

1.0 CODES AND STANDARDS

- .1 Complete installation in accordance with the latest edition of the Canadian Electrical Code Part I (CSA C22.1) and the Saskatchewan Supplement, as well as Municipal and Provincial Codes and Regulations and the local authorities having jurisdiction. Where this specification is at variance with applicable Codes and Standards, the more stringent shall apply.
- .2 Comply with CSA Electrical Bulletins and Certification Standards in force at time of bid submission. While not identified and specified by number in this Division, these Bulletins and Standards are to be considered as forming part of related CSA Part II Standard.
- .3 All references to Codes and Standards refer to the latest edition in force at the time of bid unless specified otherwise.
- .4 Under no circumstances shall the Codes and Standards referred to above and herein, be interpreted to allow a lower standard than specified elsewhere herein.
- .5 Complete overhead systems in accordance with CSA C22.3 No. 1 and underground systems in accordance with C22.3 No. 7 except where specified otherwise.
- .6 Abbreviations for electrical terms: to CSA Z85.
- .7 Complete all work in a neat manner performed by qualified tradesmen. All work shall be completed under the on-site direction of a journeyman electrician.

2.0 QUALIFICATIONS

- .1 Designate a foreman / superintendent holding a journeyman's certificate to assume complete responsibility for the electrical construction work. Submit the name, qualifications, and experience to the electrical consultant for approval.
- .2 Furnish qualified personnel to continuously direct and monitor electrical construction work.
- .3 Attend site meetings.

3.0 PERMITS, FEES

- .1 The electrical consultant will submit to the Electrical Inspection Department and Supply Authority the necessary number of drawings and specifications for examination and approval prior to commencement of work. The electrical contractor shall pay all fees associated with this examination and approval.
- .2 Obtain and pay fees associated with all electrical inspections.

4.0 APPROVED EQUIVALENTS/ALTERNATES

- .1 The listing of a manufacturer and his respective type or catalogue number as the basis of design, is to establish the construction features, sizes, quality, and accessories of an item of equipment in addition to the characteristics specified.

- .2 Approval of equivalent products will be granted on the basis of the manufacturer, and general design only. Such approval does not relieve the electrical contractor and/or supplier from providing all necessary components and finishes as called for on the drawings or in the specifications.
- .3 Request for equals must be received in the electrical consultant's office not less than seven working days prior to subcontractor bid closing date.
- .4 A detailed line-by-line compliance comparison of any product submitted for approval, must be submitted. Exceptions and non-compliance shall be clearly identified. Requests for equals must include the following:
 - .1 A detailed bill of materials correlating each item of equipment to those specified.
 - .2 Catalogue product data sheet for each proposed item of equipment. If more than one model is shown on the data sheet, indicate exactly which model is proposed.
 - .3 Copy of the specification section with each paragraph marked to show where on the product data sheet the specification requirement is satisfied (use specification cross reference numbers on the product data sheet).
 - .4 If compliance with any specification requirement cannot be substantiated by reference to published data provide a typewritten compliance statement signed by an executive officer of the manufacturer. Stating that the executive proposed products comply with all specified requirements.
- .5 A contractor quoting on materials or equipment not thus approved, does so at his own risk and will be required to install those products which are approved.
- .6 The Contractor shall make allowances in his bid for the cost of any associated changes in this division made necessary by the selection of an approved product other than that named as the basis of designs. Additional costs to this division due to the departure from equipment named shall be borne by the contractor.

5.0 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

- .1 Submit shop drawings, product data and samples in accordance with the requirements of General Conditions.
- .2 Indicate details of construction, dimensions, capacities, weights and electrical performance characteristics of equipment or material. All shop drawings shall be identified with the project name.
- .3 Where applicable, include wiring, single line and schematic diagrams.
- .4 Include wiring drawings or diagrams showing interconnection with work of other Sections.
- .5 Submit a copy of each shop drawing in electronic PDF format to the electrical consultant for review. PDF documents must be generated by manufacturer's software, or from electronically published documentation. PDF documents generated by scanning technology are not acceptable. Consultant will return shop drawing submittals via email for distribution. It is the responsibility of the Contractor to ensure adequate copies of the

shop drawings are distributed to required parties, including a copy at the construction site.

- .6 If hard copies are submitted, submit three (3) copies of each shop drawing to the electrical consultant for review. Two copies will be returned to the architect who will subsequently return one copy to the Contractor (to produce required copies at his expense).
- .7 All electrical shop drawings for the project shall be submitted at one time and within 30 days of contract signing.

6.0 DRAWINGS AND SPECIFICATIONS

- .1 Examine also the architectural, structural, security/technology and mechanical drawings and specifications.
- .2 Drawings do not indicate all construction details. Any installation involving accurate measurements of the building shall be coordinated with construction drawings and/or actual on-site measurements.
- .3 Drawings and specifications are intended to supplement each other, and any information indicated on one and omitted on the other shall be assumed as included on both.
- .4 Refer to architectural reflected ceiling plan for exact location of lighting fixtures in t-bar ceiling grids.
- .5 The electrical sub-contractor shall peruse the mechanical drawings and specifications to confirm size and location of all motors, controls, and other equipment in order to determine exact electrical requirements of all mechanical equipment. Ensure that all electrical work noted on mechanical drawings and specifications are included in the electrical contract bid price.
- .6 In order to provide sufficient detail and clarity, the symbols used for various electrical devices, occupy more space on the drawing, than the device actually occupies when installed. The electrical sub-contractor shall use common sense when actually placing these devices, ensuring that devices are grouped wherever possible. Do not space devices along wall to coincide with the scale location of the electrical device symbol.
- .7 Bidders finding discrepancies or omissions in the specifications or drawings, or having doubt as to the meaning or intent thereof, shall at once notify the Consultant who will, if necessary, send written instructions or explanation to all bidders. Oral interpretations made to any bidder shall not effect a modification of any provision of the bid documents.

7.0 EXAMINATION OF THE SITE

- .1 Prior to submitting bid, visit the site and thoroughly investigate the location, connection points, and details of all services and systems which, in any way, may affect or tie-in with the work covered in these specifications and accompanying drawings. No extra will be considered for work resulting from conditions that would have been evident upon thorough examination of the site.

