

## ELECTRICAL SPECIFICATIONS

## DIVISION 16 – ELECTRIC

## 16100.01 DEFINITIONS

A. Instructions in specification or on drawings such as PROVIDE shall mean that the electrical contractor shall furnish and install the item, equipment, wiring, etc., complete with all details. N.E.C. is NATIONAL ELECTRICAL CODE. N.E.S.C. is NATIONAL ELECTRICAL SAFETY CODE. OSHA is OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION. IBC is BUILDING OFFICIALS AND CODE ADMINISTRATION. NFA is NATIONAL FIRE PROTECTION ASSOCIATION.

CONTRACTOR where used means electrical contractor responsible for work under this section. OWNER is National Fire Protection Association.

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## 16100.02 DRAWINGS AND SPECIFICATIONS

A. Drawings and specifications are complementary to each other and what is called for by one shall be as if called for by both.

B. Electrical drawings are diagrammatic and indicate general design, layout, and arrangement of equipment and various systems. However, being diagrammatic the drawings do not necessarily show all details such as junction boxes, pull boxes, conduit runs or sizes, wiring, etc. Necessary for a complete and operable system.

C. Do not scale drawings for dimensions.

D. All dimensions and measurements shall be taken from architectural drawings and actual equipment to be furnished. The exact locations of apparatus, fixtures, equipment, conduits, outlets, receptacles, lighting fixtures, etc., shall be ascertained from the OWNER representative in the field, and the work shall be laid out accordingly. The CONTRACTOR shall verify and be responsible for all measurements taken in the field. Should the CONTRACTOR fail to ascertain the above locations, the work shall be changed at his own expense when so ordered by OWNER.

E. OWNER reserves the right to make minor changes in the location of conduit and equipment up to the time of installation, without additional cost.

F. Study and review all contract documents including drawings and specifications for architectural, structural, mechanical, and other portions of the work to overt possible installation conflicts. Adjust electrical work to conform to all conditions indicated therein.

G. Should conflicts arise which require changes in the contract documents, notify OWNER. Secure written approval and agreement on necessary adjustments before the bidding.

H. Discrepancies between drawings, between drawings and specifications, or between drawings and actual field conditions, or errors on either drawings or specifications shall be promptly brought to the attention of Architect and OWNER for a decision before the specific bidding.

## 16100.03 EXAMINATION OF PROJECT SITE

A. Prior to bidding examine the site carefully and be fully familiar with existing conditions and be fully informed of all utility, state and local requirements and regulations.

## 16100.04 EXISTING CONDUITS, PIPES, EQUIPMENT, ETC.

A. (Refer to General Specifications for additional requirements). Existing conduits, pipes, utility lines, tanks, equipment or other constructions are not in general indicated on drawings. Locate such obstructions prior to start of work and plan work so as to route and locate all new work to avoid these obstructions. Repair or replace existing installations where damaged during the course of construction.

## 16100.05 PERMITS, FEES, TAXES AND ROYALTIES

A. Arrange and pay for all necessary permits, fees, taxes, and royalties in connection with electrical work.

## 16100.06 CODES AND REGULATIONS

A. Comply with the latest applicable requirements of the NEC, NESC, OSHA, the NFPA, and the local Electric Association and local utility and telephone companies. Comply also with all requirements of local utility and telephone companies.

B. Report to the engineer prior to submitting bids, any part or portion of the electrical design which does not conform to the requirements of the applicable local or state codes or requirements of local utility or telephone companies, otherwise be held responsible to provide installation which will comply with these codes and regulations.

C. Applicable codes and ordinances and local interpretations are to take precedence when they conflict with or are more stringent than the electrical design. Drawings and specifications take precedence where design is more stringent than codes and ordinances.

## 16100.07 STANDARDS

A. Materials and installation shall also conform to latest standards and practices of the Institute of Electrical and Electronic Engineers (IEEE), the National Electrical Manufacturers Association (NEMA), Insulated Power Cable Engineers Association (IPCEA), American National Standards Institute (ANSI), American Society of Testing Materials (ASTM), and the National Bureau of Standards.

B. The foregoing rules, standards, and regulations shall not relieve the contractor from furnishing and installing higher grades of materials and workmanship which are specified herein or indicated on drawings.

