

2.6.9. Separate power and signal cables in separate conduits.

2.7. WIRING IDENTIFICATION

- 2.7.1. Provide permanent indelible identifying markings, either numbered or coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring. Maintain phase sequence and identification throughout system, i.e., panelboards, starters, terminal blocks, disconnect switches.
- 2.7.2. All control system wiring to be labeled using permanent heat-shrink wire labels. Labels to be installed at each termination point. Control system wire labels shall match those provided by system integrator or control panel manufacturer.
- 2.7.3. Maintain identification system at all junction boxes, splitters, cabinets and outlet boxes.
- 2.7.4. Use colour coded wires in communication cables, matched throughout system. All colour coding must adhere to the Electrical Code.

2.8. CABLE IDENTIFICATION

- 2.8.1. Identify each cable by attaching a suitable marker, stamped or indelibly marked with the cable number, at each end of the cable and in all junction boxes and pull boxes.

3. EQUIPMENT GROUNDING

- 3.1. Install grounding connections to typical equipment included in, but not necessarily limited to the following list: service equipment, transformers, switchgear, duct systems, frames of motors, motor control centres, starters, control panels, distribution panels.

4. FASTENING AND SUPPORT

- 4.1. Expansive screw anchors, shields, or other fastening items containing lead or other material that might loosen or melt under fire conditions shall not be used.
- 4.2. Fastenings, supports, and associated hardware shall be of Stainless Steel, Galvanized Steel or Aluminum.
- 4.3. Fastenings and supports (including channels), and their associated hardware shall be made of the same materials to reduce corrosion potential.
- 4.4. Support channels, length as required, U-shaped, size as required by carried load, or manufacturer's recommendations.
- 4.5. Support equipment, cable tray or cable clips, spring loaded bolts, cable clamps etc., to be purpose-built accessories for standard channel members.
- 4.6. Beam clamps to secure threaded rod to exposed steel work.
- 4.7. Support individual cable or conduit runs with minimum 6.0 mm diameter threaded rods and spring clips. Use larger diameter rod and appropriate spring clips where the carried load or manufacturer's recommendations require.
- 4.8. Install fastenings and supports as required for each type of equipment, cables and conduit to manufacturer's installation recommendations.
- 4.9. Provide metal brackets, frames, hangers, clamps and related support structures where indicated or as required to support conduit and cable runs.
- 4.10. Cross-tie cables in cable tray at maximum 1m spacing.
- 4.11. Provide adequate support for raceways and cables dropped vertically to equipment where there is no wall support.
- 4.12. Any aluminum support bracket or channel that is in direct contact with concrete is required to have inert spacers to reduce chemical reaction between support and concrete.

5. OUTLET BOXES & FITTINGS

5.1. PRODUCT

- 5.1.1. Size boxes in accordance with the Electrical Code.
- 5.1.2. Gang boxes where wiring devices are grouped.
- 5.1.3. Blank cover plates for boxes without wiring devices.
- 5.1.4. All outlet boxes shall be supplied with ground stud.
- 5.1.5. Surface mounted outlet and switch boxes shall be:
- 5.1.5.1. PVC
- 5.1.5.2. Ipex F-Series or equivalent.
- 5.1.5.3. To CSA C22.2 No. 18.2-06 (R2011) Non-metallic Outlet Boxes.

5.2. INSTALLATION

- 5.2.1. Install boxes to clear all building and mechanical services equipment. Where two or more devices are shown at one location, utilize multi gang boxes. Supply all outlet boxes with covers as required.
- 5.2.2. Size all boxes to accommodate the number of conduits, conductors and terminal blocks. Provide junction boxes with 20% spare terminal blocks.
- 5.2.3. Securely fasten surface mounted boxes to the building or mounting structure and support independently of the conduits entering the box.
- 5.2.4. Securely fasten flush-mounted boxes to supporting studs or wall structure and support independently of the conduit or cables entering the box.
- 5.2.5. Install junction and pull boxes mounted on brick, concrete or block walls with 3 mm (1/8 inch) thick lead or nylon washers between box and wall face.
- 5.2.6. Provide pull boxes sized to Electrical Code requirements, in all conduit raceway systems to limit length of straight conduit runs to 30 m (100 ft). Reduce this length by 7.5 m (25 ft) for each 90 degree bend or 4 m (12 ft) for each 45 degree bend or offset.
- 5.2.7. Mark location and size of all pull boxes on the record drawings.

6. CONDUIT FASTENINGS AND FITTINGS

6.1. LOCATION OF CONDUIT

- 6.1.1. The drawings do not show specific conduit runs. All conduit shall be surface mounted unless otherwise indicated in the specifications and/or shown on the drawings. All devices shall be surface mounted type except as shown.

6.2. CONDUITS

- 6.2.1. Conduit in ordinary areas to be EMT or Rigid PVC
- 6.2.2. Conduit in humid or corrosive areas shall be rigid PVC.
- 6.2.3. Minimum size to be 21 mm.
- 6.2.4. PVC-jacketed, liquid-tight flexible metal conduit for motor and equipment connections.

