

1 General

1.1 SUMMARY

.1 Section includes:

- .1 Labour, products, equipment and services necessary to complete the work of this Section.

1.2 RELATED SECTIONS

.1 Section 26 05 01: Basic electrical requirements.

1.3 SUBMITTALS

- .1 Consultant reserves the right to require Contractor to submit samples of any materials to be used in this project.
- .2 Dimensioned location drawings indicating required sleeves and/or openings in structural concrete or roofing or other locations affecting other trades work.
- .3 Proposed equipment nameplates and warning signs.
- .4 Detailed cable tray or J-Hook layouts.
- .5 Equipment/product factory testing reports.
- .6 Prior to application for Substantial Performance of the Work, submit the following to Consultant for review:
 - .1 ESA inspection certificates.
 - .2 Fire alarm system pre-testing.
 - .3 Distribution system testing and coordination study performed.
 - .4 Structured network cabling system tested and verified.

2 Products

2.1 NO-PICK EPOXY

- .1 Epoxy in prisoner areas to be one of the following as defined in the PMM.
 - .1 Sika Anchorfix 3001
 - .2 Pecora Dynapoxy EP-430 Fast
 - .3 Pecora Dynapoxy EP 1200
 - .4 Sika AnchorFix 2001
 - .5 Sika AnchorFix Artic

2.2 PAINT AND PRIMER

- .1 Where repainting of walls is required paint to be one of the following as defined in the PMM.
 - .1 Stoneglaze VSR
 - .2 Sikagard Duroplast 100

2.3 WIRE - LOW VOLTAGE UP TO 1000V SERVICE

- .1 Conductors
 - .1 ASTM Class B, soft drawn, electrolytic copper
 - .2 Stranded for # 10 AWG and larger.
- .2 Insulation
 - .1 CSA type RW90 XLPE (-40°C)
 - .1 Heat and moisture resistant
 - .2 Low temperature, chemically cross-linked thermosetting polyethylene material
 - .3 600V or 1000V rated
 - .4 For maximum 90°C conductor temperature
 - .5 For installation at minimum -40°C temperature
 - .6 To CSA C22.2 No. 38
 - .2 CSA type RWU90 XLPE (-40°C):
 - .1 Heat and moisture resistant
 - .2 Low temperature, chemically cross-linked thermosetting polyethylene material
 - .3 1000V rated
 - .4 For maximum 90°C conductor temperature
 - .5 For installation at minimum -40°C
 - .6 To CSA C22.2 No. 38
 - .3 CSA type T90 NYLON (-10°C):
 - .1 Heat resistant
 - .2 Flame retardant
 - .3 Thermoplastic PVC material with extruded nylon cover
 - .4 600V rated
 - .5 For maximum 90°C conductor temperature dry and 75°C in wet locations
 - .6 For installation at minimum -10°C
 - .7 To CSA C22.2 No. 75-M
 - .4 CSA type TEW:
 - .1 Heat resistant
 - .2 600V rated
 - .3 For maximum 105°C conductor temperature
 - .4 To CSA C22.2 No. 127
 - .5 CSA type SEW-2

- .1 Heat resistant
- .2 600V rated
- .3 For maximum 200°C conductor temperature
- .4 To CSA C22.2 No. 127

2.4 CABLE - LOW VOLTAGE UP TO 1000V SERVICE

- .1 CSA Type AC90 XLPE (-40°C)
 - .1 Conductors
 - .1 ASTM Class B, soft drawn, electrolytic copper
 - .2 Solid for sizes #10 AWG and smaller
 - .3 Stranded for sizes #8 AWG and larger
 - .2 Insulation
 - .1 Heat and moisture resistant
 - .2 Low temperature, chemically cross-linked thermosetting polyethylene material
 - .3 600V rated for sizes #10 AWG and smaller
 - .4 1000V rated for sizes #8 AWG and larger
 - .5 For maximum 90°C conductor temperature
 - .6 For installation at minimum -40°C temperature
 - .7 To CSA C22.2 No. 38
 - .3 Construction
 - .1 2, 3 or 4 insulated conductors
 - .2 Bare ground conductor
 - .3 Overall interlocking aluminium armour
 - .4 To CSA C22.2 No. 51
- .2 CSA Type TECK90 (-40°C)
 - .1 Conductors
 - .1 ASTM Class B, soft drawn, electrolytic copper
 - .2 Stranded
 - .2 Insulation
 - .1 Heat and moisture resistant
 - .2 Low temperature, chemically cross-linked thermosetting polyethylene material
 - .3 600V or 1000V rated
 - .4 For maximum 90°C conductor temperature
 - .5 For installation at minimum -40°C temperature
 - .6 CSA type RW90 XLPE

