

16140-BOXES

1.1 MATERIALS AND APPLICATIONS:

- a. Unless specifically noted or approved otherwise, boxes shall be of zinc coated steel or cast ferrous alloy as manufactured by Steel City, Crown, Crouse-Hinds, Aegleon, or approved equal.
b. Unless otherwise indicated, for exposed work on the interior of the building boxes shall be of cast metal with threaded conduit hubs and gasketed covers, or of zinc coated sheet steel of NEC gauge and size with screw fastener gasketed covers and threaded conduit tube of zinc coated malleable iron and no knockouts or recessed openings. Cover screws shall be stainless steel.
c. For exposed work, Equipment Rooms, or, in other dry areas, 8 feet or more above a floor or platform, boxes 5" square and larger shall be NEC gauge and size of zinc coated sheet steel, 4" octagonal, 4" square and 4-1/16" square "knockout" boxes shall be of zinc coated steel, NEC gauge and size. Box extensions are not permitted on exposed "knockout" boxes, and covers shall be of the raised surface type. "Handy" boxes are not permitted.

2.1 Recessed Outlet Pole-Thru Devices:

- 1. Provide BATCF for pole-thru devices for furniture-feed application as manufactured by Legrand/Wiremold or approved equal.
2. Classification and Use: Pole-thru device shall have been examined and tested by Underwriters Laboratories Inc. to comply with UL 814A section UL 814C and bear the UL Listing Mark. Pole-thru device shall also have been tested by UL and classified for fire resistance and bear the UL Classification Mark. The pole-thru device shall conform to the standards set in the National Electrical Code, Section 300-21. Pole-thru devices shall be classified for use in 1-, 1-1/2-, or 2-hour rated floors employing unprotected shaft floor units and concrete toppings (2000 Series designs), or concrete floors with suspended ceilings. Fire resistant designs with suspended ceilings shall have provisions for accessibility in the ceiling below the pole-thru device fittings. Pole-thru device shall have been evaluated by UL to meet the applicable safety standards for arcing safety enclosure when used on life, terrace, wood, and carpet covered floors. Pole-thru device shall be suitable for use in air handling plenum spaces in accordance with Section 300-22C of the National Electrical Code.
3. GAFP Pole-Thru Assembly: Pole-thru device assemblies shall consist of an insert and an activation cover. Assembly length: 18-3/4 inches (475mm). Insert body shall have the necessary elements to provide complete separation of power and communication services. Provide two (2) channels that allow up to 10 #12 AWG conductors in the power channel and 28 Category 5A data cables in the communication channel. Body consists of an impregnated fibreglass material to maintain the rating of the floor slab. Hinged interlocked metal secondary in place in insert body. Intumescent material will not have to be adjusted to maintain fire rating of the unit and the floor slab. Provide insert with a retaining feature to hold the pole-thru device in the floor slab without additional fasteners. Pole-thru insert shall also consist of a 3/4-inch trade size conduit stub that is connected to the insert body and a 2x4 (4 in x 402mm) stamped steel junction box for wire splicing and connections. Stamped steel junction box shall also contain the means necessary to electrically ground the pole-thru device to the system ground.
4. Activation cover shall be manufactured of die-cast aluminum alloy, finished in powder-coated [gray] [black] [brass] [nickel] [bronze] as selected by the Architect. Provide with two (2) gaskets (one (1) for carpet and one (1) for tile) to go under the trim flange to maintain scrub water tightness. Activation cover is 7-3/4 inches (195mm) in diameter. Provide cover with one (1) 3/4-inch (19.05mm) trade size opening for power and one (1) 1-1/4-inch (31.75mm) trade size opening for communications. Provide surface mounted activation cover that accommodates a carpet floor finish.

16180-WIRING DEVICES

1.1 MANUFACTURERS:

- d. Wiring devices and device plates shall be manufactured by General Electric, Hubbell, Bryant, Arrow Hart, Pass and Seymour, Leviton, or Eagle.