6.3. STRUT CHANNEL, FITTINGS, FASTENINGS AND ACCESSORIES

- 6.3.1. Strut channel and associated accessories shall be rated for the environment in which they are installed.
- 6.3.2. Strut clamps shall be one piece heavy-duty construction with parallel hook design.
- 6.3.3. Fastenings and supports (including channels), and their associated hardware shall be made of the same materials to reduce corrosion potential.
- 6.3.4. Two hole PVC straps to secure surface conduits.
- 6.3.5. Fasteners to be of materials suited for the area in which they are installed
- 6.3.6. Beam clamps to secure conduits to exposed steel work.
- 6.3.7. Fittings shall be manufactured for use with conduit specified. Materials and coatings shall be same as conduit.
- 6.3.8. Factory elbows where 90 degree bends are required for 25 mm and larger conduits.
- 6.3.9. All conduits entering outlet boxes and devices that are located in walls subject to movement shall be terminated by means of liquid-tight flexible conduit, approximately 450 mm in length between the conduit and the outlet box or device which is being supplied. All conduits, bus duct, wireways, etc., passing through or across expansion joints of the building shall be installed with the use of approved expansion fittings.

6.4. INSTALLATION REQUIREMENTS

- 6.4.1. Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass. All conduits shall be surface mounted unless otherwise indicated.
- 6.4.2. Cut conduit ends square and ream to remove burrs and sharp edges. Ensure that conduits butt in couplings and other fittings.
- 6.4.3. Where any galvanized or epoxy coated components are cut, drilled, welded, or the surface otherwise compromised, the area shall be repaired using the manufacturer's recommended methods and materials to restore the corrosion resistance of the components to original standards.
- 6.4.4. Install fish cord in all conduits.
- 6.4.5. Group exposed conduits together wherever possible and run parallel to building lines, supported from structural members and protected by the flanges of the structural member where practical.
- 6.4.6. All conduit fastened to the surfaces of the structure shall be mounted on strut channel. Strut channel to be suitably spaced to meet manufacturer and code requirements. Direct mounting of conduit to surface of structure will not be permitted.
- 6.4.7. Use manufacturer recommended mounting clips to secure conduit to strut channel.
- 6.4.8. Install conduits at least 150 mm (6") clear of all steam pipes and flues, and 1 m (39") clear of heaters. Do not bend over sharp objects or improperly form.
- 6.4.9. The maximum length of straight conduit run shall be 30 m (100 feet) between pull boxes or other terminations. This length shall be reduced by 10 m (32 feet) for each 90 degree bend or 5 m (16.5 feet) for each 45 degree bend or offset. Conduit runs shall not include more than the equivalent of two 90 degree bends between pull boxes except where indicated otherwise on the drawings.
- 6.4.10. Where conduits pass through roof, seal with flashing and make weatherproof. For conduits passing through exterior walls, above or below grade seal with waterproof sealing compound.
- 6.4.11. All conduits originating or passing through an area containing corrosive or explosive gases and entering normal areas, control panels, junction boxes, MCC's or any other equipment shall be suitably sealed at each point of entry to prevent any ingress of corrosive or explosive gases.
- 6.4.12. Sleeve and seal all conduits passing through floors.
- 6.3.10. Install Polypropylene pull rope in conduit of sufficient diameter and strength to pull in future additional cables.

7. CABLE TRAY

7.1. PRODUCT

- 7.1.1. All cable tray shall bear certification to CSA or cUL requirements.
- 7.1.2. All cable tray to be aluminium.
- 7.1.2.1. Configuration: Two side rails with transverse rungs welded to side rails.
- 7.1.2.2. Rung Spacing: minimum 300mm
- 7.1.2.3. Minimum Cable-Bearing Surface for Rungs: 22 mm width with radius edges.
- 7.1.2.4. No portion of the rungs shall protrude below the bottom plane of side rails
- 7.1.2.5. Hardware for Aluminum Cable Tray Used Outdoors: Stainless steel, Type 316, ASTM F 593 and ASTM F 594

7.2. LOCATION OF CABLE TRAY

- 7.2.1. The drawings do not show specific cable tray routing. Coordinate all routing with mechanical contractor to avoid interference and take advantage of pre-hung pipe racking. It is acceptable to install cable tray above pipe racking.

7.3. SCOPE

- 7.3.1. Furnish all labour, materials, supervision, equipment and services specified, indicated or requested to install a complete system. The tray system(s) shall be comprised of the supply and installation of all tray sections, fittings, supports, hangers and miscellaneous support materials, adaptors, and hardware required.

- 7.3.2. Coordinate cable tray location with other trades to ensure there is no interference with mechanical or structural components.
- 7.3.3. Where shared cable tray is used, provide separation barrier between cables of different voltages.
- 7.3.4. Cable trays shall have minimum 30% spare space for future.
- 7.3.5. Provide bonding conductors as required.