- .2 Any discrepancies, points of doubt, or contention shall be made known to the electrical consultant in writing not later than seven (7) days prior to closing date of tender; otherwise, allow for the most expensive alternative.

8.0 VOLTAGE RATINGS

- .1 Operating Voltages: to CAN3 C235.
- .2 Motors, electrical heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard.
- .3 Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

9.0 MATERIALS AND EQUIPMENT

- .1 Provide materials and equipment in accordance with the requirements of General Conditions.
- .2 Equipment and material to be CSA certified, and manufactured to standard quoted.
- .3 Where there is no alternative to supplying equipment which is not CSA certified, obtain special approval from Inspection Department.
- .4 Factory assemble control panels and component assemblies.
- .5 Uniformity of manufacturer shall be maintained for any particular item or type of equipment throughout the building.

10.0 FINISHES

- .1 Shop finish metal enclosures by removal of rust and scale, cleaning, application of rust resistant primer inside and outside, and at least two coats of finished enamel.
 - .1 Paint outdoor electrical equipment "equipment green" finish to EEMAC Y1-1.
 - .2 Paint indoor switchgear and distribution enclosures light grey to EEMAC 2Y-1.
- .2 Clean and touch up surfaces to shop-painted equipment scratched or marred during shipment or installation, to match original paint.
- .3 Clean, prime, and paint exposed hangers, racks, fastenings to prevent rusting.
- .4 All electrical fittings, supports, hanger rods, pull boxes, channel fittings, conduit racks, outlet boxes, brackets, clamps, etc. shall either have a galvanized finish, or have a painted finish over corrosion resistant primer.
- .5 Where indicated herein and on drawings, provide finishes to match samples as provided by the architectural consultant.

11.0 EQUIPMENT IDENTIFICATION

- .1 Identify electrical equipment with nameplates as follows:

Nameplates:

- .1 Plastic laminate engraving sheet, 3 mm thick, black face, white core, self-adhesive. Nameplates identifying emergency power system circuits shall be red face with white core.
- .2 Nameplate sizes:
 - Size 1 7 X 25 mm 1 line 3 mm high lettering
 - Size 2 7 x 40 mm 1 line 5 mm high lettering
 - Size 3 12 x 70 mm 2 lines 3 mm high lettering
 - Size 4 20 x 90 mm 1 line 8 mm high lettering
 - Size 5 20 x 90 mm 2 lines 5 mm high lettering
 - Size 6 25 x 100 mm 1 line 12 mm high lettering
 - Size 7 25 x 100 mm 2 lines 6 mm high lettering
- .3 Wording on nameplates to be approved prior to manufacture.
- .4 Allow for average of twenty-five (25) letters per nameplate.
- .5 Identification to be English.
- .6 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.
- .7 Nameplates for disconnects, starters, contactors and control stations shall indicate equipment being controlled, and voltage.
- .8 Nameplates for transformers shall indicate capacity, primary, and secondary voltages.
- .9 All nameplates shall be mechanically attached with a minimum of two chrome self tapping screws as well as the self adhesive.

12.0 WIRING IDENTIFICATION

- .1 Identify wiring with permanent indelible identifying markings either numbered or coloured plastic tapes, on both ends of phase conductors or feeders and branch circuit wiring.
- .2 Maintain phase sequence and colour coding throughout.
- .3 Colour Code: to CSA C22.1.
- .4 Use colour coded wires in communication cables, matched throughout system.
- .5 Contractor to coordinate identification scheme to match existing on site.

13.0 CONDUIT AND CABLE IDENTIFICATION

- .1 Colour code conduits, and metallic sheathed cables.

- .2 Code with 305 mm band of coloured spray paint at points where conduit or cable enters wall, ceiling, or floor, and at 15 m intervals in accessible ceiling spaces and service spaces:

Sound Systems	Purple
Emergency Power	Orange
Low Voltage Switching	Tan
Computer Data	Blue
Card Access	Brown
CCTV Video Surveillance System	White Striped

- .3 Contractor to coordinate identification scheme to match existing on site.

14.0 JUNCTION BOX IDENTIFICATION

- .1 Identify all system junction boxes with enamel spray paint on entire cover. Colour shall match those specified for conduit and cable identification.
- .2 Identify all junction boxes, containing branch circuit conductors, with neat hand lettering using black felt marker indicating panel and breaker number (i.e. "B-24). Provide corresponding identification on surface adjacent to junction box as well.

15.0 WIRING TERMINATIONS

- .1 Lugs, terminals, screws used for termination of wiring to be suitable for either copper or aluminum conductors.

16.0 MANUFACTURER'S AND CSA LABELS

- .1 Manufacturer's nameplates and CSA labels to be visible and legible after equipment is installed.

17.0 WARNING SIGNS

- .1 Provide warning signs, as specified or to meet requirements of Inspection Department.
- .2 Use decal signs, minimum 175 x 250 mm size.

18.0 MOUNTING HEIGHTS

- .1 Mounting heights of equipment are from finished floor to centerline of equipment unless specified or indicated otherwise.
- .2 If mounting height of equipment is not indicated, verify before proceeding with installation.
- .3 Install electrical equipment at the following heights unless indicated otherwise (assuming a minimum ceiling height of 2400 mm).
- .1 Intercom stations: 1500 mm

- .2 Closed circuit video surveillance system cameras: Refer to drawing

19.0 PROTECTION

- .1 Protect exposed live equipment during construction for personnel safety.
- .2 Shield and mark live parts "LIVE 120 VOLTS" or with appropriate voltage in English.

20.0 OWNER'S EQUIPMENT

- .1 This Contractor is responsible for electrical service connections to all Owner's equipment being supplied and installed in the building and that are shown in the contract documents. All Owner's equipment will be supplied complete with starters and disconnects as required.

21.0 WORK PROVIDED FOR OTHER DIVISIONS

- .1 Provide information as to the exact size and location of all required concrete foundations and curbs for equipment.
- .2 All bus ducts, cable tray, and conduit openings through floor, walls, and ceilings shall be sleeved 25 mm larger all around the duct, tray, or conduit. Fill the opening with 3# density acoustic media under 50% compression and seal both ends with the appropriate caulking compound. Refer to "Firestopping" specific requirements.
- .3 Supply and installation of control wiring for all line voltage thermostats, for unit heaters, force flow, and cabinet heaters.