## 16100.08 PROGRESS OF WORK

A. Schedule the progress of work so as to conform to the schedule of the work of other trades. Complete the entire electrical installation in accordance with schedules as determined for the general completion of the entire building. Cooperate with all other trades so that the installation of all electrical outlets may be properly coordinated and located.

B. Carefully check the location of outlet before the installation of materials and equipment by other trades. Any cost resulting from defective or ill-timed work performed under this division of the specifications shall be borne by this contractor under this section.

## 16100.09 PRODUCT DATA AND SUBMITTALS

A. Furnish product data and submittals for review by Architect and OWNER prior to installation.

B. Furnish detailed and dimensioned product data, submittals, and shop drawings for all electrical distribution equipment, lighting fixtures and lamps, special equipment, special systems, and special apparatus which are to be provided for installation in this work.

C. Include catalog cuts, dimensional and operating data, wiring diagrams for special systems, and such other data as may be required by Architect. Contractor shall review these submittals prior to submission for review. Do not order equipment prior to review of Architect and OWNER. Submit samples of equipment when so requested by Architect and OWNER.

## 16100.10 MINOR DEVIATIONS AND CHANGES

A. Furnish and install entire electrical installations as designed and in accordance with contract drawings and specifications. Minor deviations necessitated by field conditions or equipment being supplied may be made upon approval of Architect and OWNER. Changes in design or installation shall be done in the manner provided for in the GENERAL CONDITIONS.

## 16100.11 CUTTING AND REPAIRING

A. Provide all cutting, patching, channelling, core drilling, etc., in building structure necessary for electrical work. Locate holes to be drilled, outlets, etc., coordinate work with all other trades on the job, and make arrangements for necessary openings and chases. Seal all holes out for wiring runs.

B. No cutting, channelling, core drilling, etc., shall be done without prior approval of the architect. Make necessary repairs to finished building where patching or refinishing is necessary due to electric work. Actual work involved in these repairs shall be done by skilled craftsmen in the trades involved.

## 16100.12 MATERIALS

A. Furnish and install all material, equipment, and devices which are new, first quality, bear the listed label of the Underwriters Laboratories, Inc. and which are accepted by Architect and OWNER for installation in this project.

B. Replace, in a manner accepted by Architect and OWNER, and pay for all equipment or materials damaged in the course of installation or testing.

C. Basic bid shall include manufacturers and catalog numbers as shown in these specifications or on the drawings with NO EQUALS unless indicated. Specified materials, equipment, and devices shall be furnished and installed under the contract unless changed by mutual agreement between contractor and Architect and OWNER.

D. Where several manufacturers are indicated for material, equipment, or devices, contractor shall have the choice of manufacturers listed, but must indicate which is to be used. Equipment of other manufacturers which is equal to or superior than that specified may be proposed in accordance with the General Specification Manufacturers and catalog numbers shown in these specifications or on the drawings followed by (or EQUAL are intended as a guide to quality.

E. Substitute equipment of other manufacturers which is equivalent to or superior than that specified may be proposed. However, such substitutions must be accepted in writing by Architect and OWNER prior to bidding. If substitutions are not requested or granted, the specified materials and equipment must be installed. The decision of OWNER regarding substitutions shall be final.

F. It shall be the electrical contractors responsibility under this section of the specification to notify all related trades of the accepted substitutions and to assume full responsibility for all costs caused as a result of the substitution, prior to start of work, submit to Architect and OWNER a complete list of types, materials, and equipment and manufacturers of these items which are to be furnished for the work.

G. Copper wire must be used. Aluminum wire will not be accepted.

H. Equipment and materials must comply with the requirements of the Utility Company, and where required shall be submitted to them for their approval.

## 16100.13 PROJECT RECORD DOCUMENTS

A. Hold one set of electrical drawings and specifications on job site and keep up to date with project record data and revisions. Use this set for construction. Locate all underground runs including service entrances and feeders, and circuits relative to building. Upon completion of work, furnish OWNER with one set of marked up mylar copies of the electrical drawings showing project record installation.