1.2 DEVICES AND PLATES - GENERAL:

- a. Unless otherwise indicated or directed, devices shall be gray in color.
b. Unless otherwise indicated, plates for flush outlets shall be of #302 stainless steel. Those for surface cast boxes shall be of steel, of shape and finish to match the box. Screws shall be steel to match the plate.
c. Each device (including each switch) shall be equipped with a 1/2-inch green grounding screw for grounding the device and plate to the outlet box and to the equipment grounding conductor run with the circuit conductors. "Self-Grounding" type mounting screws will not be accepted as the device grounding method.

1.3 SWITCHES:

- a. Switches used for lighting control shall be rated 20 amps, 120-277 VAC, side wired, Pass and Seymour 521-G series.
b. Switches used for disconnecting small single-phase motors and appliances shall be rated 20 or 30 amps to match the branch circuit rating and comply with their horsepower ratings, 120-277 VAC, side wired, Pass and Seymour 521-G series and 30 ACI series.

1.4 RECEPTACLES:

- a. Unless otherwise indicated or required, receptacles shall be the duplex type, side and back wired, with nylon face. On circuits supplying two or more such receptacles, they shall be rated 15 amps, 125 volts, NEMA 5-15R, Duplex receptacles on individual circuits shall be rated 20 amps, 125 volts, NEMA 5-20R.
b. Where no other features are indicated on the drawings provide Hubbell 5292 and 5352 series for 5-15R and 5-20R respectively.
c. Where indicated on the drawings provide Ground Fault Circuit Interrupter receptacles, Hubbell GF5282 and GF3382 series for 5-15R and 5-20R respectively.

16180-RACEWAY AND OUTLET SYSTEMS

1.1 SCOPE:

- a. Contractor shall furnish and install systems of raceways, outlet boxes, equipment boards, and cabinets, as indicated on the drawings and as herein specified to accommodate the installation by others of wiring and equipment.

2.1 MATERIALS:

- a. Raceways and boxes, shall be in compliance with the relevant sections of these specifications.
b. Wall outlets shall consist of standard 4" x 4" x 2-1/2" outlet boxes with single device trays. Trim plates shall be blank to match wiring device trim plates, unless otherwise indicated.
c. Special outlets including floor outlets shall be as noted on the drawings.
d. Cabling shall be the aluminum ladder type with an inside width of 12 inches or 18 inches as is indicated on the drawings. Cable height shall be 6 inches with knockout holes 1/2 inches on all trays. Rung spacing shall be 15 inches. Side rails, rungs and endor plates shall be of aluminum alloy 6061-T6. Where indicated, cable shall be filled with a fire-retardant gel. Provide with solid bottom. Tray carrying capacity shall meet NEMA class 125 with a safety factor of 1.5. Tray shall comply with the requirements of NEMA VE1. Provide all necessary fittings, curved sections, splice plates, hardware and accessories as required for a proper installation as shown on the drawings. All equipment where there is no room for cable including penetrations through firewalls, transitions to a different tray size, etc., equipment ground bonding jumpers a size and in accordance with NEC 250, shall be provided. For penetrations through firewalls, provide sleeves as indicated or two 3 inch sleeves, minimum. Conduit terminations at cable tray shall be in accordance with the manufacturer's instructions for cable tray with clamps or other terminate conductors with plastic bushings.
e. Equipment boards shall be of size noted or shown on the drawings, and shall be constructed of 3/4" plywood, with finish grade, and with a 1/2" thick metal face. Paint board with gray fire-retardant paint.

3.1 COORDINATION:

- a. Contractor shall fully coordinate with the telephone and cable installers, and other service providers, for raceways, backboards, and grounding conditions in accordance with their requirements.
b. Contractor shall fully coordinate with other installers of telecommunications and shall install raceways, outlets, cabinets, and backboards in accordance with their requirements.

