DIVISION 16 - ELECTRICAL

SECTION 16A - GENERAL:

1. The work shall include furnishing and installing all electrical work, including final connections to all devices and placing them in service. All work shall conform to local, state, and national codes as interpreted by the authorities having jurisdiction. All materials shall be UL labeled and listed.

2. Comply with requirements of the 1996 National Electrical Code in the construction and installation of all work.

3. All major electrical service equipment specified herein shall be Square D. This includes panelboards, disconnect switches and circuit breakers. Obtain Owner's approval for substitutions.

4. All equipment shall be installed in a location and manner that shall allow for convenient access for maintenance and inspection. Access doors and panels in walls and ceilings shall be provided as required for concealed equipment, controls and boxes.

5. Make all payments for fees, permits and deposits for electrical work. Coordinate with local electrical utility to provide all equipment and pay all costs required to extend underground service from power company facilities to building including meter bases and conduit for meter conductors, CT meter cabinets, and other equipment deemed necessary by the utility company.

SECTION 16B - MATERIALS:

16B.1 CONDUITS

1.1 Underground Plastic Conduit: Type 40, heavy wall, high impact rigid virgin polyvinyl chloride (PVC) conduit and fittings, conforming to NEMA Publications TC2 and TC3 and UL listed for direct burial use: Carlon or equivalent. Type 80 PVC to be used under driveways.

1.2 Rigid Steel Conduit: Rigid, threaded, thick-walled: galvanized inside and outside or galvanized outside with a protective coating inside: UL listed and labeled according to Standard UL6; conforming to ANSI Standard C80.1; Pittsburg, Republic Steel, Robroy or Allied.

1.3 Electrical Metallic Tubing (EMT): Steel tubing, galvanized outside and provided with a slick corrosion resistant interior coating; UL listed and labeled according to Standard 797; conforming to ANSI Standard C80.3; Pittsburg, Republic Steel, Robroy or Allied.

1.4 Flexible Metal Conduit: Spirally wound with hot dip galvanized steel strips (commercial Greenfield); conforming to UL Standard UL1 and UL listed and labeled; Triangle Conduit and Cable Company, or equivalent.

1.5 Liquidtight Flexible Metal Conduit; Spirally wound, galvanized steel strips, as for flexible metal conduit; with polyvinyl chloride cover extruded over the exterior to make conduit liquidtight; UL listed, Electri-flex type "LA" or equivalent.

16B.2 CONDUIT FITTINGS

2.1 Couplings and Terminations for Rigid Steel conduit: Factory made steel threaded couplings; bushing at all boxes and cabinets, with locknuts inside and outside box or cabinet.

2.2 Couplings and Terminations for Electrical Metallic Tubing: Join lengths of EMT with steel, compression type couplings and connectors here possible. Otherwise use set-screw fittings.

2.3 Couplings and Terminations for Flexible Metal Conduit: T&B 440 Series couplings at connections between flexible and rigid conduit; T&B 3110 or 3130 Series nylon insulated throat, steel connectors at box or cabinet terminations.

16B.3 OUTLET BOXES

3.1 Sheet Steel Boxes: Sheet steel not lighter than No. 14 gauge, galvanized after fabrication: Raco, Steel City or Appleton.

3.2 Cast Metal Boxes: Cast iron or Cast alloy with threaded hubs: Crouse-Hinds, Appleton or Pyle National.

16B.4 PULL BOXES AND JUNCTION BOXES

4.1 Sheet steel, galvanized inside and outside, with galvanized covers.

4.2 Small boxes: For boxes where the volume required is not over 100 cubic inches, use standard outlet boxes.

4.3 Larger Boxes: For boxes where the volume required is over 100 cubic inches, use cabinets as specified for panelboard cabinets with covers of same gauge as boxes, secured with corrosion resistant bolts or screws.

16B.5 CONDUCTORS (600 VOLTS AND UNDER)

5.1 Type: Soft drawn, annealed copper, UL listed, rated at 600 volts, Okonite, Triange, Anaconda or Simplex No. 8 and larger shall be stranded: No. 10 and smaller may be solid.