## 16100.14 OPERATING INSTRUCTIONS AND MANUALS

A. At completion of project provide the OWNER with two sets of written instructions and manuals including manufacturers certificates of warranty, shop drawings, wiring diagrams, and parts lists of all systems and equipment installed. Bind separately in 3-ring binders with hard covers. Indicate to OWNER location and operation of distribution equipment and panel boards. Provide direct instruction to OWNER's representative for operation and maintenance of special systems.

## 16100.15 GUARANTEE

A. Furnish to OWNER a formal guarantee covering entire electrical system including equipment provided by Others and installed by electrical Contractor, to be free from defective materials and workmanship for a period of one year after date of acceptance of installation by OWNER. During this period provide all labor and new materials where required to repair or replace all defects to the satisfaction of OWNER at no additional cost.

## 16100.16 FINAL ACCEPTANCE AND WORK CLOSE-OUT

A. Contractor shall inspect the entire electrical installation to assure that all work is completed and all systems are completely operational before calling for a final acceptance of the work. All certificates including acceptance of local inspection authority must be presented at that time.

## 16100.17 BASIC MATERIALS AND METHODS

A. Furnish and install the basic materials, equipment, and devices for the electrical installation as indicated on the drawings and specified herein.

## 16100.18 DELIVERY AND STORAGE OF MATERIALS

A. Make own provisions for the delivery and safe storage of materials and equipment. Make arrangements for introduction into the building of equipment too large to pass through finished openings. Arrange to have materials delivered to the job at such stages of the work as will expedite the work as a whole. Mark materials and store in such a manner as to be easily checked or inspected.

B. Store all materials and equipment out of the weather and mechanically protect from damage, theft, and vandalism.

C. Where materials are indicated to be furnished by others for installation by the electrical contractor, make a complete and careful check of all materials delivered and furnish a receipt acknowledging acceptance, assume full responsibility for the safe-keeping of same until such time as the completed installation has been accepted.

## 16100.19 CLEANING AND PAINTING

A. In general, except where specified otherwise herein, finish painting of conduits, boxes, poles, and equipment where specified to be done in field, shall be done by other trades under another section of the specifications. Protect electrical apparatus, cabinets, boxes, and all other equipment normally furnished on the job with factory applied finish, either painted or galvanized, during storage and installation. Clean all electrical equipment, such as lighting fixtures, lamps, switchboards, panelboards, transformers, etc., of construction dirt, drill chips, debris, dust, paint smears, etc., before completion of work. Clean or touch-up and repair all scores, blemishes, rust spots, etc., to original state of finish.

## 16100.20 TRENCHING AND BACK FILL

A. Provide all trenching and back filling required for electrical work.

## 16100.21 SCOPE OF WORK

A. Work under this Contract comprises the providing of all labor, material, equipment, transportation, scaffolding, rigging, tools and related items and subcontract work for a complete operating electrical system and includes but is not limited to:

Removals, alterations, relocations and connections to existing systems. Temporary light and power. Cutting and patching. Shop drawings. Testing and adjustments. Cleaning and painting. Low Voltage Feeders. Light and Power Distribution Panels.

Motor Branch Circuit Wiring. Lighting Branch Circuit Wiring. Connections to Equipment Furnished by Others. Lighting Fixtures and Lamps. Receiving, handling, setting and connecting all motors, motor driven equipment and controls specified to be provided by the Owner.

Miscellaneous Signal and Control Systems. Plumbing and heating, ventilation and air conditioning wiring, including control wiring. Emergency electric systems, equipment and lighting.

B. Items mentioned in the above schedule are listed for the purpose of describing basic specification contract work and shall not be construed as relieving the Contractor from executing any work described throughout the specification or indicated on drawings because of its detailed omission in this schedule.

## 16100.22 SHOP DRAWINGS AND MANUFACTURER'S SUPERVISION REQUIRED

A. Provide shop drawings for the following prior to fabrication, including all accessories and manufacturer's supervision where indicated:

Electrical Panels. Lighting Fixtures and Lamps.

## 16100.23 GROUNDING

A. Provide all electrical system grounding in accordance with the NEC and any state and local code requirements even if not shown on the drawings. Include additional grounding conductors in non-metallic race ways even though the drawings show only conduit and/or neutral conductors.