22.0 WORK NOT INCLUDED IN THIS DIVISION

- .1 Low voltage and control wiring for the mechanical equipment associated with the heating and cooling of the building will not be included in this Division.

23.0 CONDUIT AND CABLE INSTALLATION

- .1 Install conduit, and sleeves, prior to pouring of concrete. Sleeves through concrete: schedule 40 steel pipe, sized for free passage of conduit, and protruding 50 mm.
- .2 Install cables, conduits, and fittings neatly and close to building structure so furring can be kept to minimum.
- .3 Conduit shall be laid out to avoid interference with other trades, and to maintain maximum headroom. Arrange conduit to conserve space, allow maintenance, and avoid crossovers where possible.
- .4 Holes through exterior walls and roof shall be flashed and made completely weatherproof.

24.0 FIRESTOPPING

- .1 Provide firestopping in accordance with the requirements of General Conditions.

- .2 Provide fire stopping and smoke seal system materials in accordance with CAN4-S115. Materials shall be asbestos free and systems shall be capable of maintaining an effective barrier against gases, flame and smoke in compliance with CAN4-S115, not exceeding opening sizes stated and conforming to all requirements of the Standard. Fire-resistance rating of fire stopping material assembly shall meet or exceed the fire-resistance rating of the floor, wall or partition being penetrated. Acceptable manufacturers include: Fyre Shield manufactured by Tremco Ltd.,

Fyre-Sil manufactured by Tremco Ltd., Mineral Wool and FSI Silicone Sealant manufactured by FSI Engineering.

Damming and backup materials, supports and anchoring devices to manufacturer's recommendations and in strict accordance with tested assembly being installed, and as acceptable to the Authority Having Jurisdiction.

25.0 ACCESS

- .1 Provide access doors for installation in walls and ceiling to service electrical equipment. Supply to appropriate trade for installation. Doors shall be ULC labelled when installed in fire separations. Wherever finish and construction allow, access doors shall be installed flush with the finished surface. Access doors shall have 16 gauge frames, 14 gauge door panels, piano hinge, screw driver latch, and mounting channels as required for installation. Minimum size shall be 300 mm x 300 mm.

26.0 INSULATION RESISTANCE TESTING

- .1 Megger circuits, feeders, and equipment up to 350V with a 500V instrument.
- .2 Megger 350 - 600V circuits, feeders, and equipment with 1000V instrument.
- .3 Check resistance to ground before energizing.

27.0 EXCAVATION AND BACKFILL

- .1 Route of underground electrical and communication services shall be as indicated on drawings. Depth shall be minimum 1000 mm below grade unless otherwise noted.
- .2 Backfill shall be machine tamped in 150 mm layers to prevent future settling.
- .3 Replace existing pavement, lawn turf, concrete, etc. where damaged, or removed in connection with the installation of these underground services.
- .4 Investigate location of all existing underground services which may exist in the vicinity of the new services. This contractor shall be responsible for all damage to existing services caused during excavation and backfill.
- .5 Level the bottom of all trenches with a 75 mm (minimum) layer of sand. Underground cables shall be covered by a 75 mm (minimum) layer of sand prior to backfill.
- .6 Install 150 mm wide green or yellow 6 mil poly ribbon approximately 300 mm above buried conductors, to serve as a warning flag.

28.0 CLEANING

- .1 Complete final cleaning in accordance with the requirements of General Conditions.
- .2 Protect all equipment and material from weather and the work of other trades. Remove waste periodically. Clean all materials and equipment prior to acceptance of the Work.
- .3 At time of final cleaning, clean lighting reflectors, lenses, and other lighting surfaces that have been exposed to construction dust and dirt. The electrical installation shall be left in a clean and finished condition, to the satisfaction of the electrical consultant.

29.0 TESTS

- .1 Conduct and pay for tests of the following:
 - .1 Circuits originating from branch distribution panels.
 - .2 Lighting and its control.
 - .3 Systems:
 - intercom and paging system
 - communications horizontal cabling
 - closed circuit video surveillance
- .2 Furnish Manufacturer's certificate or letter confirming that entire installation as it pertains to each system has been installed to Manufacturer's instructions.
- .3 Notify electrical consultant a minimum of 48 hours prior to test.
- .4 Provide instruments, meters, equipment, and personnel required to conduct tests during and at conclusion of project.
- .5 Submit test results for electrical consultant's review.

30.0 RECORD DRAWINGS

- .1 Submit record drawings in accordance with requirements of General Conditions.
- .2 Obtain one set of solid white prints to be used for record work as actually installed. Record on this set, all changes associated with the work.
- .3 Obtain one set of electrical drawing prints, and upon completion of the work, transcribe all information from the on-site record prints to the as-builts. Include all changes to the electrical contract including addenda, site instructions, change orders, and site conditions.

31.0 WARRANTY

- .1 Submit a written warranty stating that all materials and workmanship will be free from defects for a period of one (1) year from date of Substantial Performance of Work. The warranty period shall not begin until:
 - Electrical Operating and Maintenance Manuals are submitted and approved.
 - Systems Demonstration and Training is completed and Systems Demonstration certificate is submitted.

- .2 The electrical sub-contractor shall remain responsible for all electrical equipment and systems until the Electrical Operating and Maintenance Manuals are submitted and approved, and the Systems Demonstration and Training has been completed.