- .7 To CSA C22.2 No. 38
- .3 Construction
 - .1 1 or more insulated conductors
 - .2 Bare, stranded, copper ground conductor for multi-conductor cables
 - .3 Bare, solid, served copper ground conductors for single conductor cables
 - .4 Fillers with binder tape to produce a circular cross-section for multi-conductor cables
 - .5 Power cables
 - .1 1, 2, 3 or 4 conductors
 - .2 Conductors 1000V rated
 - .6 Composite cables
 - .1 3 power conductors
 - .2 3 #14 AWG control conductors
 - .3 Conductors 600V rated
 - .7 Extruded PVC inner jacket over conductor assembly
 - .8 Interlocking aluminium armour over inner jacket
 - .9 Extruded PVC overall jacket over armour
 - .1 FT4 flame test rated
 - .2 Colour black unless otherwise indicated
 - .10 Cable assembly for installation at minimum -40°C temperature
 - .11 To CSA C22.2 No. 131 and CSA C22.2 No. 174
- .3 CSA Type NMD90 (Romex or Lumex):
 - .1 Non-metallic Sheathed Cable
 - .2 300V rated
- .4 CSA Type MI
 - .1 Conductors
 - .1 ASTM Class B, soft drawn, electrolytic copper
 - .2 Solid
 - .2 Insulation
 - .1 Powdered magnesium oxide
 - .2 600V rated for feeders on 208/120V system or control wiring
 - .3 1000V rated for feeders on 600/347V systems
 - .3 Construction
 - .1 Solid conductor

- .2 Insulation around the conductor compressed to form a solid, homogeneous mass between the conductor and the metal sheath throughout the entire length of cable
- .3 Soft annealed seamless copper sheath over insulation
- .4 Extruded PVC overall jacket over sheath
 - .1 FT4 flame test rated
 - .2 Colour black unless otherwise indicated
- .5 Two (2) hour fire rated where indicated on drawings.
- .6 Connectors: watertight, field installed approved for MI cable.
- .7 Termination kits: field installed approved for MI cable
- .8 To CSA C22.1 No. 124-M
- .4 Acceptable Manufacturer
 - .1 Pyrotanax

2.5 CONTROL CABLES

- .1 Type: LVT: 2 soft annealed copper conductors, sized as indicated:
 - .1 Insulation: thermoplastic.
 - .2 Sheath: thermoplastic jacket.
- .2 Type: low energy 300 V control cable: solid annealed copper conductors sized as indicated:
 - .1 Insulation: TW 40 degrees C.
 - .2 Shielding: tape coated with diamagnetic material over each conductor.
 - .3 Overall covering: PVC jackets.
- .3 Type: 600 V stranded annealed copper conductors, sizes as indicated:
 - .1 Insulation: RW90 (x-link).
 - .2 Shielding: non-magnetic tape over each pair of conductors.
 - .3 Overall covering: PVC.

2.6 CABLE CONNECTORS

- .1 Connectors for Type AC90 Cable
 - .1 Steel or malleable iron
 - .2 Insulated throat
- .2 Connectors for Type TECK90 Cable
 - .1 Copper free aluminium body
 - .2 Steel or copper free aluminium fittings and locknut
 - .3 Certified for use in hazardous locations Classes I, II, and III
 - .4 Class I hazardous location sealing fitting

2.7 WIRE AND CABLE CONNECTORS

- .1 Copper compression type wire and cable terminations for #8 AWG and larger conductors, colour keyed, sized to suit. Long barrel NEMA 2 hole lugs for sizes #1/0 AWG and larger.
- .2 Twist type splicing connectors, copper, sized to suit, with nylon or plastic shroud for tee connections in #10 AWG and smaller conductors.
- .3 Conductor compression splice for #10 AWG or smaller.

2.8 WIRE PULLING LUBRICANT

- .1 Wire pulling lubricant to be "Ideal Industries", Yellow 77 Plus Wire pulling Lubricant or approved equivalent.

2.9 HEAT SHRINKABLE TUBING INSULATION, HEAVY WALL

- .1 Acceptable Manufacturers
 - .1 Thomas & Betts, Shrink-Kon series
 - .2 Ideal Thermo-Shrink, TS-46
 - .3 Raychem tubing WCSM
 - .4 3M cable sleeve ITCSN

2.10 MOTOR LEAD CONNECTION KITS, 600 VOLT

- .1 Connection kits for low voltage motors.
- .2 Acceptable Manufacturers
 - .1 3M, motor lead splice kit, pigtail, 5300 series
 - .2 Raychem, motor connection kit, MCK, type V
 - .3 Or approved alternate

2.11 CONDUIT AND FITTINGS

- .1 Rigid Steel Conduit
 - .1 To CSA C22.2 No. 45-M
 - .2 Rigid thick wall galvanized steel threaded conduit
- .2 Coated Steel Conduit
 - .1 Corrosive resistant coated rigid thick wall steel threaded conduit, CSA approved.
 - .2 Acceptable Manufacturers
 - .1 Rob Roy Plastibond PVC coated
 - .2 Columbex Green Guard II epoxy polyester coated
- .3 Rigid PVC Conduit
 - .1 To CSA C22.2 No. 211.2-M
 - .2 Rigid PVC conduit