5.2 Insulation: Branch circuits shall have type THHN insulation. Service feeders shall be type THHN or THWN. Feeder circuits shall be Type THHN.

16B.6 JOINTS AND SPLICES

6.1 Stranded Copper Conductors: UL approved solderless bolted pressure connectors or Thomas and Betts Series 54000 compression connectors. All connectors shall be properly sized to match conductor sizes. All compression connectors shall be applied with properly sized dies and tools.

6.2 Solid Copper Conductors: UL approved solderless bolted pressure connectors: or UL approved electrical spring connectors of "Scotchlok", Ideal or T&B "Piggy" make.

SECTION 16C - COLOR CODING:

1. Phase conductors shall be black, red, and blue for phases A, B, and C respectively in the 208 volt system.

2. Neutral conductors shall be white or gray. Grounding conductors shall be green.

3. Switch legs shall be black with white, red with white or blue with white depending on phase.

4. All wiring No. 8 and larger shall be black and be marked with color banding tape as specified. All phase conductors, neutral and equipment ground conductors shall be marked with colored tape. Apply marking at each termination and every four feet of wiring in raceways.

SECTION 16D - WIRING DEVICES:

16D.1 WALL SWITCHES

DEVICE	CATALOG NO.	
1.1 Single Pole Wall Switch	Hubbell	1203-I
1.2 Three-way Wall Switch	Hubbell	1203-I

16D.2 RECEPTACLES

2.1 Receptacle, 20 Ampere, 125 Volt, 2 Pole, 3 Wire Grounding Duplex: Hubbell No. 5362 or 5262-I (NEMA 5-15R).

2.2 Receptacle, 15 Ampere, 125 Volt, 2 Pole, 3 Wire Grounding Duplex with Self-Contained Ground Fault Circuit Interrupter: Hubbell No. GH-5262.

2.3 Outdoor Receptacle with Self-Contained Ground Fault Circuit Interrupter: Hubbell No. GF-5262 in FS or FD cast box with gasketed lift covers.

16D.3 COVERPLATES

3.1 Hubbell "P" line nylon wall plates shall be used except in unfinished or machinery spaces, where plates shall be galvanized steel if surface mounted. All switches controlling motorized equipment shall have engraved nameplates. Wall plates may be stainless steel at owner's option.

3.2 Provide engraved coverplates as required by Owner.

SECTION 16E - PANELBOARDS:

16E.1 MATERIALS

1. Panelboard Cabinets: Furnish and install cabinets to serve the various panelboards, of sizes as required to house the panelboards. Cabinets shall be rigidly constructed of sheet steel of gauges conforming to Underwriters' Laboratories Inc. requirements; corners over-lapped or welded; edges turned over to receive trim.

2. Cabinet Fronts: Cut from single sheet of not less than No. 12 gauge cold-rolled sheet steel; fastened in place by adjustable trim clamps which will allow plumbing; same size as the cabinet box if surface mounted; size to overlap the box a minimum of 3/4" on all sides if flush mounted. Provide each door with a substantial flush, cylinder tumbler lock and catch. On doors more than 48" high provide a combination three point catch and lock with T-handle. Provide each lock with two keys, with all locks keyed alike.

3. Finish: All back boxes galvanized; all exposed metal, including fronts, primed and finished in gray lacquer.

4. Where a circuit protective device is scheduled as a "spare", provide the device complete for operation. Where such a device is scheduled as a "space" or "space only", provide proper space and all necessary connectors for future installation of the size of device scheduled. Where a breaker or switch is scheduled to serve a "future" load, provide the device complete for operation.

5. All circuit breakers shall be quick make, quick break, trip free, thermal magnetic, indicating type unless noted otherwise. Branch circuit breakers shall be fully interchangeable without disturbing adjacent units.

6. Connect all circuit interrupting devices with sequence phasing.

7. Provide each panelboard with a neatly typewritten directory of circuits mounted in a cardholder on the inside of the panelboard cabinet. Cover directory with transparent sheet plastic.

