Part 1 General

1.1 RELATED REQUIREMENTS

.1 01 35 25 – Special Procedures on Lockout Requirements.

.2 26 05 00 Common Work Results - For Electrical

.3 26 05 20 Wire and Box Connectors (0-1000V)

.4 26 05 21 Wires and Cables (0-1000V)

.5 26 27 26 Wiring Devices

.6 26 05 29 Hangers and Supports for Electrical Systems

.7 26 05 31 Splitters, Junction, Pull Boxes and Cabinets

.8 26 05 32 Outlet Boxes, Conduit Boxes and Fittings

.9 26 05 34 Conduits, Conduit Fastenings and Conduit Fittings

.10 26 28 23 Disconnect Switches - Fused and Non-Fused

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.1-12, Canadian Electrical Code, Part 1 (23nd Edition), Safety Standard for Electrical Installations.

.2 Abbreviations for electrical terms: to CSA Z85.

.3 CSA Electrical Bulletins in force at the time of tender submission, while not identified and specified by number in this division, are to be considered as forming part of the related CSA Part II standard and must be complied with.

.2 Health Canada / Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

1.3 CONTRACT DRAWINGS

.1 No omissions in the drawings or specifications are intended and the Contractor shall give due consideration to this matter. Any work or material referred to in the drawings and not in the specifications, or vice versa, shall be furnished and performed as though fully covered in both. This shall apply particularly to the drawings where descriptions are sufficiently detailed so as to require little or no mention in the specifications. Items indicated on floor plans and not on riser diagrams, or vice versa, shall be considered fully covered by both.

.2 Existing information is taken from as-built drawings provided by the Departmental Representative and site investigations. All existing information shall be confirmed on site before starting.

.3 Runs of conduit and outlet locations indicated on the drawings are diagrammatic and exact locations must be determined by the Contractor as the work proceeds, with due regard to the structure and the work of other trades. The Departmental Representative reserves the right to alter locations of conduit and outlets up to 3000 mm without extra cost, provided that the Contractor is advised prior to roughing in. The Contractor shall make any changes dictated by structural requirements, or conflicts with other trades, without charge.

.4 Any error or omission shall be referred to the Departmental Representative whose decision shall be final.

.5 Building dimensions shall not be scaled from the electrical drawings but shall be obtained from the site if Architectural and/or Structural drawings are not available. Any discrepancy between the drawings and the building shall be questioned before proceeding with the installation.

1.4 WORK INCLUDED

.1 The specifications complement the drawings in describing the supply and installation of the complete electrical systems. The description of work shall include but not be limited to the following:

.1 The demolition, removal and relocation of electrical system as indicated on the drawing and in the specifications.

.2 Provision of new electrical systems, including power system and lighting system, as indicated on the drawing and in this specifications.

.3 Provision of power supply and control to mechanical equipment as indicated on the drawing and in this specification.

.4 Patching, painting, and furring as required.

1.5 DESIGN REQUIREMENTS

.1 Operating voltages: to CAN3-C235.

.2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard.

.1 Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

1.6 SUBMITTALS

.1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit updated panel schedules and circuiting on marked up electrical drawings upon completion of the work.

.3 Shop drawings:

.1 The Contractor shall prepare shop drawings showing in detail the design and construction of all equipment, panels, cabinets, lighting, lighting control, etc. Six (6) copies of all such drawings shall be submitted to the Departmental Representative for review, and the work shall not be executed until such review has been obtained.

.2 All shop drawings, other than standard manufacturers' dimensions and data sheets, shall bear the stamp of a registered professional Engineer who shall be fully responsible for the Engineering content of such drawings.

.3 Prior to submission the Contractor shall carefully check all shop drawings to ensure that they comply with the drawings and specifications in both intent and detail. No consideration will be given to shop drawings submitted without this approval and review from the Contractor. Appendix A at the end of this section must be completed and signed and must accompany all shop drawing submissions. Submissions not accompanied by Appendix A will be returned for re-submission.

.4 The Departmental Representative's review of these drawings is general and is not intended to serve as a check and shall not release the Contractor from responsibility for errors or from the necessity of checking the drawings himself, or of furnishing the materials and performing the work as required by the plans and specifications.

.5 High quality electronic "PDF" copies of shop drawings are acceptable.

.4 Quality Control:

.1 Provide CSA certified equipment and material.

.2 Where CSA certified equipment and material is not available, submit such equipment and material to authority having jurisdiction for special approval before delivery to site.

.3 Submit test results of installed electrical systems and instrumentation.

.4 Permits and fees: in accordance with General Conditions of contract.

.5 Submit, upon completion of Work, load balance report as described in PART 3 - Load Balance.

.6 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to Departmental Representative.

.5 Manufacturer's Field Reports: submit to Departmental Representative manufacturer's written report, within 3 days of review, verifying compliance of Work, as described in PART 3 - FIELD QUALITY CONTROL.

1.7 QUALITY ASSURANCE

.1 Qualifications: electrical work to be carried out by qualified, licensed electricians or apprentices in accordance with authorities having jurisdiction as per the conditions of Provincial Act respecting manpower vocational training and qualification.

.1 Employees registered in provincial apprentices program: permitted, under direct supervision of qualified licensed electrician, to perform specific tasks.

.2 Permitted activities: determined based on training level attained and demonstration of ability to perform specific duties.

1.8 SYSTEM STARTUP

.1 At the conclusion of the job, the Contractor shall review and demonstrate to the Departmental Representative, all electrical equipment and their respective functions and operation. Such demonstration shall be provided for such reasonable periods of time as the complexity of the job warrants, and as approved by the Departmental Representative. Such review and demonstration shall be made by an authorized representative of the Contractor, who shall be fully knowledgeable of the project, its installation and operation. Three bound maintenance and operational manuals shall be reviewed and left with the Departmental Representative. These manuals shall be custom written for materials and systems supplied for this project. Generic information may accompany the manuals but must only be supplemental information. These manuals shall include, but not be limited to, approved copies of all shop drawings, guarantees, manufacturers maintenance instructions, diagrams, and parts lists, all packaging and installation instructions, and all operating instructions. Where manufacturers' literature is not available, or appropriate, the Contractor shall provide same in written form. Refer also to Section 01 78 00. Prior to final inspection, submit these manuals to the Departmental Representative for review.

.2 Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components and instruct operating personnel.

.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.

1.9 MINIMUM STANDARDS

.1 All work shall be performed in accordance with Canadian Electrical Code, and National Building Code, as minimum standards. These standards together with all Local or Municipal Rules, Regulations, and Ordinances shall be considered as the Latest Approved Editions at the time of Tender Closing. In no instance, shall the standard established by the drawings and specifications, be reduced by any codes.

1.10 PERMITS, FEES AND INSPECTION

.1 The Contractor shall obtain all inspections and permits required by all laws, ordinances, rules, and regulations by public authority having jurisdiction in this district, and shall obtain certificates of such inspections and shall pay all charges in connection therewith. The final certificate of inspection shall be obtained before final payment for work shall be considered due.

.2 In no instance shall the standard established by the drawings and specification be reduced by any codes, etc..