- .4 Flexible Steel Conduit
 - .1 To CSA 22.2 No. 56
 - .2 Liquid-tight flexible steel conduit with PVC cover
- .5 Non-Metallic Flexible Conduit
 - .1 Non-metallic extra flexible PVC conduit
 - .2 Acceptable Manufacturers
 - .1 Carlon, Carflex X-Flex
 - .2 Hubbell, Polytuff Black
 - .3 Or approved alternate
- .6 Rigid Steel Conduit Fittings
 - .1 To CAN/CSA C22.2 No. 18
 - .2 Galvanized or polymer coated cast steel fittings
 - .3 Expansion fittings, watertight with integral bonding jumper suitable for linear expansion and 19 mm deflection in all directions
 - .4 Sealing condulets for hazardous areas
 - .5 Corrosive resistant coated cast steel fittings for corrosive resistant conduit
- .7 Rigid PVC Conduit Fittings
 - .1 To CSA C22.2 No. 85-M
 - .2 Rigid PVC fittings of same manufacture as rigid PVC conduit
- .8 Liquid Tight Flexible Steel Conduit Fittings
 - .1 Watertight connectors with nylon insulated throat

2.12 EMT AND FITTINGS

- .1 EMT
 - .1 To CSA C22.2 No. 83-M
 - .2 EMT galvanized cold rolled steel tubing
- .2 EMT Fittings
 - .1 Compression type, steel
 - .1 Gland compression connectors with insulated throats
 - .2 Compression couplings
 - .2 Set screw type, steel, concrete-tight
 - .1 Connectors with insulated throats
 - .2 Couplings

2.13 CABLE TRAY

- .1 Cable Trays and Fittings

- .1 To EEMAC F5-1
- .2 To CAN/CSA C22.2 No. 126-M
- .2 Ladder Type
 - .1 Class C1
 - .2 Steel, hot dip galvanized after fabrication
 - .3 Side height, 100 mm
 - .4 Rung spacing, 300 mm
 - .5 Width as indicated on drawings.
- .3 Basket Type
 - .1 Class C1
 - .2 Powder coated with average paint thickness of 30 microns to 75 microns.
 - .3 50 mm x 50 mm grid
 - .4 Side height: 100 mm minimum.
 - .5 Width as indicated on drawings.
- .4 Acceptable manufacturers for ladder and basket types:
 - .1 Legrand Cablofil
 - .2 Cooper B-Line
 - .3 Or approved alternate

2.14 WIREWAY

- .1 To CSA C22.1 No. 94-M.
- .2 Steel with hinged cover to give uninterrupted access.
- .3 Elbows, tees, couplings and hanger fittings manufactured as accessories for wireway supplied.

2.15 SURFACE RACEWAY

- .1 Surface Raceway to be Legrand Wiremold Model No. 'DS4000 Designer Series' or approved alternate.
- .2 Surface metal raceway, single or complete with snap-in divider to form 2 compartments for power and data, with removable cover. Width to suit application while keeping Code and Telecommunication standard filling ratios.
- .3 Elbows, couplings, end caps, device brackets and faceplates for power, data and voice, and fittings manufactured as accessories for wireway supplied. 120V power receptacles and mounting only for voice/data.
- .4 Finish: Grey

2.16 FASTENINGS, SUPPORTS AND SLEEVES

- .1 Fastenings

- .1 Galvanized steel straps, beam clamps and threaded rods for structural steel
 - .2 Concrete inserts, Crane Canada No.4-M for concrete work for single or double conduit cable tray.
 - .3 Unistrut multiple type inserts for runs of three or more conduits.
 - .4 Concrete fastener type "WEJ-IT" anchors
 - .5 Drywall, plaster or ceiling, 2-wing spring toggles
 - .6 40mm width, galvanized steel channels complete with accessories for metal framing channels.
 - .1 Unistrut
 - .2 Thomas & Betts
 - .3 Or approved alternate
 - .7 Metal "J" hooks cable supports systems for communication systems cabling in accessible ceiling spaces where conduit or cable tray is not being provided.
 - .8 Velcro tie wraps for bundling and securing telecommunication cabling
- .2 Sleeves
 - .1 Schedule 40 steel pipe, minimum I.D. 13 mm larger than O.D. of conduit or cable passing through.
 - .3 Strut
 - .1 Continuous slotted channel
 - .2 12 gauge pre-galvanized steel
 - .3 41.2 mm x 41.2 mm minimum

2.17 ACCESS DOORS

- .1 Access doors to Section 10 00 00, manufactured Specialties.

2.18 SPLITTER BOXES

- .1 Code gauge galvanized sheet steel enclosure EEMAC Type 4 or 12, welded corners and formed hinged cover suitable for locking in closed position.
- .2 Cast steel enclosure EEMAC 7 or 9 with gasketed bolt on cover for and to suit the designated hazardous locations.
- .3 Copper main and branch lugs to match required size and number of incoming and outgoing conductors.
- .4 At least 3 spare terminals on each set of lugs in splitters less than 400 A.

2.19 JUNCTION BOXES

- .1 Galvanized steel EEMAC Type 1, 4, 12, size as required by code for number and size of conduits, conductors and devices, complete with covers, corrosion resistant screws, terminal blocks and mounting rails.