3.2 INSTALLATION:

- a. Install pull boxes in accordance with the manufacturer's instructions. Pull boxes shall be two (2) square boxes (or equivalent) and to 150 feet in length, unless other arrangements are approved by the wiring installers.
b. Leave raceways with 100' of nylon pull cord.
c. Install raceways and boxes in accordance with relevant sections of these specifications.
d. Unless specifically noted otherwise, provide an individual 1" conduit from each indicated outlet to the nearest cable tray, equipment cable tray, cabinet or terminal board for the system involved.
e. Provide all conduits not terminating on boxes with plastic bushings.
f. At the equipment terminal board, terminate all conduits with plastic bushings.

16190-MISCELLANEOUS MATERIALS

2.1 PROGRAMMABLE LIGHT SWITCHES:

- a. The digital time switch shall be programmable to turn lights off after a preset time.
b. Time switch shall be a completely self-contained control system. It shall have a ground wire and ground strap for safety. Switching mechanism shall be a latching air gap relay.
c. Time switch shall be compatible with all electronic ballasts, motor loads, compact fluorescent and inductive loads.
d. Time switch shall operate at universal voltages of 100-300 VAC, 50/60 Hz.
e. Time switch shall have no minimum load requirement and shall be capable of controlling 0 to 800 watt incandescent, fluorescent @ 100/120 VAC, 50/60 Hz, 0 to 1200 watts fluorescent @ 230/277 VAC, 50/60 Hz, 1/8 hp @ 125 VAC.
f. Time switch shall allow manual overriding of the preset time-out period.
g. Time switch shall have the option for a one second light flash warning at five minutes before the timer runs out and twice when the countdown reaches one minute (when used to control lighting loads).
h. Time switch shall have the option for a beep warning that shall sound every five seconds once the time switch countdown reaches one minute.
i. Time switch shall have manual feature for timer reset where preading the ON/OFF switch for more than 2 seconds resets the timer to the programmed time-out period.
j. Time switch shall have an electromechanical tactile Liquid Crystal Display that shows the timer's countdown.
k. Time-out period shall be adjustable increments of 5 minutes from 5 minutes to 1 hour, and in increments of 15 minutes from 1 hour to 12 hours.
l. Time switch shall be capable of operating as an ON/OFF switch.
m. The time switch shall have a 100% OFF override switch with no leakage current to the load.
n. In the event there is an open circuit in the AC line such as a ballast or lamp failure, the time switch shall automatically switch to OFF mode.
o. Time switch shall have 5 year warranty and shall be UL and OAL listed.

2.2 OCCUPANCY SENSORS:

- a. Occupancy sensors shall be provided where indicated on the drawings. Sensors shall be the dual technology type suitable for sensing both passive infrared and ultrasonic waves type, complete with a self-contained power/switch unit to avoid the need for low-voltage wiring to a remote sensor. Each sensor shall have a time delay circuit adjustable from 8 - 15 minutes with a shortened 30 second time delay feature for set-up purposes and a manual time delay bypass feature. In addition, each sensor shall have a LED walk size indicator for set-up purposes.
b. The power/switch pack shall consist of a control transformer and rectifier circuit and a relay with contacts rated 277 VAC, 20 Amp, 480V AC.
c. The sensor shall be sensitive to 9 - 10 micrometer wave length infrared heatwaves.
d. Upon detection of the heatwaves or motion, the relay contacts shall instantly close to activate the room lighting. The contacts shall remain closed until motion or heatwaves is sensed for the full length of time set by the adjustable time delay circuit.
e. The sensor shall be ceiling mounted and located as recommended by the manufacturer. The sensor shall be provided complete with all necessary hardware, including electrical boxes and covers.
f. Unless otherwise indicated, all fluorescent lighting within the room where the occupancy sensor is located shall be controlled by the occupancy sensor.
g. Occupancy sensors shall provide 98% coverage of space where shown. Provide additional sensors as required to provide 98% coverage.
h. Submit layout of all occupancy sensors specific for this project as determined by the sensor manufacturer prior to installation of sensors.