8. PANELBOARDS & BREAKERS

8.1. PANELBOARDS

- 8.1.1. All panelboards shall be supplied by one manufacturer.
- 8.1.2. 120/208V, 3-phase, 4-wire and 120/240V, 1-phase, 3-wire distribution panelboard's bus and breakers to be rated 10,000 amps minimum interrupting capacity.
- 8.1.3. Panelboard mains, number of circuits, and number and size of branch circuit breakers shall be as indicated on the drawings.
- 8.1.4. The main bus bars shall be copper and shall be equipped with solderless lugs for incoming cables. Neutral to be of same ampere rating as mains.
- 8.1.5. Doors shall have spring hatches.
- 8.1.6. Power panelboard acceptable manufacturer(s): Schneider Canada Square "D" I-Line, Cutler-Hammer Pow-R-Line series, Siemens type NDP.

8.2. PANELBOARD CIRCUIT BREAKERS

- 8.3. Breakers shall be the bolt-on type and shall provide instantaneous trip on over-currents and time-delay trip on overloads.
- 8.4. Breakers shall be compatible with fault current rating of the panel.
- 8.5. Breakers shall be of the thermal magnetic tripping type.
- 8.6. Main breaker shall be separately mounted on top or bottom of panel to suit cable entry as required. When mounted vertically, down position should open breaker.
- 8.7. Locate panelboards as indicated on the drawings and mount securely, plumb true and square.
- 8.8. Install each panelboard 1980 mm above finished floor measured to the top of the enclosure.
- 8.9. Install panelboards mounted on brick, concrete or block walls on plywood backboards or use 3 mm thick lead washers between enclosure and wall face. Where practical, group panels on common backboard. If mounted in a humid or corrosive rated environment, follow the Electrical Code, Section 22 for installation requirements.
- 8.10. Make all field wiring connections and terminations. Connect loads to circuits as indicated and connect neutral conductors to common neutral bus with respective neutral identified.
- 8.11. Where circuit breakers are being added to existing panels, the breakers shall match existing panel breakers in terms of type.

9. WIRING DEVICES

9.1. RECEPTACLES

- 9.1.1. This specification applies to single and duplex receptacles and receptacles of other voltage and ampacity as indicated on the drawings.
- 9.1.2. Type NEMA 5-15R or 5-20R as the circuit requires, 125V, U-ground, heavy duty specification grade to CSA C22.2 No. 42-10 - General Use Receptacles.
- 9.1.3. Receptacle shall have heavy duty nylon face with steel reinforcing plate in centre.
- 9.1.4. Receptacle shall have spring loaded back wiring.
- 9.1.5. Receptacle shall have raised ground for safety.
- 9.1.6. Receptacle contacts shall have spring steel clips to reduce contact fatigue.
- 9.1.7. Receptacle shall be suitable for #10 AWG back and side wiring.
- 9.1.8. Receptacles in ordinary and humid locations shall be duplex-type, manufactured by Bryant, Arrow Hart, Leviton or approved equal.

9.2. COVER PLATES

- 9.2.1. Cover plates from one manufacturer throughout project to match switches and receptacles.
- 9.2.2. Cover plates to be PVC.
- 9.2.3. For wiring devices mounted in flush-mounted outlet boxes, thickness to be 2.5 mm.
- 9.2.4. Cover plates shall be suitable for Ipex FS/FD boxes.
- 9.2.5. Acceptable manufacturer is Ipex.

9.3. DISCONNECT SWITCHES

- 9.3.1. Provide fused or unfused disconnect switches, voltage and amperage rated to suit loads as indicated on the drawings
- 9.3.2. Disconnect shall be front-operational, heavy duty, industrial grade, quick-make, quick-break type.
- 9.3.3. Make provision for padlocking in the "OFF" position.
- 9.3.4. Mechanically interlocked door to prevent opening when handle in "ON" position.
- 9.3.5. "ON/OFF" switch position indication on switch enclosure cover.
- 9.3.6. Disconnect enclosures shall be rated for the environment in which they are installed.
- 9.3.7. Disconnect switches to be 100% load-make, load-break rated.
- 9.3.8. Disconnects shall each have early break, normally open voltage free auxiliary contact.
- 9.3.9. Unless specifically indicated otherwise on the drawings, disconnects for all equipment specified shall be as manufactured by Cooper Crouse-Hinds GHG series, Arrow Hart AH series, Cutler-Hammer HD series, Schneider Canada Square "D" CH series.

10. MOTOR STARTERS

- 10.1.1. NEMA or IEC Starters permitted.
- 10.1.2. Open-wound starters or relay coils are not allowed.
- 10.1.3. All coils to be epoxy potted.

10.2. WALL MOUNTED MANUAL MOTOR STARTERS

- 10.2.1. Single- or three-phase manual motor starters of size, type and rating, with components as



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510 Main Street

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APPROVED BY:
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