- .2 Screw-on sheet steel covers to match enclosure for surface mounting boxes.
- .3 Covers with 25 mm minimum extension around for flush-mounted junction boxes.
- .4 Galvanized steel barriers as required.

2.20 TERMINAL BLOCKS - SURGE PROTECTION

- .1 Terminal blocks, rail mounted, with surge voltage protection, rated for circuit voltage.
- .2 Acceptable Manufacturers
 - .1 Phoenix Contact Termitrab SLKK5 (Termitrab SLKK5-F) (TT-SLKK5-S).

2.21 PULL BOXES

- .1 Galvanized sheet steel welded construction, EEMAC Type 4 or 12.
- .2 Screw-on galvanized sheet steel covers for surface mounting boxes.
- .3 Covers with 25 mm minimum extension around, for flush mounted pull boxes.
- .4 Galvanized steel barriers as required.

2.22 METER CABINET

- .1 Sheet steel CSA Type 2 sprinkler-proof enclosure with meter backplate, to accommodate meters, test terminal block and associated equipment, factory installed and wired.
- .2 Utility metering cabinet to conform with Utilities specifications.

2.23 CONDUIT BOXES - GENERAL

- .1 Boxes for EMT
 - .1 Galvanized pressed steel
- .2 Boxes for Rigid Steel Conduit
 - .1 Galvanized cast iron alloy FS boxes with mounting feet for surface mounted switches and receptacles
 - .2 Gasketed cover plate for exterior location
 - .3 For corrosive resistant coated conduit: cast boxes with same finish as conduit
- .3 Boxes for Rigid PVC Conduit
 - .1 PVC boxes

2.24 OUTLET BOXES - SHEET STEEL

- .1 Pressed steel single and multi-gang flush device boxes, minimum size 100 mm x 50 mm x 38 mm. 100 mm square outlet boxes where more than 1 conduit enters 1 side, with extension rings as required.
- .2 100 mm square or octagonal outlet boxes.

- .3 119 mm square outlet boxes with extension and plaster rings as necessary for flush mounting devices in gypsum board, plaster or panelled walls.

2.25 MASONRY BOXES

- .1 Pressed steel masonry single and multi-gang boxes for devices flush mounted in exposed masonry walls with extension and plaster rings as required.

2.26 CONCRETE BOXES

- .1 Pressed steel concrete type boxes for flush mount in concrete with extension and plaster rings as required.

2.27 OUTLET BOXES - FITTINGS

- .1 Bushings and connectors with nylon insulated throats.
- .2 Knock-out fillers to prevent entry of foreign materials.
- .3 Double locknuts and insulated bushings for sheet steel metal boxes.

2.28 WIRING DEVICES - SWITCHES

- .1 Specification grade, general purpose AC switches, manual toggle operated, white and brown colour, 15A, 20A, 120-277V, 347V, single pole, double pole, three-way, four-way switches as required.
- .2 Specification grade, general purpose AC switches, manual rocker operated, white colour, 15A, 20A, 120-277V, 347V, single pole, double pole, 3 way, 4 way switches as required.

2.29 WIRING DEVICES – OCCUPANCY SENSORS

- .1 Passive Infrared Occupancy Sensor, WattStopper or equivalent:
 - .1 The passive infrared sensor shall be capable of detecting presence in the control area by detecting changes in infrared energy.
 - .2 Sensor shall be sealed and gasketed and shall be moisture and dust proof.
 - .3 Sensor shall function in a temperature range of -40°F (-40°C) to +95°F (+35°C).
 - .4 Sensor shall have adjustable digital time delay setting, adjustable from 15 seconds to 10 minutes approximately.
 - .5 Sensor shall have sensitivity setting adjustable from minimum to maximum.
 - .6 Adjustments and mounting hardware shall be concealed under a removable cover to prevent tampering of adjustments and hardware.
 - .7 Sensors shall be capable of being wired in parallel to allow coverage of large areas.
 - .8 Sensor shall have a standard 5 year warranty.
 - .9 Sensor shall be CUL listed.
- .2 Dual Technology Occupancy Sensor, WattStopper or equivalent:

- .1 Sensor shall be capable of detecting presence in the control area by detecting shifts in transmitted ultrasound and passive infrared heat changes.
- .2 Sensor shall utilize ultrasonic and PIR technologies to reduce likelihood of false operations
- .3 Sensor shall have no minimum load requirement and shall be capable of switching from 0 to 800 Watt incandescent; 0 to 800 Watt fluorescent or 1/6 hp @ 120 VAC, 60Hz; and 0 to 1200 Watt fluorescent @ 277 VAC, 60Hz.
- .4 Sensor shall have automatic-ON or manual-ON operation on both relays adjustable with DIP switch.
- .5 Sensor shall have a time delay that is adjusted automatically or shall have a fixed time delay of 5 to 30 minutes.
- .6 In automatic mode, sensor shall be capable to automatically return to Automatic-ON after lights are turned off manually.
- .7 Each sensing technology shall have a LED indicator that remains active at all times in order to verify detection within the area to be controlled.
- .8 Sensor shall have a service switch to allow end-users to operate the sensor in the unlikely event of a failure; set by a trim pot.
- .9 Sensor shall be able to control electronic low voltage, and fluorescent loads.
- .10 The Dual Technology wall switch sensor shall be a completely self contained control system that replaces a standard toggle switch
- .11 Sensor shall have standard 5 year warranty and shall be UL and CUL listed

2.30 WIRING DEVICES - RECEPTACLES FOR GENERAL SERVICE

- .1 Receptacles: specification grade suitable for back and side wiring, complete with grounding terminal, white colour for straight blade devices and black colour for twistlock devices.
- .2 All receptacles shall be from one manufacturer.