32.0 OPERATION AND MAINTENANCE DATA

- .1 Provide operation and maintenance data for incorporation into an electrical operation and maintenance manual as specified herein. The following are minimum requirements.
- .2 Include in operations and maintenance data:
 - .1 Cover page including project name, year, name of owner, electrical consultant, and electrical contractor. Cover page shall be enclosed in a clear plastic cover.
 - .2 Index.
 - .3 Electrical Contractor's Guarantee.
 - .4 List of manufacturer and supplier for all items.
 - .5 Name, address and phone number of local suppliers for items included in Maintenance Manual.
 - .6 "SYSTEMS DEMONSTRATION" certificate (refer to document included in Section 26 05 01).
 - .7 A copy of all panelboard directories.
 - .8 216mm x 280mm drawing indicating Single Line Diagram for electrical distribution system.
 - .9 Details of design elements, construction features, component function and maintenance requirements, to permit effective start-up operation, maintenance, repair, modification, extension and expansion of any portion or feature of installation.
 - .10 Technical data, product data, supplemented by bulletins, component illustrations, exploded views, technical descriptions of items and parts lists. Advertising or sales literature not acceptable.
 - .11 Operating Instructions for All Systems.
 - .12 Intercom/Paging Test Report and Verification Report (include in "Paging and Intercom System" section).
 - .13 Voice and Data Cabling Verification and Test Report (include in "Communications Horizontal Cabling" section).
 - .14 Closed circuit video surveillance system verification and test report (include in "CCTV Video Surveillance System" section).
- .3 Operation and Maintenance Data shall be contained within a 76 mm thick, black, hard cloth three ring binder. Binder shall be labelled directly on the front cover as well as the spine ("ELECTRICAL OPERATION AND MAINTENANCE MANUAL - PROJECT NAME - YEAR") with gold embossed lettering. Plastic sleeves for identification will not be accepted.
- .4 The following index tabs and associated product in information shall be contained within the binder:
 - Index
 - Contractor Guarantee
 - Manufacturer and Supplier List
 - Supplier Addresses and Phone Numbers
 - Systems Demonstration Certificate
 - Panelboard Directories

- Single Line Diagram
- Closed Circuit Video Surveillance System
- Paging and Intercom System
- Communications Horizontal Cabling
- Devices:

Divider tab pages shall be laminated mylar plastic with reinforced holes. Plastic tabs with typed insertions will not be accepted.

- .5 Provide three (3) operating and maintenance manuals as well as three electronic copies (CD disk containing O & M manual contents in PDF electronic format).

33.0 MAINTENANCE MATERIALS

- .1 Provide maintenance materials in accordance with the requirements of General Conditions.

34.0 CARE, OPERATION AND START-UP

- .1 Instruct owner's maintenance and operating personnel in the operation, care, and maintenance of equipment. A minimum of four (4) hours of instruction shall be provided. Provide documentation in maintenance manual confirming that instruction has been provided including description of system, owner representatives in attendance, date, and signatures.
- .2 Arrange and pay for services of Manufacturer's factory service representative to supervise start-up of installation, check, adjust, balance, and calibrate components.
- .3 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with aspects of its care and operation.
- .4 Complete the "SYSTEMS DEMONSTRATION" document (Refer to document in this section) and include in maintenance manual.
- .5 The instructional training session shall be videotaped, and one copy of the video (DVD format) shall be included with each of the maintenance manuals.

35.0 REVIEW OF WORK

- .1 When the contractor is satisfied that the work is completed, and after making his own inspection of work to verify completion, the electrical contractor shall submit a written request to the electrical consultant requesting a review of work.
- .2 Any deficiencies noted by the electrical consultant during the review of work, will be listed by the electrical consultant, and issued to the contractor.
- .3 Such deficiencies shall be corrected within three (3) weeks of the issuance of the deficiency list, or by a mutually agreed upon date. Once complete, the contractor shall submit a written request to the electrical consultant requesting a final deficiency review.

- .4 If subsequent site visits are required by the electrical consultant because the deficiencies listed were not complete, all time and expense costs incurred by the electrical consultant will be the responsibility of the electrical contractor.
- .5 During construction, the electrical contractor shall make any equipment or wiring accessible for review purposes, as requested by the electrical consultant.

36.0 DEMOLITION

- .1 Remove all redundant conduit and conductors to the source of supply. Where conduit is embedded in concrete or other inaccessible locations, it shall be abandoned.
- .2 Boxes, fittings, equipment and accessories which become redundant shall be completely removed. All such material shall become the property of the Contractor and he shall remove it from the site. Re-useable items of electrical equipment shall be re-installed where indicated on the drawings.
- .3 Remove all redundant light fixtures, speakers, starters, safety switches, contactors, enclosed breakers, panelboards, transformers, and other re-useable items of electrical equipment. These items shall be reinstalled where indicated on the drawings or shall be turned over to the Owner.
- .4 Where existing equipment is shown to be reinstalled, only the best quality items shall be selected for re-use.
- .5 The Contractor shall visit the site prior to submitting a bid to determine the amount of demolition work involved. No extras will be considered for work resulting from conditions that would have been evident upon thorough examination of the site.
- .6 Contractor shall dispose of luminaire ballasts containing polychlorobiphenyl contaminants, in accordance with the latest edition of all applicable local, provincial and federal codes and standards including but not limited to the following:

Environmental Contaminants Act – Chlorobiphenyl
Regulations #1 (July 1, 1985)
Regulations #2 (August 1, 1985)

37.0 BREAKDOWN AND PRICES

- .1 During the course of construction, when the Contractor is requested to submit a price for the performance of additional work, the price shall be broken down as requested by the electrical consultant to show quantity, material, and labour charges for each item.
- .2 Submit the following Contract Price Breakdown to the electrical consultant within 30 days of award of the contract, and with each monthly progress claim during construction. Alternate formats for Contract Price Breakdown are not acceptable. Submit invoices to support claims for material on site, when requested.

END OF SECTION

SYSTEMS DEMONSTRATION

PROJECT: _____

DATE: _____

TIME: _____ to _____

A demonstration of electrical systems was conducted on site, to instruct owner's personnel in the operation, care, and maintenance of electrical equipment and systems.

Systems included: (indicate)

- ___ Intercom/Paging System
- ___ Closed Circuit Video Surveillance System

The following persons have witnessed this demonstration:

Owners: _____
(name) (signature)

(name) (signature)

(name) (signature)

Contractor: _____
(name) (signature)

Manufacturer's Representative:

(name) (signature)

1. General

1.1 RELATED WORK SPECIFIED ELSEWHERE

- .1 Wire and Cable: Section 26 05 21.
- .2 Outlet Boxes: Section 26 05 32.

2. Products

2.1 MATERIALS

- .1 All fixture and branch wiring joints in junction and outlet boxes shall be made with a CSA certified pressure type connector rated at 600 volts maximum. Connector body shall consist of a cone shaped coil spring insert, insulated with a colour coded flame retardant, thermoplastic shell, which shall be knurled for easy grip.
- .2 Lugs, terminals, and screws used for termination of conductors, shall be suitable for type of conductor used.
- .3 Wire connectors to CSA C22.2 No. 65-93.