B. Receptacles which do not have their mounting legs connected to receptacle grounding point shall be grounded with a green insulated grounding jumper connected to outlet box. Provide a separate ground for each ground conductor with conduit wiring when indicated on drawings or when required by Code.

C. Provide additional grounding where shown on the drawings.

C. Basic bid shall include manufacturers and catalog numbers as shown in these specifications or on the drawings with NO EQUALS unless indicated. Specified materials, equipment, and devices shall be furnished and installed under the contract unless changed by mutual agreement between contractor and Architect and OWNER.

E. Grounding connections: Utilize Burndy "Thermoweld" process for all cable-to-cable, cable-to-steel, and cable-to-ground rod connections.

F. Where a grounding electrode is not available, a 3/4" diameter by 10'-0" long copperweld driven ground rod shall be provided for ground connections. This electrode shall have a resistance to ground not exceeding limits as set by State and Local Codes.

G. When the maximum resistance to ground specified above cannot be achieved, the Contractor shall increase the length and quantity of ground rods to achieve this resistance required. Where increased quantity and length of ground rods do not produce the maximum specified resistance, soil treatment around ground rods shall be provided.

## 16100.24 WIRING-GENERAL

A. All branch circuit wiring run within the building and not exposed to moisture, shall be installed in electrical-metallic tubing. Armored cable "AC" is permitted in concealed walls, partitions, & lights to the extent allowed by code.

B. All branch circuit wiring run outside of the building and exposed to moisture shall be installed in rigid intermediate galvanized conduit and run concealed in new construction, but exposed on existing construction.

C. All wiring for low tension, controls, communications and all other systems shall be in raceway specified for branch circuits unless specifically noted in other sections.

D. All feeder wiring run within the building shall be installed in electrical-metallic tubing. Exceptions are noted on the drawings. Aluminum conduit shall not be installed in concrete containing chloride additives.

E. Flexible metal conduit with approved type fittings may be used in limited lengths of connections to motors and recessed fixtures where it is necessary to provide flexible connections. It may also be used where structural members preclude the use of electrical metallic tubing or conduits.

F. Liquid tight flexible metal conduit in lengths of 3' or less with approved type fittings shall be used for connections to vibrating equipment, motors, and other outlets where wiring will be exposed to weather, moisture or vibrations.

G. Rigid nonmetallic conduit shall not be allowed in structural slabs unless approved by the Structural Engineers.

H. Install raceways from box to box or terminations as shown on the drawings or as required to effect circuiting described with circuit numbers adjacent to equipment. Grouping home runs or combining wires in common raceways will be allowed, with a maximum of four single pole branch circuits in a raceway. Increase wire sizes and raceways where required to avoid loss of ampacity as required by National Electrical Code.

I. Provide "OZ" or equal conduit seals for all raceways, wires or cables passing through floors, walls, walls, or ceilings.

J. All underground wiring and raceways located outside of building shall be a minimum of 24" below finished grade except wiring over 600 volts which shall be 30" below finished grade unless noted otherwise.

K. Exposed wiring within building shall be in E.M.T. with compression fittings. Concealed wiring in walls, partitions and ceilings may be MC for #10 wire and smaller (where allowed by code) and E.M.T. for MC for #10 and larger.

L. Wiring in slab shall be rigid galvanized steel or underfloor duct. Short feed connections to vibrating equipment shall be Sealtite.

M. All wiring shall be copper. Aluminum is not accepted.

## 16100.25 CONDUITS AND RACEWAYS

A. All conduits shall be 3/4" minimum trade size diameter unless specified otherwise.

B. All rigid steel conduits shall have threads pointed with Thomas and Betts copper shield where conduit is exposed to weather or dampness.

C. Raceways shall be capped with bushings during construction and swabbed clean before drawing in wire.

D. Conduits shall be cut square and reamed and all terminals shall be made up tight.

E. Rigid conduit system shall be made up with threaded fittings and couplings.

F. Exposed raceways shall run parallel to or at right angles to surfaces wired over and shall be provided with fittings or standard manufactured elbows.

