment when more than one model or make is listed on a page. Provide detailed table of contents.
- C. This contract will not be considered completed nor will final payment be made until all specified material, including test reports, is provided and the manual is reviewed by the Architect/Engineer.

1.23 PRE-ORDERED EQUIPMENT:

- A. To expedite delivery, the Owner may pre-order certain items of equipment as indicated on the drawings and specified in this Division. Contractor shall include in his bid, in addition to the amounts given for the pre-ordered equipment, his costs for state and local taxes (if not included in the purchase order), rigging, installation of equipment and all accessories, and any other items required which are not furnished with equipment. The successful bidder shall accept Owner's purchase orders as written.
- B. The purchase orders, equipment submittals, and all responsibility for the above equipment will be turned over to the successful bidder after award of the contract. It shall be the responsibility of the successful bidder, after award of the contract, to provide the following.
1. Provide breakdown of re-stocking charges of new equipment. After the following, should it occur:

- a. Release of order
 - b. Shop drawings review
 - c. Factory purchase of rough material
 - d. Equipment on production line
 - e. Equipment off production line
2. Credit information to suppliers of pre-ordered equipment, if required.
 3. Purchase orders written under his company name, to the suppliers to replace Owner's purchase orders, if required.
 4. Submittal data for all pre-ordered equipment.
 5. Operating and maintenance information for all pre-ordered equipment. Include in Operating and Maintenance Manual for entire project.
 6. Provide one year guarantee on all pre-ordered equipment. Warranty shall begin at date of substantial completion.
 7. Accessory items and other parts not pre-purchased but required for the installation of the pre-purchased equipment.
 8. Repair or replacement of equipment or parts damaged in shipping or at the jobsite.
 9. Handling, moving, and storage of pre-purchased items.
- C. Pre-ordered equipment consists of:
- 1.
 - 2.
 - 3.
- 1.24 TESTING:
- A. Submit test reports as outlined in Division 1 Sections on Quality Control Services and each Division 16 Section.
 - B. Testing as required by these specifications shall pertain to all equipment, wiring, devices, etc. installed under this contract and being reused.
 - C. General Scope:
 1. Perform all tests and operational checks to assure that all electrical equipment, both Contractor and Owner-supplied, is operational within industry and manufacturer's tolerances and is installed in accordance with design specifications.
 2. The tests and operational checks shall determine the suitability to energize.
 3. Schedule tests and give a minimum of two weeks advance notice to the Architect. Reschedule testing for Owner convenience if required.
 - D. Test Report: Submit three copies of the completed report to the Architect no later than fifteen (15) days after completion of test unless directed otherwise. The test report shall be bound and its contents certified.

The test report shall include the following:

1. Project information including: Building, name, address, date, and other pertinent information.
2. List of equipment tested.
3. Description of test.
4. List of test equipment used and calibration date.
5. Baseline, accepted, or published target value for test with code or standard reference indicating where value was derived.
6. Test results that summarize all measured values with baseline values.
7. Conclusions and recommendations.
8. Appendix, including appropriate test forms that show all measured values.

E. Failure to Meet Test:

1. Any system material or workmanship which is found defective on the basis of performance tests shall be reported directly to the Architect.
2. All failed tests shall be sent immediately by fax/email to Engineer with proposed corrective action and proposed re-test date and time.
3. Contractor shall replace the defective material or equipment as necessary, and repeat test until test proves satisfactory without additional cost to the Owner.
4. The Contractor or testing agency shall have a calibration program which maintains all applicable test instrumentation within rated accuracy. The accuracy shall be traceable to the National Institute of Standards and Technology (NIST) in an unbroken chain. Instruments shall be calibrated in accordance with the following frequency schedule:
 - a. Field Instruments: 6 months
 - b. Laboratory Instruments: 12 months
 - c. Leased specialty equipment: 12 months. (Where accuracy is guaranteed by lessor, i.e., Doble).