3. Execution

3.1 INSTALLATION

- .1 Remove insulation carefully from ends of conductors and:
 - .1 Install mechanical pressure type connectors and tighten as recommended by Manufacturer as specified in CSA C22.2 No. 65-93. Installation shall meet secureness tests.

END OF SECTION

1. General

2. Products

2.1 MATERIALS

- .1 Conductors: copper, sized as indicated, with 600 volt insulation rated at 90°C. The conductor shall have PVC insulation with an overall nylon jacket (T90 or THHN), or cross-linked polyethylene insulation (R90 XLPE or RW90 XLPE).
- .2 Conductor shall be stranded for sizes #10 AWG and larger.
- .3 Conductors: to CSA C22.2 38.
- .4 Armoured cable: Copper conductors, interlocking armour fabricated galvanized steel strip.
- .5 Teck cable: copper conductors sized as indicated with 600 volt insulation rated at 90°C. Chemically cross-linked thermosetting polyethylene insulation, inner jacket of polyvinyl chloride material, interlocking aluminium armour, polyvinyl chloride overall coating (FT-4 flame test rated).

3. Execution

3.1 INSTALLATION – GENERAL

- .1 In conduit systems in accordance with Section 26 05 34.
- .2 #12 AWG shall be the minimum wire size used for branch circuits. All building conductors shall be sized to allow for a maximum of 2% voltage drop.
- .3 Conductor phasing for three phase electrical distribution equipment shall be made phase A, B, C, from left to right when facing equipment. The A, B, C, phasing shall be continuous from the incoming utility supply, throughout the electrical system, including panels, motor control centres, transformers, etc. and shall continue through to all the branch circuitry to the final connection of the outlet or device. Phase colour coding shall be red, black and blue for phases A, B and C respectively (X, Y, Z sequence). Continuous colour coding of insulation is required for conductors sized #2 AWG and smaller. Colour code phase taping for conductors sized #2 AWG and smaller will not be allowed.
- .4 Neutral conductors shall be white, ground conductors green, and isolated ground conductors green with yellow striped identification.
- .5 #14 AWG may be used for armoured cable drop to lighting fixtures only.
- .6 Conductors drawn into conduit shall not be pulled more than 30 metres nor more than three 90° bends without pullboxes.
- .7 Lubricant for pulling conductors shall be wax base insoluble in water and non-hardening.
- .8 Identify all conductors (including neutral) with “Brady” marker to describe circuit number, wherever they are terminated in a junction box or panelboard.

- .9 Neutral conductors shall not be derated.
- .10 Low voltage wiring shall be red, blue, and orange in colour, minimum #16 AWG, THHN.
- .11 Control wiring conductors shall be red in colour (except associated building neutral conductor shall be white in colour).
- .12 Ground conductors shall be green in colour **A separate insulated (green) ground conductor shall be installed in each conduit system.** The conduit system will not constitute an adequate ground.
- .13 Install a separate insulated (green with yellow trace stripe or yellow band) conductor for each group of three isolated ground circuits installed with a common neutral (one isolated ground conductor per common neutral).
- .14 Insulation for all conductors installed exterior to the building shall be rated at minus 40 degrees Celsius.
- .15 Circuits sharing a neutral shall be consecutive breakers in the panel (i.e. 1, 3, 5 or 8, 10, 12). Circuits energizing receptacles in computer labs, or dimming circuits shall not share neutrals.
- .16 Refer to Section 26 05 34 regarding installation of armoured cable.
- .17 Branch wiring for emergency power supply branch circuits shall be banded with yellow identification.

END OF SECTION

1.0 General**2.0 Products****2.1 MATERIALS**

- .1 Grounding equipment to: CSA C22.2 No. 41.
- .2 Copper grounding conductors to: ASA G7.1.

2.2 EQUIPMENT

- .1 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:
 - .1 Grounding and bonding bushings.
 - .2 Protective type clamps.
 - .3 Bolted type conductor connectors.
 - .4 Compression connectors – Burndy Type #YGHR-C (ground rod to cable) and #YGHC-C (cable to cable).
 - .5 Bonding jumpers, straps.
 - .6 Pressure wire connectors.

3.0 Execution**3.1 INSTALLATION – GENERAL**

- .1 Install a complete permanent continuous grounding system including electrodes, conductors, connectors, accessories, as indicated, to conform to requirements of electrical consultant and local authority having jurisdiction over installation.
- .2 Install connectors to Manufacturer's instructions.
- .3 Protect exposed grounding conductors from mechanical injury.
- .4 Use mechanical connectors for grounding connections to equipment provided with lugs.
- .5 Soldered joints not permitted.
- .6 Install bonding wire for flexible conduit, connected at both ends to grounding bushing, solderless lug, clamp of cup washer and screw. Neatly cleat bonding wire to exterior or flexible conduit.
- .7 Install separate insulated green ground conductor in each conduit system. The conduit system will not be considered as providing an adequate ground.

- .8 Install a continuous green insulated ground conductor (#6 AWG minimum), the entire length of cable tray. Bond the conductor to each section of the cable tray. Terminate the ground conductor at the main building ground grid.
- .9 Install a separate bonding conductor to outdoor lighting poles, each equipment branch circuit, and each duplex receptacle branch circuit for computer.

3.2 COMMUNICATION SYSTEMS

- .1 Install grounding connections for telephone, computer, sound, fire alarm, and intercommunication systems as follows:
 - .1 Telephones: make telephone grounding system in accordance with telephone company's requirements. Install #6 insulated green copper grounding conductor from main telephone service entrance plywood to the main building ground grid.
 - .2 Computer, sound, fire alarm and intercommunication systems shall each be provided with a separate ground conductor originating at the main building ground grid.

3.3 TESTS

- .1 Perform tests in accordance with Section 26 05 01.
- .2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of the Electrical Consultant and local authority having jurisdiction over installation. Ground resistance to be maximum five (5) ohms prior to connections being completed at the ground grid.
- .3 Perform tests before energizing electrical system.
- .4 Disconnect ground fault indicator during tests.