G. Supports on all raceways shall run parallel to or at right angles to surfaces wired over and shall be spaced at a maximum of 10'. Supports on raceways larger than 2" shall be spaced at a maximum of 6'.

H. Fastenings shall be lead shields, rawl plugs, wood screws, lag bolts, beam clamps or toggle bolts. No wooden plugs will be permitted. No nuts will be permitted.

I. Conduits and hangers shall be installed in a manner not to interfere with the work of other trades. This shall include tropezes hangers to straddle ducts, pipes or other obstructions where necessary. No perforated strip iron will be permitted.

J. Provide a conduit expansion fitting where run crosses an expansion joint in the structure and where conduit is attached to separate structures. Expansion fitting shall be "OZ" type "AX", Thomas and Betts, Steel City or approved equal.

K. Rigid IMC conduit shall be "EIP Uni-Swivel" or approved equal.

L. Rigid heavy-wall galvanized conduit shall be Republic, National, Triangle, or approved equal.

M. Rigid aluminum conduit shall be Alco, Reynolds, Kaiser or approved equal.

N. Rigid non-metallic conduit shall be polyvinyl chloride Schedule 40 heavy wall made by Corlon or approved equal.

O. Surface metal raceways shall be Wemold, Kindorf or approved equal.

P. Flexible metallic conduit shall be Anacoconda, Columbia, General Cable or National. Liquid-tight type shall be Anacoconda, Columbia or American Flexible Conduit Company.

Q. Rigid conduit bushings shall be impact resistant plastic insulating type as made by Thomas & Betts, Appleton, Steel City or approved equal.

R. Electrical-metallic tubing shall be Republic, EIP, National or approved equal with screw-type fittings.

S. All steel conduits in direct contact with earth shall be painted with two (2) coats of black asphalt prior to installation.

T. Provide a continuous red plastic strip 1'-0" above top of all underground conduit.

U. Conduit supports and hangers shall be galvanized by Steel City, Kindorf, or equal.

## 16100.26 OUTLET BOXES

A. Outlet boxes for ceiling fixtures shall be 4" octagonal galvanized steel boxes not less than 1 1/2" deep provided with 3/8" galvanized malleable iron fixture stud.

B. Outlet boxes set in concrete slabs for ceiling fixtures shall be 4" octagonal galvanized steel boxes of sufficient depth to have conduit entering from the sides clear of reinforcing steel. Box shall have 3/8" galvanized malleable iron fixture stud.

C. Concealed outlet boxes for wall brackets, switches and receptacles shall be 4" square galvanized steel boxes 1 1/2" deep with raised plaster covers of sufficient depth to accommodate wall surface material.

D. Exposed outlet boxes in dry locations for switches and receptacles shall be 4" square galvanized steel boxes not less than 1 1/2" deep with raised covers with rounded corners. If rounded corner covers cannot be provided in proper number of gangs, boxes shall be Wemold or cast F.S. boxes so that corners of flat plates or covers do not project over box edge.

E. Exposed outlet boxes in damp locations or where exposed to weather shall be cast galvanized steel plates or covers.

F. Outlet boxes for switches and receptacles in tile or other hollow masonry construction shall be 3 1/2" deep galvanized changeable switch boxes. Through-the-wall boxes shall not be used.

G. Concealed outlet boxes shall have all unused knockouts closed with snap-in plate and local code requirements even if not shown on the drawings. Include additional grounding conductors in non-metallic race ways even though the drawings show only conduit and/or neutral conductors.

H. Pressed steel boxes shall be Steel City, Raco, Appleton, General Electric, or Thomas and Betts.

I. Cast boxes shall be Crouse Hinds, Flye-National or General Electric.

J. All outlet boxes shall be of approved size for the number of wires to be accommodated according to NEC requirements.

K. 16100.27 PULL OR JUNCTION BOXES AND WIRING TROUGHS

A. Furnish and install pull or junction boxes where indicated or where necessary to facilitate pulling of conductors. All boxes shall be sized according to NEC requirements.

B. Boxes shall be formed of hot dipped galvanized sheet steel except where specified otherwise.

C. Boxes installed in wet areas or where exposed to weather shall be cast aluminum with cast bolted covers.

D. Provide wiring troughs where indicated or where necessary to neatly interconnect safety switches, starters, relays, controls, etc. Troughs shall be Square D, or approved equal.