1.11 SUPERVISION

.1 The Contractor shall provide supervision and sufficiently qualified foreman to ensure that the job proceeds in a proper and efficient manner. If in the opinion of the Departmental Representative, such personnel are not competent to carry out their work, the Contractor shall replace these men immediately upon written request of the Departmental Representative.

1.12 OTHER TRADES

.1 The Contractor shall co-operate and investigate with other trades to make maximum use of the spaces and avoid conflict with pipes, ducts, equipment radiation, etc. Shop drawings shall be prepared by the Contractor indicating the route of main conduits and ducts which shall be submitted to the Departmental Representative for review.

.2 The Contractor shall co-operate with other Contractors on the site and carry out the work, in such a way, as not to hinder or hold-up the work of other trades.

.3 The Contractor shall consult with other Contractors, where their respective installations conflict and shall re-route conduits, ducts, outlets, equipment, etc., as required, subject to the approval of the Departmental Representative.

.4 The Contractor shall obtain from the mechanical, system furniture provider and other trades, complete detailed wiring diagrams of equipment requiring connections and shall be responsible for pointing out any discrepancies or the reason why they cannot be adhered to.

1.13 GUARANTEE

.1 The Contractor shall guarantee all work, under this Division, free from defects, for a period of one (1) year, after final acceptance of the entire project. The Contractor shall make good all defects, other than normal wear and tear, during the life of the guarantee. Notwithstanding the above, longer guarantees may be required for specific installations or equipment, as indicated in other sections of the specifications.

.2 Guarantees shall be submitted in writing, bound where more than one is required, and submitted to the Departmental Representative for review. Each guarantee shall include:

.1 Project name and address.

.2 Guarantee time period (commencement date shall be the date as shown on the project final certificate of completion, unless otherwise indicated).

.3 Clear and concise definition of what is guaranteed.

.4 Signatures of company officers of the Contractor and/or manufacturers, as applicable.

1.14 RECORD DRAWINGS

.1 One (1) set of white prints will be provided for record drawing purposes. Maintain project "as-built" record drawings and accurately record significant deviations from the Contract Documents, caused by site condition or Contract change. Mark changes on white prints in "RED".

.2 Prior to start of testing, balancing and adjusting, finalize production of as-built drawings.

.3 Testing, balancing and adjusting to be performed using as-built drawings.

.4 Turn over the as built drawings to the Departmental Representative at the completion of the project.

1.15 RENOVATION WORK

.1 Co-ordinate the removal or shutdown of existing services with the Departmental Representative. Indicate intent to remove, disconnect, or shutdown services in writing, and receive an affirmative written reply, prior to the start of such work.

.2 Remove all equipment and services indicated on the drawings or made redundant by renovation. If doubt exists, with reference to the removal of same items, obtain clarification from the Departmental Representative before proceeding. All equipment removed shall be brought to the attention of the Departmental Representative, who shall take possession of such items. If the Departmental Representative deems such equipment redundant, the Contractor shall remove and dispose of such items at his own cost.

.3 Maintain services to, and reconnect all equipment and apparatus to remain, should such services be disrupted during the renovation work.

.4 Renovation must be accomplished with the facility in full operation. In the event that it is necessary to temporarily relocate existing equipment to accommodate the work, or allow it to proceed in an orderly fashion, temporary services must be provided as a part of the work.

.5 Where circuitry to an existing panelboard has been changed, revise the existing directory accordingly. In the absence of a directory, provide one and detail the new and/or revised circuitry.

Part 2 Products

2.1 MATERIALS AND EQUIPMENT

.1 Contract materials shall be new and C.S.A. approved for their specific use.

.2 For the purposes of uniformity, similar materials shall be of one manufacturer (i.e. all panels and switchgear; breakers, all motor control equipment; all light fixtures in as much as is possible; etc.)

.3 To avoid the possibility of the work being delayed, the Contractor shall order all materials as soon as possible, and he shall report at once to the Departmental Representative any delays in the delivery of materials which would hold up the completion of the job.

2.3 WIRING TERMINATIONS

.1 Ensure lugs, terminals, screws used for termination of wiring are suitable for either copper or aluminum conductors.

2.4 EQUIPMENT IDENTIFICATION

.1 All electrical equipment is to be provided with “lamicoid” nameplates as further described herein. Care is to be taken to ensure that all plates are affixed true and level, and plumb in all instances.

.2 Nameplates are to be affixed to all “metal” surfaces with steel type “pop-rivets”.

.3 Nameplates are to be affixed to other types of surfaces with contact type cement.

.4 Contact type cement is to be applied (buttered) to complete rear side of plate, as opposed to several locations or areas on same.

.5 Lamicoid nameplates installed on distribution panelboards, motor control centres, splitter troughs, transformers, etc. shall indicate the following:

.1 Designated name of equipment.

.2 Amperage of overcurrent protection device.

.3 Voltages, number of phases and wires.

.4 Designation of power source

.1 Example:

PANEL 101 – 150AMPS
120/208V–3PH–4W
FED FROM MAIN SWITCHBOARD

.6 Lamicoid nameplates installed on all various system controls, control panels, disconnect switches, etc. shall contain the following information.

.1 Designated name of equipment.

.2 Designated name of power source.

.3 Branch circuit breaker number(s) where possible.

.4 Voltage(s).

.1 Examples:

EXHAUST FAN NO. 1
PANEL H – 120V
CCT. NO.17

SUPPLY FAN NO. 1
M.C.C. NO.1
600V–3PH

.7 Lamicoid nameplates installed on fusible type disconnect switches are also to indicate maximum designated/designed fuse size.

.8 Lamicoid nameplates are to be installed on all junction and/or pull boxes sized 150 mm x 150 mm and larger indicating name of system, designated panel name and electrical characteristics where applicable.

.9 Lamicoid nameplates are to be installed adjacent to each overcurrent devices located in switchboards, CDP panels, etc.. They need only indicate designated name and/or number of equipment they feed. Unused O.C. devices are to be identified as spare(s).

.10 Install an additional “lamicoid” nameplate on all, or any piece of electrical equipment, or apparatus (i.e.: main switchboard, CDP panels, panelboards, motor control centres, etc.) that may contain overcurrent devices, i.e. circuit breakers and/or fuses, that have been designed for, and incorporate interrupting capacity sized “larger” than 10 kaIC.

.1 Example:

Minimum interrupting capacity of breakers installed in this panel to be not less than 20 kAC.

Minimum interrupting capacity of fuses installed in this MCC to be not less than 20 kAIC.

.11 Allow for an “average” of forty letters for each lamicoid nameplate.

.1 Lamicoid 3 mm thick plastic engraving sheet, black letters, white face, for all electrical systems except fire alarm systems which shall have white letters on red face.

.2 1.5 mm thick nameplates above receptacles as previously indicated, with top left and right corners to be rounded off.

.3 Lettering on lamicoid nameplates shall not “start” or “end” nearer than 8 mm from either, or both ends of said plates. Size of lettering, including overall lengths of various plates shall be as indicated in the following chart.