END OF SECTION

1. General

1.1 RELATED WORK SPECIFIED ELSEWHERE

- .1 Conduit, conduit fastenings, and conduit fittings: Section 26 05 34.

2. Products

2.1 SUPPORT CHANNELS

- .1 Support channels, length as indicated, U-shape, size 41 mm x 41 mm, 2.5 mm thick, surface mounted or suspended.

2.2 FASTENERS

- .1 Acceptable Fasteners:
 - Hilti "HKD"
 - Hilti "kwik" bolts
 - beam clamps

2.3 MANUFACTURERS

- .1 Acceptable Channel manufacturers: Burndy Ltd., Electrovert Ltd., Unistrut Ltd.

3. Execution

3.1 INSTALLATION

- .1 Lead anchors and plastic anchors will not be permitted.
- .2 Secure equipment to poured concrete with expandable inserts.
- .3 Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.
- .4 Secure surface mounted equipment with twist clip fasteners to inverted "T" bar ceilings. Ensure that "T" bars are adequately supported to carry weight of equipment specified before installation of same.
- .5 Support equipment, conduit or cables using clips, spring-loaded bolts, cable clamps designed as accessories to basic channel members.
- .6 Fasten conduit or cables to building construction or support system using straps.
 - .1 One-hole steel straps to secure surface conduits and cables 50 mm and smaller.
 - .2 Two-hole steel straps for conduits and cables larger than 50 mm.
 - .3 Clamps to secure conduit to exposed steel work.
- .7 Suspended support systems:
 - .1 Support individual cable or conduit runs with 6 mm diameter threaded rods and spring clips.

- .2 Support 2 or more cables or conduits on channels supported by 6 mm diameter threaded rod hangers where direct fastening to building construction is impractical.
- .8 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.
- .9 Provide adequate support for raceways and cables dropped vertically to equipment where there is no wall support.
- .10 Do not use wire lashing, tie wraps, or perforated strap to support or secure raceways or cables.
- .11 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of the electrical consultant.
- .12 Install fastenings and supports as required for each type of equipment cables and conduits, and to Manufacturer's installation recommendations.
- .13 Do not install screws through upper flute portion of metal roof deck when roof membrane is located directly on top of metal roof deck. Confirm with general contractor.

END OF SECTION

1.0 General

1.1 SECTION INCLUDES

- .1 Conduit
- .2 Boxes
- .3 Cabinets

2.0 Products

2.1 MATERIAL

- .1 Interior Boxes: Provide galvanized sheet steel boxes, blanked for conduit, attached lugs for locating.
- .2 Exterior Boxes: Cast aluminum deep type boxes, FA series with threaded hubs.
- .3 Masonry Boxes: 90 mm deep, conduit knockouts for mounting in masonry walls.
- .4 Combination boxes with barriers where outlets for more than one system are grouped.
- .5 Back boxes for specialty system as recommended by suppliers.

2.2 COMPONENTS

- .1 Ceiling outlets, surface mounting, concealed:
 - .1 101 mm square, depth 54 mm, Iberville 52171 series.
 - .2 119 mm square, depth 54 mm, Iberville 72171 series.
- .2 Ceiling outlets, concealed mounting in concrete:
 - .1 101 mm octagonal concrete rings, depth from 38 mm to 152 mm 54521 series.
 - .2 Extension ring to change from recessed conduit to exposed conduit, 101 mm octagonal, 38 mm deep square Iberville 53151-2 or 38 mm deep octagonal 51151C or 54 mm deep, 55171C.
- .3 Wall boxes, concealed in concrete or masonry: for one (1) and two (2) gang applications shall be 101 mm square, 54 mm deep, 52171 series complete with suitable 52-C-49 series square cornered raised tile wall cover for proper device and wall surface application. Masonry boxes may be used for line voltage switching.
- .4 Wall outlets, concealed non-masonry construction, with plaster finish: for one (1) or two (2) gangs used with switches, receptacles, etc., use 54 mm deep 52171 series, with matching plaster covers, depth to suit. Alternately, use 119 mm square boxes, Iberville 72171 series and covers as required. (For more than two (2) gangs use solid boxes GSB series with GBC series cover, or special boxes as required.)

- .5 Wall outlets, surface, exposed mounting or used for outdoor outlets: one (1) or more gang, FS series or FD series, conduit.
- .6 Covers: Unless wiring devices and plates are mounted, provide blank, round canopy covers to match boxes.

2.3 OUTLET BOXES FOR RIGID PVC CONDUIT

- .1 Materials:
 - .1 Rigid PVC boxes and fittings: Unplasticized PVC.

2.4 PULL AND JUNCTION BOXES

- .1 Pull and junction boxes: to CSA C22.2 No. 40-M1989 and as follows:
 - .1 Material: sheet steel.
 - .2 Covers: screw-on.
 - .3 Barriers: where indicated.

2.5 FLOOR BOXES

- .1 Floor Boxes: to CAN/CSA-C22.2 No. 18-92 and as follows:
 - .1 Faceplates: round, matte stainless steel.
 - .2 Covers: to fit devices as indicated on drawings.
 - .3 Concrete-tight Boxes: electrogalvanized sheet steel, after set adjustable.
 - .4 Fire rated poke thru boxes: Standard of Acceptance Legrand #6STC-6CT-NK-6MAAP2A-68REC (two (2) required).

3.0 Execution

3.1 INSTALLATION

- .1 All outlet boxes to be flush mounted in all areas except mechanical rooms, electrical rooms, above removable ceiling and crawl spaces.
- .2 Support boxes independently of connecting conduits.
- .3 No sectional, gangable or handy boxes are to be used.
- .4 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.