E. All covers on boxes and troughs shall be screw cover type, or combination hinge and screw type.

## 16100.28 WIRES AND CABLES – 600 VOLT INSULATION

A. Wiring shall be type THWN or THH unless otherwise noted below or on the drawings; for conductors larger than #6 AWG, type XHHW will also be accepted.

B. MC cable shall be UL labeled type "MC" two, three, or four conductor type THWN.

C. Cables in high temperature areas shall have an insulation type suitable for the temperature cables used in spaces for environmental air shall conform with applicable NEC requirements.

D. All wire and cable conductors shall be copper with insulation rated 600 volts. Conductors #10 and smaller shall be solid; larger conductors shall be stranded.

E. Branch circuits for power and lighting shall be not less than #12 AWG or as noted. Wires to be sized for appropriate voltage drop.

F. Fixture wires shall be not less than #14 AWG type SFF-2 and flexible cords shall be not less than #14 type S.

G. Control wiring shall be not less than #14 AWG, unless otherwise noted.

H. Color coding shall be used throughout the system using black, red and blue for phase wires, white for grounded neutral wires and green for equipment grounding conductors. Electrical Contractor shall comply with applicable of the NEC.

I. Where wire or cable is installed in areas with an ambient temperature in excess of 86 degrees F, its current carrying capacity shall be decreased in accordance with the NEC. The wire and cable sizes shall be increased to obtain a current carrying capacity equal to or greater than the trip or fuse rating of the protective device protecting the wire or cable.

J. Copper conductor wires and cables shall be as manufactured by Anacoconda, General Cable, General Electric, Hatfield Wire and Cable Company, Phelps-Dodge, Essex or Kerite.

## 16100.29 WIRE SPLICING AND TERMINATING OF 600 VOLT CONDUCTORS

A. Splices of wires up to 3 #6 conductors shall be made with pressure type connectors. Wire nuts or screw caps will not be permitted. Splices above this size shall be made with approved mechanical connectors, Scotchfill and Scotch #88 vinyl tape.

B. Splices in cables #6 gage and larger shall be made with cast sleeve type connectors with set screws, Scotchfill and Scotch #88 vinyl tape.

C. Copper conductor terminations shall be made with mechanical, set screw, pressed copper lugs. Two bolt lugs shall be used if necessary to obtain sufficient contact surface of 200 ampere per square inch capacity, to maintain rigidity in terminating large cables.

D. Small wire splices shall be made with Thomas and Betts Wire nuts or approved equal connectors.

E. Large wire splices shall be made with "OZ" type XW and "OZ" type XTP, or approved equal connectors.

F. Terminal lugs shall be pressed copper screw lugs as made by Mac or equal.

## 16100.30 WIRING DEVICES AND PLATES

A. Provide at every indicated outlet the proper devices and plates as specified herein or on the drawings. Where more than one device is indicated in one location, they shall be ganged together in one box and under one plate as required.

B. Wall plates finish to be selected by OWNER.

C. Devices listed are to establish type, color, operation and capacity. Manufacturers shall be Hubbell, Pass and Seymour, or Arrow Hart.

## 16100.31 WIRING IN CONNECTION WITH OTHER TRADES AND OWNER'S EQUIPMENT

A. The Mechanical Contractors or OWNER will provide motor drives. Motorized equipment (except control units), electric heaters and electric controls attached to pipes and/or equipment shall be installed by the Mechanical Contractor who provides this item. All remote buttons, relays, control cabinets, control motors, starters, IMCC, etc. and other electrical equipment not shown or specified to be supplied by the Electrical Contractor shall be turned over to the Electrical Contractor for installation.

B. The plans and specifications as prepared for bidding purposes indicate the work to be done, but are not detailed shop drawings and details of connections will not be available until shop drawings and other pertinent data is supplied by the Mechanical Contractors and Manufacturers of equipment. In submitting a bid, the Electrical Contractor guarantees he has performed similar work and is familiar with the type and scope of work to be done, as all electrical work required to properly operate this equipment, line connections, control connections, installation of starters, remote starting buttons, control motors, relays, wiring interconnections and all associated work shall be provided by the Electrical Contractor.