Dated calibration labels shall be visible on all test equipment.

F. Independent Testing Agency:

1. The tests and/or operational checks indicated hereinafter in these Specifications shall be performed by a recognized independent testing agency engaged and paid for by the Contractor.
2. The testing agency shall meet federal OSHA criteria for accreditation of testing laboratories, Title 29, Part 1907. Membership in the National Electric Testing Association constitutes proof of meeting such criteria.
3. The testing agency shall be responsible for implementing all final settings and adjustments on protective devices in accordance with Owner's specified values.

4. Testing Agencies: Subject to compliance with requirements and qualifications, the following are accepted agencies:
 - a. Electro-Test, Inc.
 - b. Orbis Engineering Field Services Ltd.

G. Independent Testing Agency requirements shall apply to the following Division 16 sections:

1. 16425 - Switchboards
2. 16452 - Grounding
3. 16475 - Overcurrent Protective Devices
4. 16481 - Motor Control Centers
5. 16483 - Motor Variable Frequency Drive
6. 16495 - Transfer Switches

All work described in each section under field quality control shall be accomplished by the Independent Testing Agency.

1.25 DEMOLITION/REMODEL WORK:

- A. Refer to Division 1 Section on Summary of work for requirements on working in Owner-occupied areas of the existing building and Division 2 section on selective demolition. The following are additions and modifications.
- B. The project involves renovation and remodel of the existing building. On the drawings, work may be denoted by showing items as bold or light line weight and certain renovation symbols are used. These indications and symbols are amplified as follows:
 1. Bold Print (when used): Work included in this contract is denoted in bold print or line weight.
 2. Light Print (when used): Work shown lightly indicates existing conditions to remain.

R = Existing items to be removed. Contractor shall remove the existing item and the associated existing wiring. Where the raceway serving the equipment is accessible (via removal of suspended ceiling, crawl space, etc.) the raceway shall also be removed. Where the removal of a raceway leaves visible evidence on an existing surface which is not being repaired or replaced by the General Contractor, this contractor shall repair the surface. Where the existing raceway is concealed, the outlet box shall be cleaned, and a blank coverplate installed. Where the concealed raceway is uncovered by demolition performed by the General Contractor, the raceway shall be removed (or extended to new location if appropriate).

E = Existing item to remain in place. Contractor shall perform the following function based upon the item to remain:

- | | | |
|------------|---|--|
| Luminaires | - | Leave in place. |
| Switches | - | Maintain circuit continuity. |
| Receptacle | - | Remove devices if required for new work and reinstall. |
| Clock | - | Clean and reinstall. |

ER = Existing item to remain in place; replace device. Contractor shall perform the following function based upon the item to remain:

- | | | |
|------------|---|--|
| Luminaires | - | Clean and install new lamps. |
| Switches | - | Remove and replace with new in existing box. |

- Receptacles - Remove and replace with new in existing box.
- Clock - Clean and replace.

RL =Existing item to be relocated. Contractor shall remove the existing item, and store in a safe place. The existing item shall be relocated to the new position as called for on the drawings. At Contractor's option, the existing wiring may be extended, or new wiring may be run from the source. Based upon the item to be relocated, the Contractor shall perform the following function:

- Luminaires - Clean and install new lamps.
- Switches - Replace.
- Receptacles - Replace.
- Clocks - Clean and relocate.