2.31 WIRING DEVICES - RECEPTACLES FOR PATIENT CARE AREAS

- .1 Receptacles: CSA Approved, ULC Listed, specification Hospital grade with green dot symbol, suitable for back and side wiring, flush, complete with grounding terminal, thermoplastic polyester face/body construction, 2-pole, 3-wire grounding receptacles complete with one piece nickel-plated brass mounting strip with integral grounding clips, ground retention clips, nickel-plated brass wiring clamps with nickel-plated brass screws, front circuit identification area and reinforced thermoplastic brass colour as required for type of area for straight blade devices.
- .2 Receptacles of one manufacturer.

2.32 WIRING DEVICES - COVER PLATES

- .1 Stainless steel Type 302 alloy, vertically brushed, 0.8 mm thick cover plates.
- .2 Nylon, smooth, high impact strength.

- .3 Pressed steel, galvanized.
- .4 Cast covers for cast boxes with gaskets.
- .5 Outdoors:
 - .1 Marine grade outlet box hood
 - .2 Weather proof die cast alloy 360 copper free aluminum
 - .3 Nema 3R rating for in-use protection
 - .4 Gaskets are closed-cell foam
 - .5 Latching covers hold securely
 - .6 Large cord openings
 - .7 Holes for padlocks are 6.4 mm diameter
- .6 Cover plates of same manufacture as devices.

2.33 FUSES

- .1 Form I, Class "J" HRC for continuous loads
- .2 Form II, Class "C" HRC for cycling loads

2.34 PUSHBUTTONS OPERATORS

- .1 Rockwell Automation, 800T Series
- .2 Exact type and rating to suit application
- .3 Or approved alternate

2.35 ROOFTOP CONDUIT SUPPORT SYSTEM

- .1 Cooper B-Line "Dura - Blok" series rooftop support systems
- .2 Or approved alternate

2.36 PLYWOOD BACKBOARDS

- .1 Plywood backboards, good one side, 4' x 8' x $\frac{3}{4}$ " unless indicated otherwise. Treat with primer and two coats of fire retardant paint.
- .2 Mount plywood on vertical strapping, on 40 mm centres to provide 10 mm clearance between wall and rear of plywood. Treat strapping similar to plywood.

2.37 FINISH

- .1 Equipment enclosure finish: baked grey enamel, ANSI 49 or ANSI 61.

3 Execution

3.1 WIRE AND CABLE

- .1 Install wiring in raceways unless noted otherwise.
- .2 Install separate and dedicated neutral wires for each circuit fed from:

- .1 Harmonic mitigation transformers/panelboards (e.g. RP-Hxx)
- .2 UPS panelboards (e.g. RP-Uxx)
- .3 Lighting panelboards (e.g. LP-Lxx)
- .3 Provide 600 V rated cable for up to 208 V application; 1000V rated cable for up to 600 V application.
- .4 Wiring in walls: typically drop or loop vertically from above to better facilitate future renovations. Generally wiring from below and horizontal wiring in walls to be avoided unless indicated.
- .5 Minimum wire sizes:
 - .1 In residential construction power and lighting No. 14 AWG
 - .2 In commercial construction Power and lighting No. 12 AWG
 - .3 Control No. 14 AWG
 - .4 Fire alarm No.: to Section 28 31 00 Fire Detection and Alarm Systems
- .6 Type AC90 cable length limitations:
 - .1 Ceiling box to luminaire:
 - .1 3 m maximum in non-accessible ceilings;
 - .2 3 m in accessible ceilings
 - .2 Junction box to outlet:
 - .1 4 m maximum
- .7 Load current limitations:
 - .1 Conductors rated for more than 90°C:
 - .1 75°C code ampacity rating
 - .2 90°C code ampacity rating if terminating device and/or equipment maximum conductor termination temperature is 90°C rated.
 - .2 Motor connection:
 - .1 75°C code ampacity rating
- .8 Use wire lubricant when pulling wires into conduit. Wires shall be kept straight and not twisted.

3.2 CONNECTORS

- .1 Install compression terminations and splices in accordance with manufacturer's written instructions.
- .2 Make splices in junction boxes.
- .3 Make connections in lighting circuits with twist type splicing connectors.
- .4 Terminate and splice conductors No. 8 and larger at terminal blocks in junction boxes.

- .5 Seal terminations and splices exposed to moisture, corrosive conditions or mechanical abrasions with heavy wall heat shrinkable insulation.
- .6 Install fixture type connectors and tighten. Replace insulating cap.