C. This Contractor shall carefully review the plans and specifications of the other trades, (Kitchen Equipment Contractors), (Heating, Ventilating, Air Conditioning Contractors) and (Plumbing Contractors), and other equipment requiring electrical connections, as all electrical work required for the operation of this equipment not specified as being furnished by others shall be the responsibility of this Contractor.

D. Detailed wiring diagrams, instructions and shop drawings of equipment will be provided to this Contractor by other trades, or by OWNER.

E. Should operation faults be found in the interconnecting of mechanical and electrical equipment, the fault when determined shall be attributed to the Contractor responsible for same. In the event of dispute, the Engineer shall make the final decision as to responsibility for correction. Improper wiring diagrams or shop drawings shall not be the responsibility of the Electrical Contractor.

F. For the nature and extent of control wiring involved, refer to drawings and specifications of other trades, and review the equipment to be provided by the OWNER. Any control wiring diagrams shown are for estimating purposes only and must be verified by shop drawings before proceeding with the installation.

G. Motor starters, manual and magnetic, and starter control buttons or switches shall be provided by (other) contractors except as noted on the Electrical Drawings and installed by this Contractor.

H. This Contractor shall receive, place and connect Owner's equipment requiring electrical connections, unless specified otherwise.

I. This Contractor shall furnish all disconnect switches for motors and equipment as required by Code. Lock-out type buttons shall not be permitted. Provide fused disconnect switches wherever manufacturer requires them.

## 16100.32 LAMPS AND FIXTURES

A. Provide fixtures as shown on the fixture schedule and described below. The fixtures shall be supplied complete with lamps and any auxiliary devices necessary for their function. Fixtures shall be securely fastened to the ceiling structure as well as the outlet box where necessary to maintain proper alignment.

B. This Contractor shall provide all stems, rods, supports, hang straight swivels, chain or angle iron bracing, etc., of the proper length and size as required to install fixtures in a neat and secure manner in their proper positions.

C. Regular fixture stem and support sets shall be used in all cases unless specified otherwise. A minimum of one stem or support shall be furnished for each four (4') feet of fixture chassis except where the chassis is manufactured in eight (8') foot sections, in which case a stem or support may be placed at eight (8') foot intervals. Provide clips for lay-in fixtures in accordance with Article 410-16C of the NEC.

D. All ballasts for fluorescent fixtures shall be ETL and UL listed, shall be electronic, high frequency, high light output, unless specified otherwise, and shall be equipped with an internal, thermal protection system. Ballasts shall be Class P in accordance with UL requirements. Provide low temperature (-20 DEG. C) ballasts in all HID and fluorescent fixtures mounted outside of building, unless specified otherwise. Ballasts shall be Advance with less than 20 % total harmonic distortion (THD). Indicate ballasts as specified on drawings.

E. Ballast shall have the following minimum sound ratings:

Trigger Start - A  
Preheat - A  
16100.27 PULL OR JUNCTION BOXES AND WIRING TROUGHS  
Rapid Start - 430 ma - A  
Slimline - B  
High Output - 800 ma - B  
Power Groove - 1500 ma - C

F. Fixtures shall be designed and applied such that the ballast/fixture combination with all units in place in the room or space shall have an audible sound.

G. Fixture/Ballast combination shall be designed to limit maximum ballast case temperature to 90 degrees C.

H. Lighting fixtures shall conform to Articles 410 and 300-22 of the NEC.

I. This Contractor shall verify final types of ceiling construction for each fixture and shall provide plaster frames, special supports or bracing as required for the particular ceiling.

J. This provision shall supersede and take precedence over any type mounting detailed on the drawings, or the drawings schedules, or further delineated in these specifications. No additional compensation will be allowed for failure to observe this provision.

K. Fixture catalog numbers may be shown for four (4') foot or other modular sections. This represents the series type required, not necessarily the correct length. The plans show the actual length of units or runs required. Fixture catalog numbers or part numbers for accessories are to be interpreted as requiring a complete and operating fixture unit with all such intended accessories, including mounting, guards, lenses, supports, plaster frames, bodies, lamps, etc.