.4 Sizes as follows:

NAMEPLATE SIZES

Size 1	10 mm x 50 mm	1 line	5 mm high letters
Size 2	13 mm x 75 mm	1 line	6 mm high letters
Size 3	16 mm x 75 mm	2 lines	5 mm high letters
Size 4	19 mm x 90 mm	1 line	10 mm high letters
Size 5	37½ mm x 90 mm	2 lines	13 mm high letters
Size 6	25 mm x 100 mm	1 line	13 mm high letters
Size 7	37½ mm x 100 mm	2 lines	6 mm high letters
Size 8	50 mm x 150 mm	2 lines	13 mm high letters

.12 Labelling of all branch circuit phase and neutral conductors to be done on both ends of all circuit conductors plus in “all” junction and/or pull boxes located in between. Use write-on, self-laminating labels sized as necessary. To be installed in a “flagged” manner around individual conductor(s).

.13 Coverplates for junction and/or pull boxes located above finish ceilings and housing branch circuits are to have each branch circuit number neatly identified on coverplate. Felt marker-pen may be used for this purpose.

.14 All of the following conductors are to have their insulation colours identified as indicated:

Phase A	Red
Phase B	Black
Phase C	Blue
Neutral	White/Grey
Bond	Green
Ground	Green
Isolated Ground	Green c/w Yellow Strip

.1 Colour code conductor insulation and others as per the following:

.1 All sizes of phase conductors up to and including #2 AWG.

.2 All sizes of neutral, bond and/or ground conductors, up to and including #3/0 AWG.

.2 Approved coloured tapes in lieu of insulation colouring may be used to identify conductors that exceed sizes as indicated in items .14.1.1 and .14.1.2 above, and is to take place on both ends of runs for a minimum of 300 mm from where terminations take place.

.15 Some examples of electrical apparatus that could have (identical types) of removable covers, and will require to have their lamicoid nameplates installed on wall(s) adjacent to control, rather than directly to their covers are the following.

.1 Manual TOL switches

.2 Relays.

.16 All various pieces of mechanical equipment are to be identified with identical information as indicated on electrical equipment nameplate feeding same mechanical equipment.

.17 Both plates are to be supplied and installed by the electrical contractor in the absence of any mechanical trade identification.

.18 Bonding conductors require labelling on both ends of runs where they are “dedicated” solely to the designated branch circuit they accompany. Identify with same number(s) being used to identify accompanying branch circuit phase and neutral conductor.

.19 All junction and/or pull boxes, condulet fittings (and covers), etc., complete with their respective coverplates are to be colour coded as per the following. Boxes are to be coloured both inside and outside, where “one” colour only is required. Boxes are to be coloured on inside only where “two” colours are required. Metal coverplates are to have both colours applied diagonally where “two” colours are required. Complete plate is to be painted where one colour only is required.

.20 Schedules shall be installed on the back of each door for panels, neatly arranged and mounted in frame under transparent cover. Schedules shall show system voltage, which outlets are on each circuit and any special information necessary. Schedules shall be typewritten and of a permanent nature.

2.5 WIRING IDENTIFICATION

.1 Identify wiring on both ends of phase conductors of feeders and branch circuit wiring by circuit number at all panelboards, pull and junction boxes, outlet and equipment connections, and all devices. Labels shall be Panduit PLD-1 or PLD-2 as required. Labels to be installed in such a manner as to present white area with information in "flagged" position. Wrap around conductor in "U" fashion and have it adhere to itself. Identify neutrals and bond wires indicating which circuits with which they are used.

.2 Maintain phase sequence and colour coding throughout.

.3 Colour coding: to CSA C22.1.

.4 The individual conductors and conductor pairs used in the various communications cables shall be colour coded. Maintain the colour coding scheme for each system throughout.

2.6 CONDUIT AND CABLE IDENTIFICATION

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

.2 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15 m intervals.

.3 Colours: 25 mm wide prime colour and 20 mm wide auxiliary colour.

	Prime	Auxiliary
up to 250 V	Yellow	
up to 600 V	Yellow	Green

2.7 SPRINKLER PROTECTION

.1 All equipment such as panelboards, control cabinets, etc., installed in areas equipped with sprinkler protection, shall be fitted with sprinkler hoods and shall comply with the intent of C.E.C. Sections 26-008 and Appendix B-26-008.

Part 3 Execution

3.1 INSTALLATION

.1 Do complete installation in accordance with CSA C22.1 except where specified otherwise.

3.2 NAMEPLATES AND LABELS

.1 Ensure manufacturer's nameplates, CSA labels and identification nameplates are visible and legible after equipment is installed.

3.3 MOTOR AND EQUIPMENT CONNECTIONS

.1 Provide final connections to all motors, equipment, controls, etc. indicated on the drawing. These motors, equipment, controls, etc. shall include those supplied under other sections of this specification, as well as Owner supplied items. Ensure that equipment will operate properly (e.g. proper rotation) and report any instance of defective equipment to the Departmental Representative.

3.4 CO-ORDINATION OF PROTECTIVE DEVICES

.1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings.

3.5 CUTTING AND PATCHING

.1 Cutting and patching shall be the responsibility of this Contractor and shall be performed by a skilled tradesperson.

.2 Make every effort to minimize cutting and patching by providing dimensions, locations and other data for bases, sleeves, boxes, etc., to be built in as construction proceeds. Set sleeves and mark openings in concrete forms and masonry before placing concrete and masonry.

3.6 FIELD QUALITY CONTROL

.1 Conduct following tests:

.1 Power distribution system including phasing, voltage, grounding and load balancing.

.2 Insulation resistance testing:

.1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.

.2 Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument.

.2 Check resistance to ground before energizing.

.3 Test all wiring included in the Contract, to ensure there are no shorts or grounded conductors and that insulation values are as required by the Canadian Electrical Code.

.4 The Departmental Representative reserves the right to use any piece of electrical equipment, device, or material installed under this Contract for such reasonable lengths of time and at such times as he may require to make a complete and thorough test of the same, before the final completion and acceptance of the work.

.5 The following wiring methods detailed below are designed to enhance the ability to perform capacitive leakage tests; these methods are to be strictly followed and tests performed under this Contract

.1 All circuit conductors are to be individually tie wrapped to their corresponding labelled neutral conductor in all panelboards, pull boxes and junction boxes. Enough slack conductor length should be left to enable the ability to clamp the ground detector around the individually tie wrapped circuit conductor and its corresponding labelled neutral. This wiring method is to be neat and of good workmanship quality

.2 The main switchboard, CDP's, panelboards, etc. are to have their respective feeder phase and neutral conductors tie wrapped together and enough slack conductor length to enable the ability to clamp the ground detector around each set of feeders. This wiring method is to be neat and of good workmanship quality.

.3 After all electrical wiring has been completed by the Electrical SubContractor, he is to test the grounded electrical distribution system to ensure there are not ground shorts, and capacitive leakage in the system is within acceptable limits

.4 All feeders or branch circuits, which do not have neutral conductors, are to have their respective phase conductors tie wrapped together in accordance with the methods described previously.

.6 Submit properly prepared and bound reports of all tests indicating:

.1 The date and time of the test.

.2 The name or names of those who conducted the test.

.3 The purpose of the test.

.4 The results of the test.

.5 Any applicable code limits or bounds.