8. All panelboards shall be listed by Underwriters' Laboratories Inc.

9. Provide each panelboard with a factory engraved nameplate which shall identify the panelboard name.

16E.2 LIGHTING AND APPLIANCE PANELBOARDS:

1. Panelboards shall have the number and size of bolted-in circuit breakers as scheduled. Panels shall be Square D, type NQOD with bolt-on breakers as required for the interrupting ratings schedules or equivalent.

SECTION 16F - LIGHTING CONTACTORS:

1. Electrically held with 120 volt coil in NEMA I Enclosure.

2. Allen Bradley, ASCO, Square D.

3. Control for contractor shall be photocell and optionally, remote switch mounted at owner specified location.

SECTION 16G - INTERIOR LIGHTING FIXTURES:

16G.1 MATERIALS

1. Provide and install a lighting fixture on each and every lighting outlet shown. Furnish fixtures in accordance with the designations on the drawings and as specified herein. All features specified or scheduled for fixtures shall be provided, even if the catalog number given in the specifications or schedule lacks the required numerals, prefixes or suffixes corresponding to the features called for.

2. All lighting fixtures shall bear the label Underwriters' Laboratories Inc.

3. Provide electronic ballasts and T-8 lamps for all fluorescent fixtures where possible.

4. Fixtures shall comply with ANSI 132.1.

16G.2 BALLASTS

1. Ballasts shall have a minimum power factor of 85 % and total harmonic distortion not to exceed 16%.

2. All rapid start ballasts installed in an interior space shall be energy saving. The ballast shall be high power factor, UL labeled, with automatic reset features and "A" sound rating. Ballasts mounted outside shall be rated for full operation at -20 Degrees F.

16G.3 LAMPS

1. Fully equip each fixture with a full set of new lamps at the completion and acceptance of the work; lamps shall be General Electric, Westing house of Sylvania. Incandescent lamps shall be inside frosted unless specified or recommended otherwise by the fixture manufacturer. Fluorescent lamps shall be 3500 degree k lamps for interior fixtures.

SECTION 16H - MOTORS:

1. All motors will, unless otherwise noted, be furnished under other Divisions of the specifications, or will be furnished by the Owner. Where motors are mounted integrally with items of equipment, they will be erected in place with such equipment ready for equipment ready for electrical connection.

SECTION 16I - MOTOR STARTERS:

1. All motor starters (controllers) will, unless otherwise noted, be furnished under other divisions of the specifications, or will be furnished by the Owner.

2. Install under this Division, including supporting structures, all motor starters and control equipment which are not shipped integrally mounted with the controlled equipment. Provide and install all wiring of every character, for both power and control, except that which is factory installed and shipped as an integral part of assembled equipment.

SECTION 16J - DISCONNECT SWITCHES:

1. Disconnecting switches shall be manufactured by Square D. Switches shall be heavy duty, enclosed type, rated for 250 volts. Switches used as service switches shall bear a UL service entrance label and nameplate shall so indicate.

2. Fused switches shall have rejection type fuseholders. Fuses for power equipment shall be UL RK-5 dual element, time delay, current limiting, Buss FRN-R/FRS-R equivalent.

SECTION 16K - EXECUTION:

16K.1 EXCAVATION

1.1 Perform all excavation work required in connection with the installation of the work under this Division. After the electrical work has been installed, tested and approved, backfill all sidewalks, streets and other pavement and repairing the openings in them to return to the surface to approximately its original condition.

VOICE:806.780.7475
FAX: 806.780.0129
CELL: 806.777.7775
EMAIL:mtspe@door.net
STRAHAN ENGINEERING
4601 50TH STREET SUITE 212
LUBBOCK, TEXAS 79414

08.10.00
STATE OF TEXAS
MICHAEL T. STRAHAN
84881
LICENSED
PROFESSIONAL ENGINEER

R-F
ROGERS - FORD
ARCHITECTURE - INTERIOR DESIGN
2616 THOMAS AVENUE
DALLAS, TEXAS 75204
TELEPHONE (214) 871-9388
FAX (214) 871-3155

LONE STAR BANK
Belwood Parkway East
at Beltline Road
Addison, TX

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ELECTRICAL SPECIFICATIONS