- .5 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.
- .6 Provide correct size of openings in boxes for conduit or cable connections. Reducing washers are not allowed.
- .7 Adjust position of outlets in finished masonry walls to suit course lines. Coordinate cutting of masonry walls to achieve neat openings for all boxes.
- .8 Do not distort boxes during installation. If boxes are distorted, replace with new boxes.
- .9 Use plaster rings to correct depth. Use 30 mm on concrete block.
- .10 Provide boxes sized as required by the Canadian Electrical Code. All boxes are to be the deep type as a minimum.
- .11 Install vapour barrier material to surround and seal all outlet boxes located on exterior walls of building. Maintain wall insulation.
- .12 Outlets installed in party walls to be offset by a minimum of one stud space.
- .13 Ceiling outlet boxes shall be provided for every surface mounted fixture or row of fixtures installed on suspended "hard" ceilings.
- .14 For outlets mounted above counters or in millwork coordinate location and mounting heights prior to installation. Refer to architectural details
- .15 Adjust height of outlets above heating cabinets. Coordinate with mechanical contractor.
- .16 Outlets flush mounted in T-bar ceilings shall be supported with "Caddy" type supports spanning to T-bar grid.
- .17 Outlet boxes in metal stud walls are to be solidly anchored on two sides of the box to the wall system to ensure box will not move within the wall.

END OF SECTION

1. General

1.1 RELATED WORK SPECIFIED ELSEWHERE

- .1 Electrical General Provisions: Section 26 05 01.

2. Products

2.1 SHEET METAL BOXES

- .1 All octagon boxes shall be hot dipped galvanized steel, minimum 100 mm in diameter #54151. All 100 mm square boxes shall be minimum 40 mm deep #52151. Deep boxes #52171 shall be installed where specified and where six or more conductors enter the box.
- .2 Device boxes shall be minimum 64 mm deep (#1104).

2.2 CAST BOXES

- .1 All exterior outlet boxes shall be cast aluminum with female threaded hubs suitable for surface or recessed mounting as shown and required. (Crouse Hinds FS series)

2.3 PVC BOXES

- .1 PVC outlet boxes shall be CSA approved, two gang with gaskets cover unless otherwise stated. Size and quantity of knockouts shall be coordinated with conduit entrances.
- .2 PVC boxes and fittings to: CSA C22.2 No. 85.

3. Execution

3.1 INSTALLATION

- .1 Support boxes independently of connecting conduits. Secure outlet boxes to building structure.
- .2 Fill boxes with paper to prevent entry of construction material.
- .3 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Reducing washers not allowed.
- .4 Outlet boxes shall not be mounted back-to-back within the same stud space (separate by at least one stud).
- .5 Boxes installed in exterior stud walls shall be surrounded with a "poly pan" vapour barrier box prior to mounting. Openings through poly wrap for cables or conduit shall be sealed with caulking by this contractor prior to installation of wallboard. The "poly pan" vapour barrier box shall be installed with stud strapping supports on all four sides, so that a bead of caulking may be compressed between the poly pan flange and the wallboards. The stud strapping supports shall be installed by the framing contractor.

- .6 Outlet boxes that penetrate opposite sides of a wall assembly forming a fire separation, shall be offset to maintain the integrity of the fire separation. Boxes shall not be installed back-to-back.
- .7 Coordinate location of outlet boxes in masonry walls, so that the outlet box is centred between masonry block course lines. All cutting of masonry for installation of electrical equipment shall be completed using rotary cutting equipment.
- .8 Extension rings shall **not** be utilized to accommodate conductor fill requirements.
- .9 Where 25 mm conduit is utilized, outlet boxes must be minimum 119 mm (4 11/16") square.
- .10 Where outlet boxes are installed in a stud framed wall, a 300 mm length of stud shall be fastened to the side of the outlet box opposite the framing stud to which the outlet box is attached. This 300 mm length of stud will become sandwiched between the gypsum board wall finishes thereby supporting the outlet box on the "unsupported" side of the box.
- .11 Spacing of outlet boxes mounted side by side shall be maximum 125 mm (including installation in masonry, brick, and concrete, etc.).
- .12 For flush mounted device (switch or duplex receptacle) outlet boxes, utilize a 102 x 102 mm square outlet box (64mm deep) with a square cut single device raised cover. Face of wall finish shall come within 5 mm from face of outlet. Plaster rings will not be permitted.
- .13 All outlet boxes installed in masonry walls shall be approved masonry boxes.
- .14 Confirm the direction of door swings with architectural drawings, and on site, to confirm that outlet boxes for light switches are located on the latch side of the door.
- .15 Coordinate rough-in location of all outlet boxes with architectural, structural, and mechanical drawings. Review all architectural room elevations prior to rough-in of outlet boxes to ensure that there are no conflicts with other building components.
- .16 Where devices are located adjacent to one another they shall be grouped in a multi gang outlet box. Provide and install barriers where required.

END OF SECTION

1. General

1.1 RELATED WORK

- .1 Fastenings and Supports: Section 26 05 29.

2. Products

2.1 CONDUITS

- .1 Rigid metal conduit: to CSA C22.2 No. 45.
- .2 Electrical metallic tubing (EMT): to CSA C22.2 No. 83. EMT shall be thin-walled electroplated steel.
- .3 Flexible metal conduit and liquid-tight flexible metal conduit: to CSA C22.2 No. 56.
- .4 Type DB2 PVC duct for ductbanks and direct burial: sized as indicated on drawings, to CSA C22.2 No. 211.1.
- .5 Rigid PVC conduit: sized as indicated on drawings to CSA C22.2 No. 211.2.
- .6 Flexible non-metallic tubing: to CSA C22.2 No. 227.3. Ipex "Cor-Line" or approved equivalent.

2.2 CONDUIT FASTENINGS

- .1 One hole galvanized steel straps to secure surface conduits 50 mm and smaller. Use two hole galvanized steel straps for conduits larger than 50 mm.
- .2 Beam clamps to secure conduits to exposed steel work.
- .3 Channel type supports for two or more conduits at the following maximum spacings:
 - 1500 mm for 13 mm and 19 mm conduits
 - 2000 mm for 25 mm and 32 mm conduits
 - 3000 mm for 40 mm and larger conduits
- .4 6 mm diameter threaded rods to support suspended channels.
- .5 Conduit clamps for conduits on channels.

2.3 CONDUIT FITTINGS

- .1 Fittings for raceways: to CSA C22.2 No. 18-97.
- .2 Fittings manufactured for use with conduit specified.
- .3 Factory "ells" where 90 degree bends are required for 19 mm and larger conduits.