.7 Such tests shall not be construed as evidence of acceptance of any part of the Contract, and it is agreed and understood that no claim for damage will be made for any injury or breakage to any part or parts of the above, due to the aforementioned tests, where caused by weakness or inaccuracy of parts, or by defective materials or workmanship of any kind whatsoever.

.8 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.

.9 Manufacturer's Field Services:

.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.

.2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

.3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

3.7 CLEANING

.1 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.

.2 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

.3 On completion of this project, the Contractor shall remove all debris and leave the site neat and tidy. Equipment shall be checked for proper fitting and alignment, adjusted, cleaned, repainted where necessary, and left in first class condition.

END OF SECTION

APPENDIX A

Shop Drawing Submittal Form

General Contractor:	
Phone Number:	Fax No:

Electrical Contractor:	
Phone Number:	Fax No:

Electrical Contractor Project Representative:	
Phone Number:	Fax No:

Shop Drawing Items:
Number of Shop Drawing Copies:
Supplier of Shop Drawings:
Manufacturer of Shop Drawings:
Specification Section and Items:

Drawing Reference:

Specified Options Indicated Yes No

Items are in Conformance with Plans and Specifications Confirmed by Contractor.
(If No, explain):

Contractor's Signature: Date:

Part 1 General

1.1 RELATED SECTIONS

.1 Section 26 05 00 - Common Work Results - Electrical.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CAN/CSA-C22.2 No.18-98(R2003), Outlet Boxes, Conduit Boxes and Fittings.

.2 CAN/CSA-C22.2 No.65-03(R2008), Wire Connectors (Tri-National Standard with UL 486A-486B and NMX-J-543-ANCE-03).

.2 Electrical and Electronic Manufacturers' Association of Canada (EEMAC)

.1 EEMAC 1Y-2, 1961 Bushing Stud Connectors and Aluminum Adapters (1200 Ampere Maximum Rating).

.3 National Electrical Manufacturers Association (NEMA).

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

.2 Collect and separate for disposal packaging material for recycling in accordance with Waste Management Plan.

.3 Divert unused wiring materials from landfill to metal recycling facility as approved by Departmental Representative.

Part 2 Products

2.1 MATERIALS

.1 For branch circuit wiring #10 AWG and smaller, use spring type pressure wire connectors with current carrying parts of copper, or copper alloy, and insulating cap, all to fit copper conductors as required. Standard of acceptable quality: Ideal "wing nuts".

.2 Joints for all other wiring shall be made using T & B colour keyed compression type connectors, 54000 series, and T & B series compression tools. Insulation shall consist of a first layer of compound type tape followed by a layer of Scotch #33 vinyl tape.

Part 3 Execution

3.1 INSTALLATION

.1 Remove insulation carefully from ends of conductors and:

.1 Install spring type wire connectors for branch circuit and control wiring #10 AWG and smaller. Plier tighten all wire nut joints and connections.

.2 Install pressure type wire connectors for branch circuit wiring larger than #10 AWG. Insulating tapes to overlap successive wraps by a minimum of 50%.

.3 The splicing of feeders conductors is not acceptable.

.2 All connections shall be made electrically and mechanically secure. The sizes of connectors shall be according to manufacturer's recommendations for each wire size and combination of wires.

END OF SECTION

Part 1 - General

1.1 RELATED SECTIONS

.1 Section 26 05 20 - Wire and Box Connectors (0-1000V).

1.2 REFERENCES

.1 CSA C22.2 No .0.3-96, Test Methods for Electrical Wires and Cables.

.2 CAN/CSA-C22.2 No. 131-M89 (R1994), Type TECK 90 Cable.

1.3 PRODUCT DATA

.1 Submit product data in accordance with Section 26 05 00, Item 1.6 Submittals.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.

.2 Fold up metal banding, flatten and place in designated area for recycling.

Part 2 - Products

2.1 GENERAL

.1 Wire and cable shall conform fully to the latest specifications of the Canadian Standards Association (C.S.A.), Electrical and Electronic Manufacturers Association of Canada (EEMAC), the Insulated Power Cable Engineers Association (IPCEA), and the American Society of Testing Materials (ASTM).

2.2 BUILDING WIRES

.1 Wiring on circuits exceeding 50 volts to ground shall be of soft drawn stranded copper of 98% conductivity and of full size and AWG gauge. Insulation shall be cross-linked polyethylene RW-90 rated 600 volts. Wiring shall be continuously colour coded as follows:

.1 Phase A Red
.2 Phase B Black
.3 Phase C Blue
.4 Neutral White/Grey
.5 Ground Green
.6 Where extra colours are required for three way switches, etc., they shall be yellow.

.2 Colour coding shall be by insulation colour as follows: Phase conductors on sizes up to and including No. 2 AWG. Neutral, ground and bond conductors on sizes up to and including No. 3/0 AWG. Approved coloured tape, in lieu of coloured insulation, may be used for phase conductors sized No. 1 AWG and larger, neutral, ground and bond conductors sized No. 4/0 AWG and larger.

.3 ACM alloy conductors may be utilized for feeders 100A or above, size as indicated, with 600V insulation of cross-linked thermosetting polyethylene material rated RW90 XLPE.

2.5 CONTROL CABLES

.1 Type LVT: Soft annealed copper conductors, sized as indicated, with thermoplastic insulation, outer covering of thermoplastic jacket.

Part 3 - Execution

3.1 GENERAL

.1 The Contractor shall run all circuits so that the voltage drop, in no case exceeds 3% of the line volts. The neutral wire, wherever it is run shall be continuous with no fuses, switches, or breaks of any kind.

.2 The installation of more than 3 conductors in a run of conduit is permissible provided C.E.C. Section 4-004(1) is adhered to with respect to the derating of the conductors.

.3 The minimum conductor size for all 20-amp branch circuits is to be #12 AWG. For 20 amp 120 volt branch circuits, the following table shall be followed:

Branch Circuit One-Way Length from Panel to Load (Including Vertical Drops)	Phase Wire Size	Dedicated Neutral Wire Size	Shared Neutral Wire Size	Bond Wire Size
Up to 24.38 m	#12 AWG	#12 AWG	#10 AWG	#12 AWG
24.68 m to 38.1 m	#10 AWG	#10 AWG	#8 AWG	#12 AWG
38.4 m to 56.38 m	#8 AWG	#8 AWG	#6 AWG	#10 AWG

.4 The requirements for accommodating larger common or “shared” branch circuit neutral conductors where the application might warrant such, could restrict the use of some types of AC-90 cables. In certain instances however, the installation of AC-90 cable (where permissible), and the use of “oversized” neutral conductors where required, is more than acceptable.

.5 Oversized #10 AWG branch circuit wiring conductors to be extended to outlet box of device they feed. Oversized #8 or #6 AWG branch circuit wiring conductors to be extended from panelboard to junction box located on wall or in ceiling space directly above outlet or device they feed. A #8 or #6 AWG wire can be reduced to #10 AWG for vertical portion of drop only.

.6 All “stranded” conductors are to be “twisted together” prior to any types of terminations taking place, but not necessarily limited to, some of the following areas:

.1 Receptacles.
.2 Light switches.
.3 Neutral terminal strips.
.4 Bonding terminal strips.
.5 Circuit breakers.
.6 Disconnect switches.
.7 Relays
.8 Terminating lugs, etc.