- C. Existing equipment that is removed and not scheduled to be reused shall remain the property of the Owner and be delivered for disposition unless specifically indicated otherwise and shall be stored in a location designated by the Owner. Items which are removed and not wanted by the Owner shall become the property of the Contractor and shall be removed from the site.
- D. Existing equipment that is removed and is to be reused shall be cleaned, serviced and operable before being reinstalled.
- E. Revise panelboard schedules to reflect removal or relocation of equipment. Circuit integrity of equipment in adjacent areas shall be left intact.
- F. Where remodeling interferes with existing circuits and equipment which are not to be removed, such circuits and equipment shall be reworked and relocated as required to complete the project.
- G. The Contractor shall remove all distribution equipment, conductors, etc., which are indicated to be removed or which must be removed to accommodate demolition. Equipment to be removed may require reworking conduit and wiring in order to maintain service to other equipment.
- H. Where remodeling interferes with circuits serving areas outside of the project or phase limits or which are remodeled in later phases of the project, circuits shall be reworked or temporary circuits provided as required.
- I. Existing equipment and circuiting shown are based on field surveys and/or Owner furnished drawings. The Contractor shall verify conditions as they exist with necessary adjustments being made to the drawing information.
- J. Coordinate the routing of all conduits with the existing mechanical and plumbing systems in order to avoid conflicts with ducts, pipes, etc. Where existing electrical boxes, conduit, or equipment interfere with installation of new ducts, plumbing, walls, soffits, luminaires, outlets, etc., the Contractor shall resolve the conflict with the appropriate trade.
- K. Reuse of existing luminaires, devices, conduits, boxes, or equipment will be permitted only where specifically indicated on the drawings or allowed under the appropriate section of the specifications.
- L. Electrical Outages: Electrical outages must be held to a minimum. The Contractor shall submit a Method of Procedure (MOP) for each outage to the Owner detailing the reasons for the outage, areas affected, sequence of procedures to accomplish work, estimated maximum length of time, the date and time of day outage will occur. The Contractor shall meet with the

Owner to set a schedule and date for the outage based on the MOP. Due to the critical implications of power outages, the Owner may direct the Contractor as to the time of day or night and date an outage may take place.

1. The Contractor will be responsible for providing temporary power required for the duration of the outages. The required outages to connect and disconnect the temporary power will require a MOP as described above.
- M. If other suspected hazardous material, in any form, is discovered by this Contractor in the process of his work, he shall report such occurrence to the Architect immediately. The Engineer will determine the action to be taken. Hazardous material removed is not a part of the work to be done under this Division.
- N. When called for in the specifications, or on the drawings, the Contractor shall meter the points indicated for thirty (30) consecutive days using a three phase analyzer. The analyzer shall be set up to record amperes for each phase at 15 minute intervals. The Contractor shall compile a summary report, listing maximum readings and submit the report and tape to the Electrical Engineer. The analyzer shall have been calibrated within the previous 60 days. Submit documentation of the calibration to the Engineer.
- O. Contractor is responsible for sending removed lamps to be recycled. The Contractor should ensure the recycling agency meets RCRA and CERCLA regulations. Provide certificate of compliance in O&M Manuals.

1.26 WARRANTIES:

- A. Refer to the Division 1 Section on Warranties and Bonds for procedures and submittal requirements for warranties. Refer to individual equipment specifications for warranty requirements. In no case shall the warranty for the total electrical system be less than one year from date of acceptance by the Owner.
- B. Compile and assemble the warranties specified in Division 16, into a separated set of vinyl covered, three ring binders, tabulated and indexed for easy reference.
- C. Provide complete warranty information for each item. Information to include product or equipment description, date of beginning of warranty or bond; duration of warranty or bond; and names, addresses, and telephone numbers and procedures for filing a claim and obtaining warranty services.

1.27 CLEANING:

- A. Refer to the Division 1 Section on project closeout or final cleaning for general requirements for final cleaning.
- B. Clean all luminaires, lamps and lenses per manufacturer's recommendation prior to final acceptance. Replace all inoperative lamps.

1.28 CONSTRUCTION REQUIREMENTS:

- A. The contractor shall maintain and have available at the jobsite current information on the following at all times:
 1. Up-to-date record drawings.
 2. Equipment/Device/Product Submittals
 3. Site observation reports with current status of all action items.

- 4. Test results; including recorded values, procedures, and other findings.
- 5. Outage information.