3.3 MOTOR LEAD CONNECTION KITS, 600 VOLT

- .1 Install motor lead connection kits for low voltage motors.

3.4 CONDUIT AND EMT - GENERAL

- .1 Run parallel or perpendicular to building lines.
- .2 Group raceways wherever possible. Support on channels.
- .3 Install expansion joints as required.
- .4 Run raceways in web portion of structural steel columns and beams.
- .5 Do not drill structural members to pass through.
- .6 Locate raceways behind infrared or unit heaters with 1500 mm clearance.
- .7 Locate raceways not less than 125 mm clear where parallel to steam or hot water lines with a minimum of 75 mm at crossovers.
- .8 Do not install horizontal runs in masonry walls.
- .9 Use metallic raceway where temperatures exceed 75°C or where enclosed in thermal insulation.
- .10 EMT and non-metallic conduits to contain insulated green ground wire.
- .11 Install 6 mm diameter nylon pull cord in empty raceways.
- .12 Conduits may be surface mounted (exposed) in mechanical and electrical rooms and spaces; and concealed elsewhere.

3.5 CONDUIT AND FITTINGS

- .1 Minimum conduit sizes:
 - .1 Surface installation: 21 mm trade size conduit, 16mm in residential applications
 - .2 Embedded in concrete: 27 mm trade size conduit
 - .3 Directly buried: 53 mm trade size conduit
- .2 Conduit application and type:

Application	Type
Corrosive areas	rigid steel corrosion resistant coated
Hazardous areas	rigid steel
Outdoor areas	rigid steel hot dip-galvanized

Embedded in concrete	rigid PVC
In or below grade slab	Rigid PVC
Exposed in unfinished areas up to 3 m above finished floor. Use EMT above 3m	rigid steel
Connection to motors and equipment subject to vibration	liquid tight flexible steel conduit
Final connection to dry type transformer	flexible steel conduit
Whip connection to modular furniture - power	Furniture whip provided by furniture system manufacturer or flexible EMT
Whip connection to modular furniture - others	non-metallic extra flexible PVC
Unheated parking garage area	Rigid steel

- .3 Use field threads on rigid conduit of sufficient length to draw conduits up tight.
- .4 Do not bend coated steel conduit. Use elbows for deflections.
- .5 Do not install conduit under slab on grade.
- .6 Do not install conduit in slab, unless indicated otherwise on drawings.
- .7 Use factory "ells" where 90° bends are required for 27 trade size and larger conduits.
- .8 Bend conduit offsets cold. Do not install crushed or deformed conduits and avoid trapped runs in damp or wet locations. Prevent the entrance of water and lodging of concrete, plaster, dirt, or trash in conduit, boxes, fittings, and equipment during course of construction.
- .9 Where conduit joints occur in damp or wet locations, make joints watertight by applying an approved compound on the entire thread area before assembling. Draw up all conduit joints as tightly as possible.
- .10 Cap exposed empty conduits which do not terminate in outlets, panels, cabinets, etc., with standard galvanized plumber's pipe caps.
- .11 Plug empty conduits which terminate flush with floors or walls with flush coupling and brass plug.
- .12 Install conduit sleeves for all exposed conduits and cables passing through walls, ceilings, or floors, and fill void between sleeve and conduit with caulking. If fire-rated caulking is required by code, use same class as walls, ceilings or floors.
- .13 Terminate conduit stubbed up through concrete floor for connection to free standing equipment with a coupling flush with finish floor, and extend rigid conduit to equipment, except where required, use flexible conduit from a point 150 mm above floor.

- .14 Install double locknuts and bushings on all rigid conduit terminations into threadless openings. Increase length of conduit threads at terminations sufficiently to permit bushing to be fully seated against end of conduit.
- .15 Mechanically bend steel conduit.
- .16 Install sealing condulets in conduits at hazardous area boundaries.
- .17 Conduits in Poured Concrete
 - .1 Locate to suit reinforcing steel. Secure firmly to prevent movement during pour.
 - .2 Clear each conduit with mandrel and brush before concrete sets.
 - .3 Protect conduits from damage where they stub out of concrete.
 - .4 Install sleeves where conduits pass through slab or wall.
 - .5 Provide oversized sleeve before membrane is installed where conduits pass through waterproof membrane. Use cold mastic between sleeve and conduit.
 - .6 Encase conduits completely in concrete; provide 50 mm minimum concrete cover.
 - .7 Replace with exposed conduit, any conduit run found to be obstructed after concrete sets.

3.6 EMT AND FITTINGS

- .1 Minimum EMT size: 21 mm trade size conduit.
- .2 EMT Application
 - .1 Exposed in unfinished areas, above truss level and for drops in column web to 3 m above finished floor. Use rigid steel conduit below 3 m.
 - .2 In block walls and stud partitions.