3.2 INSTALLATION OF BUILDING WIRES

.1 Where pulling wires and cables, the use of an approved lubricant only will be permitted. No wires or cables shall be pulled in conduits until such conduits are free from moisture and in no case shall wires be pulled until approval of the Engineer is obtained.

.2 All various types of cables are to be installed parallel or perpendicular to building lines and shall be adequately secured to the building structure at not more than 1500 mm intervals or as otherwise indicated, in such a manner as to ensure they are protected from potential types of mechanical damage occurring. Install independent supports for cabling in ceiling spaces, and do not use those of other trades. Do not secure cables to mechanical systems piping or ducts, suspended ceiling support wires, etc.. The laying of “unsupported” cables of any types whatsoever directly atop ceiling grid system is strictly prohibited.

.3 Install and secure surface cables directly to underside of metal decking and/or ceiling slab where installed in any concealed ceiling spaces.

.4 Cables are “always” to be installed as high as possible to underside of structure.

.1 Where cables are installed in same direction as steel joists, they are also to be secured as high as possible to underside of metal decking and/or structure. Do not install cables in the upper portions of any Q-Decking.

.5 The grouping together of cables to form a “bundle” for securing purposes, is acceptable provided that the following procedures are adhered to.

.1 In addition to securing cables at 1500 mm intervals to structure, multiple or bundled groups of cables (including low voltage types), shall be tye-wrapped together at mid-point between each structure support, or every 760 mm. Secure to structure at 1500 mm intervals, and secure together (between structure supports) at 1500 mm intervals.

.6 After all wiring devices have been installed, the Contractor shall test all systems to make sure there are no grounds, leaks, or shorts. Such tests shall be performed to the satisfaction of both the inspection authority having jurisdiction and the Engineer.

3.5 INSTALLATION OF CONTROL CABLES

.1 The installation of “surface” wiring on walls or in open (non-enclosed) type ceilings, shall be Type EMT conduit complete with associated steel type connectors and couplings.

.2 EMT conduit is to be extended to within 610 mm of “all” various control devices associated with the operation of any given piece of mechanical equipment.

.3 Unless specifically indicated otherwise, liquid tight, flexible metal type conduit complete with steel type connector and steel locknut may be used for the “final” 610 mm connection between the end of the EMT conduit and the applicable control device.

.4 EMT or PVC type conduit “wall stubs” complete with flush installed device box shall be installed in all masonry or concrete partitions where, and as may be required, where plenum rated cabling is used.

.5 EMT connectors complete with nylon insulated throat or threaded type bushing shall be installed on end of EMT stub above “finish” type ceilings, etc., where plenum rated cabling is used.

.6 All EMT conduit stubs are to be “bonded” to ground as per CEC.

.7 Ground control cable shield.

3.6 STRANDED CONDUCTORS

.1 All stranded conductors prior to terminating under device bolts such as circuit breakers, switches, receptacles, etc., are to be twisted together so as to form a single conductor to ensure a reliable mechanical connection.

3.7 CAPACITIVE LEAKAGE WIRING METHODS

.1 The following wiring methods detailed below are designed to enhance the ability of the Owner to perform capacitive leakage tests in the future:

.1 All circuit conductors are to be individually ty-wrapped to their corresponding labelled neutral conductor in all panelboards, pull boxes and junction boxes. Enough slack conductor length should be left to enable the ability to clamp the ground detector around the individually tywrapped circuit conductor and its corresponding labelled neutral. This wiring method is to be neat and of good workmanship quality.

.2 The ty-wrapping of the neutral with its respective phase conductors is to be made at the closest point of entry into panelboards, pull boxes and junction boxes.

.3 The main switchboard, CDP's, panelboards, etc. are have their respective feeder phase and neutral conductors ty-wrapped together with enough slack conductor length to enable the ability to clamp the ground detector around each set of feeders. This wiring method is to be neat and of good workmanship quality. This ty-wrapping is to be located such that ease of clamping the ground detector can be accomplished without excessive exposure to live bussing.

.4 After all electrical wiring has been completed by the Electrical SubContractor, he is to test the grounded electrical distribution system to ensure there are no ground shorts or grounds.

.5 All feeders or branch circuits which do not have neutral conductors are to have their respective phase conductors ty-wrapped together in accordance to the methods described previously.

END OF SECTION

PART 1 - General

1.1 RELATED SECTIONS

.1 Section 26 05 00 Common Work Results - For Electrical.

1.2 WASTE MANAGEMENT AND DISPOSAL

.1 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.

.2 Fold up metal banding, flatten and place in designated area for recycling.

PART 2 - Products

2.1 SUPPORT CHANNELS

.1 U shape, size 41mm x 41mm x 2.5mm thick, surface mounted, suspended, set in poured concrete walls and ceilings.

.2 All strut to be galvanized.

.3 All threaded hanger rods to be minimum 10mm diameter, larger if required, made from mild steel.

.4 In concrete use cast in threaded inserts wherever possible. Should additional inserts be required use a "red head" type of insert capable of carrying at least 227 kg.

.5 Supports for all conduit work shall be one hole steel pipe straps; unistrut, or equal, with necessary fittings, approved for their respective use.

.6 All pull and junction boxes, wireways, and multiple conduits shall be supported by a steel channel support system with all components, hangers, wall supports, cable clamps, etc., specifically manufactured and approved for their application.

.7 Fastening devices for cabinets, boxes, supports etc., shall be nut and bolt, expansion shields, wedge anchors, or toggle bolts, size and number to suit the application or as detailed on the drawings. Toggle bolts may not be used in plasterboard construction.

.8 Fastening devices for outlet boxes shall be nut and bolt, expansion shields, wedge anchors or caddy clips, size and number to suit the application or as detailed on the drawings.

.9 Where outlet boxes are set in drywall construction, a piece of steel stud shall be secured to either side of the outlet box or use caddy quick-mount box supports, or caddy J-1-A for side box supports

PART 3 – Execution

3.1 INSTALLATION

.1 Secure all equipment in a manner so as not to distort or cause undue stress on any components.

.2 Secure equipment to masonry, tile and plaster surfaces with lead anchors or nylon shields.

.3 Secure equipment to poured concrete with expandable inserts.

.4 Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts. Toggle bolts shall not be used to secure equipment to plasterboard, drywall, or acoustic tile surfaces.

.5 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.

.6 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.

.7 Fasten exposed conduit or cables to building construction or support system using straps.

- .1 One-hole steel straps to secure surface conduits and cables 53mm and smaller.
- .2 Two-hole steel straps for conduits and cables larger than 53mm
- .3 Beam clamps to secure conduit to exposed steel work.

.8 Suspended support systems.

- .1 Support individual cable or conduit runs with 10mm dia. threaded rods and spring clips.
- .2 Support 2 or more cables or conduits on channels supported by 10mm dia. threaded rod hangers where direct fastening to building construction is impractical.

.9 For surface mounting of two or more conduits use channels at 1500mm on centre spacing.

.10 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.

.11 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.

.12 Do not use wire lashing or perforated strap to support or secure raceways or cables.

.13 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 Departmental Representative.

.14 Do not support any electrical conduits, wire or equipment from ceiling system support cables.