Division 16

SPEC SECTION	ITEM	REQUIREMENTS								
		REPORT/ DATA		TEST	FACTORY TEST	REPORT	FACTORY REP SUPERVISION AT SITE	TRAINING REQD AT SITE	EXTRA MATERIAL	O & M
		SHOP DRAWING	LISTING PRODUCT DATA							
16010	SCHEDULE OF VALUES					X				X
	ELECTRICAL COORDINATION DRAWINGS	X								
	CONTRACTOR/EQUIPMENT WARRANTIES									X
	O&M MANUALS	X	X						X	X
16110	RACEWAYS		X							
	ELECTRICAL METALLIC TUBING		X							
	FLEXIBLE METAL CONDUIT		X							
	INTERMEDIATE METAL CONDUIT		X							
	LIQUID-TIGHT FLEXIBLE CONDUIT		X							
	NON-METALLIC CONDUIT PVC		X							
	RIGID METAL CONDUIT		X							
	SURFACE METAL RACEWAY	X	X							X
	WIREWAYS	X	X							X
	RIGID ALUMINUM CONDUIT		X							
16111	CABLE TRAY	X	X							X
	LADDER	X	X							X
	TROUGH	X	X							X
	SOLID BOTTOM	X	X							X
	CHANNEL	X	X							X
16120	WIRES & CABLES		X	X		X				X
16135	CABINETS, BOXES & FITTINGS	X	X							X

SPEC SECTION	ITEM	REQUIREMENTS								
		REPORT/ DATA		TEST	FACTORY TEST	REPORT	FACTORY REP SUPERVISION AT SITE	TRAINING REQD AT SITE	EXTRA MATERIAL	O & M
		SHOP DRAWING	LISTING PRODUCT DATA							
16142	ELECTRICAL CONNECTIONS FOR EQUIPMENT		X	X						
16143	WIRING DEVICES		X	X						X
16190	SUPPORTING DEVICES	X	X							X
16195	ELECTRICAL IDENTIFICATION	X	X							
16425	SWITCHBOARDS	X	X	X	X	X	X	X	X	X
16452	GROUNDING	X	X	X		X				X
16460	TRANSFORMERS	X	X	X		X				X
16466	BUSWAYS	X	X	X		X				X
16470	PANELBOARDS	X	X	X		X			X	X
16471	COMPUTER ROOM - POWER DISTRIBUTION EQUIPMENT	X	X	X		X	X	X		X
16475	OVERCURRENT PROTECTIVE DEVICES	X	X	X		X		X	X	X
16481	MOTOR CONTROL CENTER	X	X	X		X	X	X	X	X
16483	MOTOR VARIABLE FREQUENCY DRIVE	X	X	X	X	X	(2)X	X		X
16495	TRANSFER SWITCHES	X	X	X	X	X	X	X		X
16503	POLES & STANDARDS		X							X
16515	LIGHTING	X	X	X					X	X
	BALLASTS	X	X	X						X
16535	EMERGENCY LIGHTING	X	X	X						X
16621	DIESEL GENERATOR SETS	X	X	X	X	X	X	X	X	X
16660	GROUND-FAULT PROTECTION	X	X	X		X				X
16675	TRANSIENT VOLTAGE SURGE SUPPRESSOR	X	X	X	X	X				X
16721	FIRE ALARM SYSTEMS	X	X	X		X	X	X		X
16730	CLOCK PROGRAM SYSTEM	X	X	X						X

SPEC SECTION	ITEM	REQUIREMENTS								
		REPORT/ DATA		TEST	FACTORY TEST	REPORT	FACTORY REP SUPERVISION AT SITE	TRAINING REQD AT SITE	EXTRA MATERIAL	O & M
		SHOP DRAWING	LISTING PRODUCT DATA							
16770.2	PUBLIC ADDRESS, INTERCOM & MUSIC SYSTEMS	X	X	X		X	X	X		X
16931	LIGHTING CONTROL EQUIPMENT	X	X	X				X	X	X