3. Execution

3.1 INSTALLATION

- .1 Drawings do not show all conduits. Those shown are in diagrammatic form. Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.
- .2 Conceal conduits except in unfinished areas and concealed ceiling spaces.
- .3 Use rigid conduit in any location which, in the opinion of the electrical consultant is subjected to mechanical damage or corrosion.
- .4 Use flexible metal conduit or armoured cable only for the following:
 - .1 Connection to surface or recessed fixtures in t-bar ceilings (maximum 3000 mm length).
 - .2 Vertical branch circuit wiring to outlets in steel stud partition walls. Do not use for horizontal branch circuit wiring within partition walls. Convert armoured cable to EMT at junction box located in ceiling space directly above the outlet in the wall.
- .5 Use rigid P.V.C. underground or in concrete slabs only. PVC conduit is not acceptable above floor slab.
- .6 Use flexible non-metallic tubing in concrete slabs only. Flexible non-metallic tubing is not acceptable above concrete floor slab (adapt to EMT).
- .7 Use liquid-tight flexible metal conduit and liquid-tight connectors for connection to all motors and transformers.
- .8 Bend conduits cold, so that conduit at any point is not flattened more than 1/10th of its original diameter. Consider conduits bent more than this or kinked as defective and replace.
- .9 Mechanically bend steel conduit over 19 mm diameter.
- .10 Field threads on rigid conduit shall be sufficient length to draw conduits up tight.
- .11 Provide polypropylene pull cord in empty conduits to facilitate pulling wiring in future.
- .12 Run 3 - 25 mm spare conduits up to ceiling space from each flush panel. Terminate these conduits in 152 x 152 x 102 mm junction boxes located in the accessible ceiling space above or in case of an exposed concrete slab, terminate each conduit in a surface type box mounted on the underside of the slab.
- .13 Where conduits become blocked, use of corrosive agents is prohibited. Remove and replace blocked section.
- .14 Dry conduits out thoroughly before installing wire.
- .15 Conduits shall not pass through structural members without the knowledge and consent of the structural consultant.

- .16 Locate conduits not less than 75 mm parallel to steam or hot water lines with a minimum of 25 mm at crossovers.
- .17 All conduit connectors shall be complete with a nylon insulated throat wherever conduit terminates in an outlet or junction box.
- .18 Conduit shall be secured to building structure. Do not fasten conduit to suspended ceiling or its support.
- .19 Run conduit parallel or perpendicular to building lines, when installed exposed or in ceiling spaces.
- .20 Locate conduits a minimum of 1.5 metres from infrared or gas fired heaters.
- .21 Conduits to be run in flanged portion of structural steel.
- .22 Group conduits wherever possible on surface channels.
- .23 Install CSA approved expansion fittings complete with grounding jumpers where conduits cross building expansion joints. Provide offsets in conduit adjacent to building expansion joints, where conduit is installed above suspended ceilings.
- .24 Conduits installed between heated and unheated spaces shall be sealed internally with a silicone sealant at the wall between the two spaces.
- .25 PVC conduit stubbed below grade for utility service entrance conduits, shall be sleeved (minimum 600 mm in length) with an O.D. 25 mm larger than the PVC conduit.
- .26 A minimum of one expansion joint shall also be installed in each 3000 mm length of PVC conduit installed on the exterior of the building.
- .27 Install conduit sealing fittings in hazardous areas. Fill with compound.

3.2 CONCEALED CONDUITS

- .1 Horizontal runs are not permitted in masonry walls.
- .2 Conduits are not permitted in terrazzo or concrete toppings.

3.3 CONDUITS UNDERGROUND

- .1 Slope conduits to provide drainage.
- .2 Thoroughly waterproof joints (PVC excepted) with a heavy coat of bituminous paint.

3.4 IDENTIFICATION

- .1 Refer to General Provisions – Conduit and Cable Identification: Section 26 05 01.

END OF SECTION

1. General

1.1 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and product data in accordance with 26 05 01.

1.2 OPERATING AND MAINTENANCE DATA

- .1 Provide data for incorporation into Electrical Maintenance Manual specified in Section 26 05 01.

2. Products

2.1 SWITCHES

- .1 15 amp, 120V, single pole, three-way, four-way switches as indicated.
- .2 Manually operated specification grade AC switches as indicated and with following features:
 - .1 Terminals approved for #10 AWG wire.
 - .2 Silver alloy contacts.
 - .3 Urea or melamine moulding for parts subject to carbon tracking.
 - .4 White rectangular rocker type operator ("decorator" style).
 - .5 Grounding terminal or self-grounding clip.
- .3 Switches of one Manufacturer throughout project.
- .4 Switches to: CSA C22.2 No. 111.

2.2 COVERPLATES

- .1 Coverplates from one Manufacturer throughout project.
- .2 Sheet steel utility box cover for wiring devices installed in surface mounted utility boxes.
- .3 Cast coverplates for wiring devices mounted in surface mounted FS or FD type conduit boxes.
- .4 Weatherproof "while in use" coverplates, complete with gaskets for duplex receptacles as indicated. Coverplates shall be suitable for wet locations whether or not a plug is inserted into the receptacle.
- .5 Type 302 stainless steel coverplates for all other devices. Thickness shall be minimum .9 mm (.04"). Finish shall be smooth satin without lines.

3. Execution

3.1 INSTALLATION

- .1 Switches:

- .1 Install single throw switches with handle in "UP" position when switch closed.
 - .2 Install switches in gang type outlet box when more than one switch is required in one location.
 - .3 Mount toggle switches at height specified in Section 26 05 01 or as indicated.
 - .4 Locate light switches on latch side of doors.
- .2 Coverplates:
- .1 Protect coverplate finish with paper or plastic film until painting and other work is finished.
 - .2 Install suitable common coverplates where wiring devices are grouped.
 - .3 Do not use coverplates meant for flush outlet boxes on surface mounted boxes.
- .3 Device Identification:
- .1 Identify branch circuit number on all receptacles with fine tipped black felt permanent marker on side of receptacle body. Identification shall be visible only when coverplate is removed.
 - .2 Identify all receptacle coverplates with clear self-adhesive mylar tape with black lettering (i.e. "A-32"). Alternatively, coverplates can be mechanically engraved.
 - .3 Identify all surge protected isolated ground receptacle coverplates with additional label (as above) indicating "COMPUTER ONLY".

END OF SECTION