.15 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

.16 In addition to the C.E.C. conduit support requirements, all suspended conduit runs containing horizontal or vertical elbows shall have one additional support installed not greater than 300mm from the midpoint of the 90° bend.

END OF SECTION

PART 1 - General

1.1 RELATED SECTIONS

.1 Section 26 05 00 Common Work Results - For Electrical.

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data for junction box and cabinets in accordance with Section 26 05 00, Item 1.6 Submittal.

1.3 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.1-15, Canadian Electrical Code, Part 1, 23nd Edition.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.

.2 Fold up metal banding, flatten and place in designated area for recycling.

PART 2 - Products

2.1 JUNCTION AND PULL BOXES

.1 Pull and junction boxes, where larger than standard boxes shall be the equivalent to Type "C" or "D" boxes sized according to C.E.C. Sections 12 3000 to 12 3038. Use Type "D" for boxes up to 300mm x 300mm and Type "C" for boxes 300mm x 300mm or larger.

.2 Pull boxes and junction boxes shall be of sheet metal construction with all welded steel corners and screw on flat covers for surface mounting.

.3 All flush installed boxes shall be Type “D”. Covers for flush mounted pull boxes shall extend a minimum of 25 mm all around.

.4 Concealed junction boxes (within ceiling space) shall not be smaller than 100 mm square.

.5 All junction boxes containing more than three circuits shall be complete with terminal strips for phase conductors, neutral and bonds.

PART 3 - Execution

3.1 JUNCTION AND PULL BOX INSTALLATION

.1 Install pull boxes in inconspicuous but accessible locations and secure them adequately to the building structure. Pull boxes installed in the middle of conduit runs without backing are not acceptable.

.2 The location of junction and/or pull boxes in suspended ceiling spaces, i.e. - dry wall, T-Bar, etc., is not to be greater than 760mm above the finished ceiling and must be easily accessible.

.3 All suspended junction, pull and outlet boxes shall be supported with minimum size 10mm threaded rods, nuts and flat washers. Threaded rods shall be secured to boxes with one flat washer and nut installed on both sides of box. One rod required for all boxes sized up to and including 119mm square. Two rods required for boxes larger than 119mm square, up to and including 203mm square. A minimum of four rods required for all boxes larger than 203mm square.

.4 Install terminal blocks as indicated in cabinets.

.5 Only main junction and pull boxes are indicated. Install pull boxes so as not to exceed 30m of conduit run between pull boxes.

3.2 IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results - Electrical.

.2 Install size 2 identification labels indicating system name, voltage, phase and circuit numbers where applicable.

END OF SECTION

PART 1 - General

1.1 RELATED SECTIONS

.1 Section 26 05 00 Common Work Results - For Electrical.

1.2 REFERENCES

.1 CSA C22.1-2015, Canadian Electrical Code, Part 1.

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.

.2 Fold up metal banding, flatten and place in designated area for recycling.

PART 2 - Products

2.1 OUTLET AND CONDUIT BOXES GENERAL

.1 Size boxes in accordance with CSA C22.1.

.2 103 mm square or larger outlet boxes as required for special devices.

.3 Gang boxes where wiring devices are grouped.

.4 Blank cover plates for boxes without wiring devices.

.5 347 V outlet boxes for 347 V switching devices.

.6 Combination boxes with barriers where outlets for more than one system are grouped.

2.2 GALVANIZED STEEL OUTLET BOXES

.1 Electro-galvanized steel single and multi-gang flush device boxes for flush installation, minimum size 91mm x 53mm x 41mm or as indicated. 103mm square outlet boxes when more than one conduit enters one side with extension and plaster rings as required.

.2 Electro-galvanized steel utility boxes for outlets connected to surface-mounted EMT conduit, minimum size 103mm x 54mm x 53mm.

.3 103mm square or octagonal outlet boxes for lighting fixture outlets.

.4 103mm square outlet boxes with extension and plaster rings for flush mounting devices in finished walls.

.5 Surface outlet boxes installed below 2438 mm shall be hot dipped galvanized cast "FS", or "FD" series boxes with metal coverplates.

2.3 CONDUIT BOXES

.1 Cast FS boxes with factory-threaded hubs and mounting feet for surface wiring of switches and receptacles.

.2 PVC FS boxes with factory-threaded hubs and mounting feet for surface wiring of switches and receptacles.

2.4 FITTINGS - GENERAL

.1 Bushing and connectors with nylon insulated throats.

.2 Knock-out fillers to prevent entry of debris.

.3 Conduit outlet bodies for conduit up to 31.75 mm and pull boxes for larger conduits.

.4 Double locknuts and insulated bushings on sheet metal boxes.

PART 3 - Execution

3.1 INSTALLATION

.1 Support boxes independently of connecting conduits.

.2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.

.3 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.

.4 Provide correct size of openings in boxes for conduit and cable connections. Reducing washers are not allowed.

.5 At each local switch, convenience outlet, receptacle, ceiling or wall fixture, continuous row of fixtures, or system unit (i.e. fire alarm, etc.) provide and install a standard pressed steel outlet box unless specifically noted otherwise. All outlet boxes shall be galvanized inside and out and set flush with finished surfaces. They shall be rigidly and securely set. Boxes shall not be mounted back to back, but separated by a minimum of 300mm, to prevent noise transmission.

.6 In centering outlets, the Contractor is cautioned to allow for radiation, pipes, ducts, etc., and for the variation in arrangement and thickness of finishes, etc.. His failure to comply with this will not relieve him from the cost of necessary alterations.

.7 The Contractor shall allow for the relocation of an outlet up to 3000mm from where shown, provided he has been notified so prior to rough-in of the same.

.8 All suspended boxes are to be supported with minimum size 12mm threaded rod(s).

.9 All flexible conduit fixture feeds shall originate from the side of the outlet box and not from the box cover.

.10 Flush installed boxes being used as a junction or pull box that requires a blank metal coverplate, is to have an appropriate sized, one or two gang “plaster ring” installed on same. This permits the use of a standard, one or two gang (blank) finish metal coverplate to be used, and avoids the necessity of acquiring an oversized, custom made coverplate.

.11 When installing flush boxes in metal drywall partitions, always screw a short piece of metal stud (same width as partition) to non-supported side of box.

.12 Concealed boxes installed above drywall ceilings or behind walls, are to have their locations identified on room sides of access opening frames with properly colour coded identification discs.

.13 Condulet fittings (LB, LL, LR, etc.) and their respective covers/plates are to be painted, and where concealed, have their locations identified with appropriate colour coded, 21mm, self-adhering discs, applied to T-bar splines and/or access opening frames, in similar manner as for concealed junction and/or pull boxes, etc..

.14 Tile type extension rings are not to be used on boxes that have not been “flush” installed. They are not intended, not acceptable for “surface” type application.

3.2 IDENTIFICATION

.1 All outlet boxes shall be colour coded as per the colour coding legend for conduits and cables. Refer to Specification Section 26 05 00. Outlet boxes are to be coloured only on the inside.

END OF SECTION

PART 1 - General

1.1 RELATED SECTIONS

.1 Section 26 05 00 Common Work Results - For Electrical.