3.7 CABLE TRAY

- .1 Install cable tray systems.
- .2 Provide barriers where required by Code.
- .3 Support cable trays from structural members. Support cable tray on both sides or on cantilever brackets to provide continuous open access to one side of the tray as required. Coordinate support locations and weight per support with building structure. Provide any additional support fastenings required.
- .4 Provide the following minimum clearances:
 - .1 300 mm vertical between top of tray and equipment or structure above.
 - .2 300 mm vertical between trays (between bottom of the upper tray to top of lower tray).
 - .3 600 mm horizontal on access side of tray.
- .5 Ensure that sharp burrs or projections are removed to prevent damage to cables and injury to personnel.

- .6 Install cables individually.
- .7 Lay cables into cable tray. Use rollers where necessary, to pull cables.
- .8 For maintained spacing, secure cables in cable tray at 3 m centers for horizontal runs with black coloured tie wraps and at 1500 mm centres for vertical runs with aluminum clamps supplied by tray manufacturer.
- .9 Maintain power cables greater than one diameter minimum spacing unless shown otherwise.
- .10 Firestop Fire Barriers (refer to Section 26 05 01).
 - .1 Penetration of fire rated walls with cable trays is not allowed. Provide instead metallic sleeves to match cable tray capacity to allow for transitioning of cabling. Pack, seal and firestop around and inside in accordance with Section 07 84 00 Fire Stopping and Smoke Seals.

3.8 WIREWAYS

- .1 Install per manufacturer's recommendations.
- .2 Keep number of elbows, offsets and connections to a minimum.
- .3 Install barriers where required by Code.
- .4 Install gutters to full length of equipment.

3.9 SURFACE RACEWAYS

- .1 Install per manufacturer's recommendations.

3.10 FASTENINGS AND SUPPORTS

- .1 Provide supports and fastenings for the Work of this Division. Do not use supports or equipment provided by other Trades.
- .2 Equipment fastenings and supports shall conform to manufacturers recommendations.
- .3 Do not attach to, or suspend any electrical product or service from the roof deck, mechanical ductwork or piping.
- .4 Do not use wire lashing or perforated strap to support or secure raceways or cable.
- .5 Support rods for any suspended item must not be attached to or extended through steel pan type roofs or through concrete slab roofs.
- .6 For surface mounting of two or more raceways or cables use channels.
- .7 Where there is no wall support for raceways and cables dropped vertically to equipment, provide channel properly secured to floor and structure.
- .8 Hang supports from structural members. Where location does not permit direct support from structure provide necessary brackets, frames, channels secured to structural members.

- .9 Fasten exposed conduit and cables to building construction or support systems using straps. Use beam clamps on exposed steelwork.
- .10 Masonry, tile and plaster surfaces: use lead anchors.
- .11 Poured concrete: use expandable inserts. Low velocity powder activated fastenings may be used only in poured concrete.
- .12 Steel structures: use clips, spring loaded bolts, cable clamps, designed as accessories to basic channel members.
- .13 Do not use powder activated fasteners in, tile, precast concrete or steel structure.
- .14 Do not install conduits or cables on the bottom chord of joists or trusses.
- .15 Use beam clamps of the 2-bolt design and of such type that the rod load is transmitted only concentrically to the beam web centreline. The use of "C" and "I" beam side clamps will not be allowed.
- .16 Where the roof or floor framing consists of open web or long span steel joists and/or trusses, ensure that hangers are located at or within 150 mm of the joist or truss top or bottom chord panel points, otherwise provide additional structural steel as required where hanger spacing does not coincide with joist or truss spacing. Design suspension assembly such that the hanger load is transmitted only concentrically to the supporting joist or truss. The use of "C" and "I" beam clamps, brackets, etc., will not be allowed.
- .17 Locate secondary structural steel members between joists or trusses at or within 150 mm of top or bottom chord panel points. Where the secondary structural steel member cannot be located at or near a joist or truss panel point, provide additional diagonal structural steel web member/members designed for the applicable load to the nearest panel point in the opposite chord member. Diagonal hangers which will induce lateral stresses in the chord members of the joist will not be permitted. Submit shop drawings of the suspension assembly indicating the location of suspension or support points, the maximum load at each suspension point, location and size of hangers, brackets and intermediate framing members when required, and also details of connection to building structure.

3.11 ACCESS DOORS

- .1 Provide an access door and arrange for its installation by the Division in whose work it occurs, whenever any electrical item equipment requiring accessibility, maintenance or adjustment is concealed.

3.12 SPLITTER BOXES

- .1 Install splitters as indicated and mount plumb, true and square to the building lines.
- .2 Extend splitters full length of equipment arrangement.

3.13 JUNCTION BOXES

- .1 Install junction boxes in inconspicuous but accessible locations. Secure to structure.

- .2 Install terminal blocks on mounting rails, for termination of each wire and cable regardless of size.
- .3 Only one voltage source is permitted in a junction box.
- .4 Install barriers to separate different auxiliary systems.
- .5 In areas with hard ceilings (e.g. gypsum board), install junction boxes in an accessible area. Extend conduit to junction or pull boxes.
- .6 If an accessible area is not within reasonable reach, group all junction boxes for all systems in one area of the room and advise the Design Architect/Consultant of the need of an access door. Do not proceed with work until approval for access panel is received from the Design Architect.