16400-SECONDARY DISTRIBUTION EQUIPMENT

1.1 OVERCURRENT PROTECTION DEVICES:

- a. Unless otherwise indicated, circuit breakers shall be provided as the over-current protection devices for services, separately derived systems, feeders, and branch circuits. Fuses may be used only where indicated on the drawings, or required by the manufacturer for equipment connected, or specified herein.
b. Molded-case and sub-miniature circuit breakers shall be the attic or thermal-magnetic type, quick-make and quick-break for manual and automatic operation. Multi-pole breakers shall be common trip. Circuit breakers shall be listed in place where possible. Thermal-magnetic breakers shall be cataloged at 40°C or ambient compensated. Ampere ratings, frame sizes, and short circuit ratings shall be as indicated on the drawings. Series ratings may be applied only where specifically indicated on the drawings. Individual enclosures shall be NEMA 1 indoors, 3R outdoors, unless otherwise indicated. Other circuit breakers shall be suitable for installation in Panelboards as here-in after specified.
c. Single-pole 15 and 20 amp circuit breakers shall be SWD rated.
d. Fuses shall be the non-renewable, time delay, cartridge type, UL Class RK5 unless otherwise indicated; for installation in Safety Switches.

1.2 SWITCHING EQUIPMENT:

- a. Fusible switches shall be incorporated into Safety Switches, as hereinafter specified. Manual operation shall be quick-make and quick-break. Fuse holders shall be the Class R type, unless otherwise indicated.
b. Safety Switches shall be the NEMA heavy duty type, horsepower rated, with interlocked covers, non-fusible except where fused switches are indicated or fuses are required. Switch mechanisms shall be quick-make and quick-break. Enclosures shall be NEMA 1 indoors, NEMA 3R outdoors unless otherwise indicated. Fuse holders, where required, shall be as specified above for fusible switches.
c. Switches for disconnecting small single-phase motors and appliances shall comply with SECTION 16180 WIRING DEVICES.

2.1 INSTALLATION:

- a. Distribution Equipment shall be installed in strict accordance with the manufacturer's instructions for handling, support, connections, assembly, protection, energization, adjustment, and similar procedures.
b. Fastening methods shall comply with SECTION 16100 BASIC MATERIALS AND METHODS.
c. Floor mounted equipment such as Transformers shall be provided with 4" high concrete pads and shall be secure to the concrete pad. Pads shall have a 3/4 inch chamber on each accessible side.
d. Equipment interiors shall be thoroughly cleaned of dust, dirt, trash, and other foreign material prior to energization of the equipment.
e. Upon completion of the project, furnish to the Owner one complete set of replacement fuses, consisting of three fuses of each type and rating used.
f. Directory cards for Panelboards shall be neatly filed in with a typewriter to indicate the type and location of the load on each circuit or feeder.

PANELBOARDS

1.1 SUBMITTALS:

- a. Submit for approval panelboard shop drawings which include as a minimum the following information:
1. Cabinet dimensions.
2. Mounting requirements.
3. Buswork arrangement.
4. Circuit breaker arrangement.
5. Accessories.

2.1 BRANCH CIRCUIT PANELBOARDS:

- a. Equipment shall be built to NEMA Standard PB-1, UL Standards UL30 and UL67, and NEC requirements.
b. Panelboard backboxes shall be constructed of galvanized sheet steel and shall be securely fabricated with screws, bolts, rivets, or by welding. Backboxes shall be a minimum 20" wide and 5-3/4" deep, unless noted otherwise, and heights shall not exceed 72" overall. Top or bottom gutter space shall be increased 6" where feeder loops through panel. End plate shall be applied without knockouts.
c. Covers shall be constructed of high grade flat sheet steel with:
1. Door-in-door construction shall be provided. The inside hinge door shall allow access to device handles only. Door shall close flush with cover and adjacent panels shall also close flush with inside type. The outer hinged door shall allow access to wiring gutter.
2. A flush latch and tumblers type lock, no panel door may be held closed without being locked. All such locks shall be keyed alike. Furnish to the lock two keys with each lock, or a total of 10 keys for the project.
3. Four or more cover fasteners of a type which will permit mounting slabs on box. Cover shall also have inside support slabs rest on lower edge of cover when being fastened. For flush mounted panelboards, cover fastening hardware shall be concealed behind the hinged door.
d. Panelboard phase and neutral bus barwork shall be of copper. A copper ground bus shall be provided in each panel.
e. Minimum short circuit rating of any panelboard assembly shall be 10,000A. Furnish panelboards with interrupting capacity not less than that required by specification of circuit breakers with higher interrupting capacity.
f. Ampacity of main shall be equal to, or greater than, the ampacity of the feeder unless otherwise indicated.
g. Where drawings schedules indicate spaces for additional bus bars, bus breakers, furnish all necessary hardware, bus, brackets, hardware, and removable block covers.
h. Breakers in panelboards shall be physically arranged in locations which permit schedules on the drawings, where possible. They shall be connected to the phases as shown.
i. Unless otherwise indicated, all equipment shall be suitable for panelboard type equipment, circuit breakers shall be of the bolt-in type.