1.2 REFERENCES

.1 Canadian Standards Association (CSA)

.1 CAN/CSA C22.2 No. 18-98(R2003), Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware, A National Standard of Canada.

.2 CSA C22.2 No. 45-M1981 (R2003), Rigid Metal Conduit.

.3 CSA C22.2 No. 56-04, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.

.4 CSA C22.2 No. 83-M1985(R2003), Electrical Metallic Tubing.

.5 CSA C22.2 No. 211.2-M1984(R2003), Rigid PVC (Unplasticized) Conduit.

.6 CAN/CSA C22.2 No. 227.3-05, Non-metallic Mechanical Protection Tubing (NMPT), A National Standard of Canada (February 2006).

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.

.2 Fold up metal banding, flatten and place in designated area for recycling.

PART 2 - Products

2.1 CONDUITS

.1 Thinwall Type "EMT" conduit shall conform to C.S.A. C22.2 No. 83, galvanized, sized as indicated.

.2 Flexible galvanized steel liquid tight conduit shall conform to C.S.A. C22.2 No. 56, sized as indicated.

.3 Flexible PVC conduit: to CAN/CSA-C22.2 No. 227.3, sized as indicated.

2.2 CONDUIT FASTENINGS

.1 One hole steel straps to secure surface conduits 53mm and smaller. Two hole steel straps for conduits larger than 53mm.

.2 Beam clamps to secure conduits to exposed steel work.

.3 Channel type supports for two or more conduits at 1500mm on centers.

.4 Threaded rods, 12mm diameter, to support suspended channels.

2.3 CONDUIT FITTINGS

.1 Fittings: manufactured for use with conduit specified. Coating: same as conduit.

.2 Factory "ells" where 90 degree bends are required for 27mm and larger conduits.

.3 Couplings for thinwall Type "EMT" shall be set screw type, zinc with matching locknuts.

.4 Connectors for thinwall Type "EMT" shall be set screw type, zinc with matching locknuts.

.1 Connectors 32mm and larger shall be complete with threaded plastic bushings. Connectors less than 32mm shall be complete with insulated throats.

.5 Connectors for flexible conduit, armoured cable shall be set screw galvanized steel. Units shall be equal to T&B #3110 series, steel, and be complete with case hardened locknuts.

.6 Connectors for liquid tight flexible conduit shall be watertight, compression type galvanized steel or aluminum. Locknuts shall be case hardened. Dry type connectors may be used in dry indoor areas not exposed to liquids or moisture, if approved for use.

.7 Utilize watertight connectors and couplings for exposed vertical runs of EMT.

2.4 FISH CORD

.1 Polypropylene.

.2 All branch circuit wiring run in thinwall Type EMT conduit shall be complete with a No. 12 AWG minimum green insulated bonding conductor, increasing as required by Table 16A of the C.E.C.

.3 All concealed and exposed conduit shall be kept parallel to building lines and run "on the square". All conduits shall be installed to avoid proximity to steam and hot water pipes by 150mm. Conduits shall run through ceiling spaces and down in walls. No conduit shall run in or under floor slabs unless specifically indicated.

.4 All conduits shall be securely held in place by means of approved supports and in accordance with C.E.C. Sections 12-1010, 12-1114 and 12-1404. All EMT conduit straps shall be steel. Cast straps are not acceptable. EMT conduit shall be installed as a complete system and shall be securely fastened in place within 915 mm of each outlet box, junction box, cabinet, couplings or fittings and the spacing between supports as follows:

.1 Less than 1500mm for 21mm EMT;

.2 Less than 2286mm for 27mm and 35mm EMT;

.3 Less than 3048mm for 41mm EMT or larger.

.5 No branch circuit wiring shall run in concrete slabs. Conduit stubs in concrete shall be protected from damage during construction. Conduit openings shall be sealed with plugs or caps to prevent entrance of foreign materials. Where conduits pass through a waterproof membrane an oversize sleeve shall be installed and caulking applied to maintain the waterproof properties of the membrane. A cold cure mastic shall then be applied between sleeve and conduit.

.6 Flexible conduit, not smaller than 10mm I.D., or flexible armoured cable with separate grounding conductor, and complete with insulating anti shorts, shall be used between lighting fixtures and their respective junction boxes, and where rigid or "EMT" conduit cannot be used, such as in cabinet work.

.7 Liquid tight flexible conduit, not smaller than 10mm I.D., shall be used for connections to all transformers, motors and equipment, in both wet and dry areas.

.8 Upon installation of all conduits, terminate in boxes, cabinets, and fittings, or install suitable plugs or caps, to prevent the entrance of foreign materials. Conduits shall be swabbed out using a drag, consisting of tight fitting rubber washers and shall be dry before conductors are pulled in.

.9 All conduit subject to corrosive elements shall be treated with corrosion resistant compounds.

.10 Conduit shall not pass through structural members without the permission of the Departmental Representative.

.11 A sufficient number of fittings shall be used to permit easy pulling of wires. Conduits shall be continuous, and shall be made electrically and mechanically secure throughout.

.12 Conduits shall not run directly between outlets on the opposite sides of a common partition, in order to prevent sound transmission.

.13 It is strictly prohibited to install or otherwise “conceal” any types of rigid or flexible conduits, cables, etc. “within” the uppermost, or top portions of metal type Q-Deck “flutes”, regardless of their intended use(s).

.1 All or any types of wiring associated with metal type decking is to be “surface” installed on underside, or room side of same.

.14 Install conduit sealing fittings in hazardous areas. Fill with compound.

.15 Minimum conduit size for lighting and power circuits: 21mm.

.16 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.

.17 Mechanically bend steel conduit over 21mm diameter.

.18 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.

.19 Install fish cord in empty conduits.

.20 Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.

.21 Dry conduits out before installing wire.

PART 3 - Execution

3.1 INSTALLATION

.1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.

.2 Conceal conduits except in mechanical and electrical service rooms.

.3 Rigid PVC or Galvanized rigid steel threaded conduit shall be used in all poured concrete construction. Thinwall Type "EMT" shall be used for all branch circuit wiring and all systems installed exposed on ceilings and walls unless noted otherwise. Bends, offsets, or elbows made on the job for steel conduits shall be made so that the conduit is not injured or flattened.

.4 Group conduits wherever possible on suspended or surface channels.

.5 Do not pass conduits through structural members except as indicated.

.6 Do not locate conduits less than 75mm parallel to steam or hot water lines with minimum of 25mm at crossovers.

3.3 CONCEALED CONDUITS

.1 Run parallel or perpendicular to building lines.

.2 Do not install horizontal runs in masonry walls.

.3 Do not install conduits in terrazzo or concrete toppings.

3.4 COUPLINGS AND CONNECTORS

.1 Threaded couplings shall be used for all rigid steel threaded conduit joints. All joints in or below concrete slabs shall be thoroughly red leaded and screwed tight. No exposed threads shall be left, i.e., running thread couplings are not approved.

.2 Rigid steel threaded conduit shall connect to boxes and cabinets with the use of two case hardened steel locknuts and insulated bushing. Painted area at locknut connections shall be scraped clean, and locknuts screwed tight to ensure ground continuity.

.3 Thinwall Type "EMT" couplings shall be securely tightened.