3.14 TERMINAL BLOCKS - SURGE SUPPRESSION

- .1 Install surge suppression terminal blocks.

3.15 PULL BOXES

- .1 Install pull boxes in inconspicuous but accessible locations. Secure to structure.
- .2 Install pull boxes so as not to exceed 30 m of conduit run between pull boxes.
- .3 Only one voltage source is permitted in a pull box.
- .4 Install barriers to separate different auxiliary systems.
- .5 In areas with hard ceilings (e.g. gypsum board), install pull boxes in an accessible area. Extend conduit to junction or pull boxes.
- .6 If an accessible area is not within reasonable reach, group all pull boxes for all systems in one area of the room and advise the Design Architect/Consultant of the need of an access door. Do not proceed with work until approval for access panel is received from the Design Architect.

3.16 OUTLET AND CONDUIT BOXES

- .1 Install conduit outlet boxes for conduit up to 32 mm and pull boxes for larger conduits.
- .2 Support boxes independently of connecting conduits.
- .3 Seal boxes during construction to prevent entry of debris, dust and dirt.
- .4 For flush installations mount plaster rings to box, flush with wall surface to permit wall finish to come within 6 mm of opening.
- .5 Provide correct size of openings in boxes for conduit, armoured cable connections. Reducing washers will not be acceptable.
- .6 Install switches and other controls close to door lock or latch jambs and other openings, maintaining a minimum of 100 mm from trims of doors (except where installed in door frames of metal partitions) check door swings.
- .7 Install 100 mm square or octagonal outlet boxes for lighting fixture outlets.

3.17 METER CABINET

- .1 Install meter cabinet as close as feasible to service entrance switchboard.
- .2 For utility meters install cabinets with all local utility requirements.

3.18 MASONRY BOXES

- .1 In block walls use deep boxes to provide clear space around knockout for AC90 cable entry.

3.19 WIRING DEVICES - SWITCHES

- .1 In all front of house areas and public areas, all switches are to be Decora/Decorator style.
- .2 Install single throw switches with handle in UP position when switch is closed.
- .3 Install switches in gang type outlet box when more than one switch is required in a location.
- .4 Mount toggle switches at height indicated.
- .5 Switches to be white unless otherwise noted.

3.20 WIRING DEVICES - OCCUPANCY SENSORS

- .1 Install each occupancy sensor at locations indicated.
- .2 Mount occupancy sensor/switches at height indicated.

3.21 WIRING DEVICES - RECEPTACLES

- .1 Generally, install receptacles vertically with ground pins up.
- .2 In patient care areas, 15A/20A straight blade receptacles to be hospital grade.
- .3 In all front of house areas and public areas, all receptacles are to be Decora/Decorator style.
- .4 Comply with requirements of CSA Standard Z32, with regards to identifying the circuit number and supplying panelboard, permanently identified at the outlets. Identify this information in the areas on the front of each receptacle.
- .5 Install receptacles vertically, use gang type outlet box where more than one receptacle is required in a location.
- .6 Where split receptacle has a portion switched, mount vertically and switch upper portion.
- .7 Coordinate with architectural and interior design drawings for final positioning and mounting heights of power and voice/data receptacles. Where there is disagreement between electrical and architectural drawings, take the architectural drawings as correct.
- .8 Maintain clearances between receptacle outlet boxes and millwork as stipulated on the drawings.
- .9 Align and evenly space outlet boxes that are mounted as a group.
- .10 Receptacles to be white unless otherwise noted.

3.22 WIRING DEVICES - COVER PLATES

- .1 Protect stainless steel cover plate finish with paper or plastic film until painting and other work is finished.
- .2 Install suitable common cover plates where wiring devices are grouped.
- .3 Cover plate to match colour of device.
- .4 Do not use cover plates designed for flush outlet boxes on surface-mounted boxes.
- .5 Provide plaster ring where necessary.
- .6 Install cover plates as follows:

Area	Cover Plate Type
Gypsum board, plaster or panelled	stainless steel (nylon)
Offices	Nylon
Service	Nylon
Exterior	Lockable weather proof

3.23 WELDING RECEPTACLES

- .1 Install welding receptacles.
- .2 Ensure that phase rotation is similar for all receptacles.

3.24 CONTROL DEVICES

- .1 Install as indicated.

3.25 PLYWOOD BACKBOARDS

- .1 Install G1S plywood backboards where indicated on drawings.
- .2 Backboards shall be painted with intumescent grey paint.

3.26 FIELD FABRICATED METAL WORK

- .1 Clean and prime paint field fabricated metal work.
- .2 After fabrication deburr, scrape, grind smooth, wire brush with power brush and degrease metal work.
- .3 Prime paint steel with 1 coat of CISC/CPMA 2.75 oil alkyd primer.
- .4 Prime paint aluminum as follows: wash with detergent solution and wipe down with SSPC-SP1 solvent. Apply Glidden #Y-5229 primer to 1.5 mils DFT.
- .5 For brass and bronze alloy materials, prepare as for aluminum but apply 1 coat of CAN/CGSB-1.40-M zinc chromate primer.

END OF SECTION