DRY-TYPE BUILDING TRANSFORMERS

1.1 SUBMITTALS:

- a. Submit for approval manufacturer's data sheets for each dry-type transformer provided. Submitted shall show as a minimum the following information:
1. Electrical characteristics.
2. Impedance.
3. Temperature rise.
4. Insulation class.
5. Ambient ratings.
6. Enclosure dimensions.
7. Installation and maintenance instructions.

2.1 RATINGS:

- a. Unless otherwise indicated, 3-phase transformer primary voltages shall be 480V "delta", and secondary voltages shall be 120/208V, 4 wire "wye".
b. The transformer overrated capability shall be in accordance with IEEE C57.96 for standard transformers and IEEE C57.110 for non-linear transformers.
c. Transformers shall be energy efficient and shall meet or exceed NEMA TP-1 requirements.

2.2 CONSTRUCTION FEATURES:

- a. Enclosures shall be ventilated for indoor use unless otherwise indicated.
b. Windings shall be of copper or aluminum. Windings shall be designed for full load operation at a maximum temperature rise of 115°C above a 40°C ambient, however winding insulation shall be rated 220°C.
c. Each transformer shall be provided with PCB tape on the primary winding of the manufacturer's standard percentage, but not less than four 2.5% PCB tape.
d. Core and coil assemblies shall be mounted on rubber isolation pads to minimize transmission of sound and vibration. Sound levels for individual transformers, measured in accordance with NEMA standards, shall not exceed 45 decibels for sizes 225 KVA and smaller and 50 decibels for sizes larger than 225 KVA.
e. Transformers included to be the non-linear type shall, in addition, be suitable for use on distribution systems supplying loads which generate 3rd, 5th, 7th, 11th and 13th harmonic currents. Non-linear type transformers shall have a full length copper electrostatic shield which produces an average effective coupling capacitance of 30 Picofarads between primary and secondary. Electrical noise attenuation shall average 120 dB common mode and 30 dB normal mode. Non-linear type transformers shall have the neutral bar sized for at least 200% ampacity of the secondary phase conductors, shall have a "Y" rating of K-13, designed for use with 100% non-linear switching loads and shall be UL 1581 listed.

3.1 MOUNTING:

- a. For floor mounted units, provide 4" high poured concrete pads. Provide vibration isolating pads under frame supports.

3.2 CONDUIT CONNECTIONS:

- a. Where feasible, conduits shall enter the enclosures of floor mounted transformers from underneath.
b. Where conduits must attach to transformer housing, utilize 12" lengths of flexible conduit terminated with connectors and bonding bushings.

3.3 NOISE AND VIBRATION:

- a. Transformers producing objectionable sound or vibration shall be corrected as directed by the manufacturer, or replaced.

Biloba Architecture, PLLC



8601 JM Keynes Drive
Suite 365
Charlotte, NC 28262
704.248.2922
www.biloba.co

ELECTRICAL and Electrical Engineer
McKnight Smith Ward Griffin Engineers
4223 South Boulevard
Charlotte, NC 28202
704.527.2112
NC Certificate of License: F-0595
MSWG PROJECT #20-027



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