.4 Connectors for thinwall Type "EMT", liquid tight and flexible conduit or cable shall terminate at boxes and cabinets with one case hardened locknut. Painted area shall be scraped clean, and locknut screwed tight to ensure ground continuity.

.5 Couplings and connectors for rigid P.V.C. shall be cleaned with solvent and joined with cement C.S.A. approved for the purpose.

3.5 CONDUIT FITTINGS

.1 Install conduit fittings where required. Secure conduit in fittings and secure conduit to structure within 300mm of fitting.

.2 Colour code coverplates, ceiling splines and access covers in accordance with Section 26 05 00.

END OF SECTION

Part 1 - General

1.1 SECTION INCLUDES

.1 Switches, receptacles, wiring devices, cover plates and their installation.

1.2 RELATED SECTIONS

.1 Section 26 05 00 - Common Work Results - Electrical.

1.3 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.2 No.42-10, General Use Receptacles, Attachment Plugs and Similar Devices.

.2 CAN/CSA C22.2 No.42.1-00 (R2009), Cover Plates for Flush-Mounted Wiring Devices (Bi-national standard, with UL 514D).

.3 CSA C22.2 No.55-M1986 (R2008), Special Use Switches.

.4 CSA C22.2 No.111-10, General-Use Snap Switches (Bi-national standard, with UL 20).

1.4 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 26 05 00, Item 1.6 Submittals.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.

.2 Fold up metal banding, flatten and place in designated area for recycling.

Part 2 - Products

2.1 RECEPTACLES – 15A

.1 Duplex receptacles, CSA type 5-15R, 125 V, 15A, U ground, to: CSA-C22.2 No.42 with following features:

.1 Extra heavy duty compact design.

.2 White urea moulded housing.

.3 Suitable for No. 10 AWG for back and side wiring.

.4 Break-off links for use as split receptacles.

.5 Eight back wired entrances, four side wiring screws.

.6 Triple wipe contacts and riveted grounding contacts.

.7 One piece brass grounding strap.

.2 Other receptacles with ampacity and voltage as indicated.

.3 Receptacles of one manufacturer throughout project.

.4 Specific materials:

.1 Normal Power: Hubbell Cat. No. BR15WHI.

.5 Alternate materials:

.1 Pass & Seymour and Leviton.

2.2 GFCI RECEPTACLES – 15A

.1 GFCI duplex u-ground receptacles shall be heavy duty grade, A.C. rated 15 amperes at 125 volts, U ground, having parallel slots with double wiping contacts, ground terminal, and one piece body.

.2 GFCI receptacles shall be white complete with LED indication with coverplates as indicated below. GFCI Receptacles shall be equal to Hubbell Circuit Guard Series Cat. No. GFTR15W.

.3 Other acceptable manufacturers: Hubbell, Bryant, Pass & Seymour and Leviton provided they comply with the drawings and specifications.

2.3 COVERPLATES

.1 Coverplates for wiring devices to: CSA-C22.2 No.42.1.

.2 Coverplates from one manufacturer throughout project.

.3 Sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.

.4 Type 302 stainless steel cover plates, for wiring devices mounted in flush-mounted outlet box.

.5 Sheet metal utility style cover plates for wiring devices mounted in surface-mounted FS or FD type conduit boxes.

Part 3 - Execution

3.1 INSTALLATION

.1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.

.2 Mount receptacles at height in accordance with Section 26 05 00 - Common Work Results - Electrical.

.3 Where split receptacle has one portion switched, mount vertically and switch upper portion.

.4 All receptacles, and their wall plates, shall be installed plumb, with long axis in the vertical position, U ground terminal on the top. Pigtail branch circuit conductors shall be used for connection to receptacles in cases where more than one phase conductor or neutral conductor exist in the outlet box. Do not use feed through features on receptacles. Twist stranded conductors and form under head of terminal screw. Tighten terminal screw to specified torque.

.5 Power and neutral conductor terminations shall be made using the back wiring feature on the receptacle for conductor sizes #12 and #10. Where voltage drop considerations require #8 AWG conductors to feed a receptacle, the #8 conductor shall be extended to a surface mounted junction box located in the ceiling space directly above the receptacle. The #8 AWG conductor shall be reduced to #10 AWG in the junction box before extending on down in the vertical drop to the receptacle.

.6 Install a green insulated bonding conductor, equal in ampacity to the receptacle ampacity, between the grounding terminal of the receptacle and the grounding screw or stud of the outlet box.

.7 Receptacles above counters shall be installed above the backsplash to a height as indicated on the drawings and coordinated on the site.

.8 All receptacles are to be polarity tested.

.9 All receptacles are to be identified with Lamicoid nameplates in accordance with Section 26 05 00 - Common Work Results - Electrical. The nameplate for each receptacle shall indicate the panel from which the receptacle is fed, as well as the branch breaker circuit number(s). In addition, a Ty-Rap Cat. No. TY5532M identifying tag shall be secured in the outlet box, marked with the same identification and arrange to be visible when the coverplate is removed, without removal of the receptacle.

.10 Coverplates:

.1 Protect all cover plates 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 cover plates meant for flush outlet boxes on surface-mounted boxes.

END OF SECTION

PART 1 - General

1.1 SECTION INCLUDES

.1 Materials and installation for fused and non-fused disconnect switches.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 26 05 00 - Common Work Results - Electrical.

1.3 REFERENCES

.1 Canadian Standards Association (CSA International).

.1 CAN/CSA C22.2 No.4-M89 (R2000), Enclosed Switches.

.2 CSA C22.2 No.39-M89 (R2003), Fuseholder Assemblies.

1.4 SUBMITTALS

.1 Submit product data in accordance with Section 26 05 00, Item 1.6 Submittals.

1.5 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 26 05 00 Common Work Results - Electrical.

.2 Indicate on shop drawings:

.1 Fuse clip arrangement/class.

.2 Overall length, height and depth of each type of switch.

.3 Number of poles, including neutrals where required, amperage rating, and voltage rating of each type of disconnect required.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.

.2 Fold up metal banding, flatten and place in designated area for recycling.

PART 2 - Products

2.1 DISCONNECT SWITCHES

.1 Fusible and non-fusible disconnect switches in CSA Type 1 rated enclosures or as indicated, size as indicated.

.2 Provision for padlocking in "ON" and "OFF" position.

.3 Mechanically interlocked door to prevent opening when handle in "ON" position.

.4 Fuseholders: suitable without adaptors, for type and size of fuse indicated.

.5 Quick-make, quick-break action.

.6 ON-OFF switch position indication on switch enclosure cover.

.7 Fuseholder assemblies to CSA C22.2 No. 39.

2.2 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results - Electrical.

.2 Indicate name of load controlled on size 4 nameplate.

2.3 MANUFACTURERS

.1 Standard of acceptability for Heavy Duty Disconnect Switch:

.1 Non-Fusible Disconnect Switch:

.1 Cutler-Hammer as detailed on drawing.

.2 Other acceptable manufacturers:

.1 Square 'D', FPL, Siemens.

PART 3 - Execution

3.1 INSTALLATION

.1 Install disconnect switches complete with fuses if applicable.

.2 Supply all necessary mounting hardware and channel as required to mount switches.

END OF SECTION