.13 Names, addresses, phone numbers and facsimile numbers of Contractor, Consultants, sub-contractors and suppliers used on the Work together with a specification reference of the portion of the Work they undertook.

1.8 Product Handling

.1 Use all means necessary to protect the products of this Division before, during and after installation and to protect products and installed work of all other trades.

.2 Immediately make good any damage by repair or replacement at no additional cost to the Owner and to the approval of the Consultant.

.3 Remove advertising labels from all electrical equipment. Do not remove identification of certification labels.

.4 Remove dirt, rubbish, grease, etc. resulting from this work from all surfaces, including the inside of all cabinets, equipment enclosures, panelboard tubs, etc.

1.9 Alternate and Separate Prices

.1 In accordance with the Instructions to Bidders, state on the Tender Form in the space provided, the amount to be added or deleted from the base bid tender amount for the use and installation of equipment as an alternate to those specified.

1.10 Guarantee

.1 Furnish a written guarantee to the Owner prior to final contract payment, which will be in effect for one year from the date of final acceptance of the complete work. Replace or repair at no cost to the Owner any defective material or workmanship except where, in the opinion of the Consultant, such defects are due to the misuse or neglect by the Owner.

.2 This general guarantee shall not act as a waiver of any specified or special equipment guarantees which cover a greater length of time.

1.11 Progress Claims

.1 Within thirty (30) days after award of contract, a breakdown of material and equipment items including labour and expense components shall be compiled in format acceptable to the Consultant. Subsequent requests for payment shall be documented accordingly.

2. PRODUCTS

2.1 Selected Products and Equivalents

.1 Products and materials provided shall be new and free from all defects. Defective products or materials will be rejected, regardless of previous inspections. The Contractor shall be responsible to remove and replace defective products at their expense, and shall be responsible for any resulting delays and associated expenses which result from defective

products being rejected. Related materials shall be of the same manufacturer throughout the project.

.2 Products and materials referred to in the specifications by trade names, manufacturer's name and catalogue reference are those which shall be used as the basis for the Tender.

.3 The design has been based on the use of the specified product.

2.2 Alternative Products

.1 All product substitutions must be approved by the Consultant. Failure to obtain approval from the Consultant will result in the alternative product being rejected, in which case the Contractor shall provide an approved product at no additional cost to the Owner.

.2 The Contractor shall assume full responsibility for ensuring that when providing alternative products or materials, all space, weight, connections, power and wiring requirements etc. are considered. Any costs incurred for additional components, changes to services, structural or space requirements, layouts and plans, etc. that may be necessary will be borne by the Contractor.

.3 Suppliers to submit all requests for alternative product approval to the Consultant. Submissions must be received by the Consultant not less than seven (7) working days prior to the close of tenders. Submissions received after the "Cut-Off" date will not be reviewed.

All submissions which are approved by the Consultant shall be identified as "Approved Alternatives" in an Addendum. Alternative products not listed in the Addendum will be rejected.

.4 Approval of an alternate is not intended to change the original specifications unless specifically stated in the addenda. The submitter is responsible for all costs incurred by other trades as well as his own, to install the product/system in accordance with the contract documents.

.5 All submissions to be provided with technical data and whatever pertinent information that may be required by the Consultant to evaluate equivalency to the specified product. The responsibility to provide sufficient technical data with respect to submissions will remain solely with those making the submission.

2.3 Quality of Products

.1 All products provided shall be CSA Approved, Canadian Underwriters' Laboratory approved where applicable, and new, unless otherwise specified.

.2 If products specified are not CSA approved, obtain special approval from the local regulatory authority. Pay all applicable charges levied and make all modifications required for approval.

.3 Products provided, if not specified, shall be new, of a quality best suited to the purpose required and their use subject to approval by the Consultant.

2.4 Uniformity of Manufacture

.1 Unless otherwise specifically called for in the Specifications, uniformity of manufacture shall be maintained for similar products throughout the work.

2.5 Product Finishes

.1 Finish all cabinets, panelboards, switchboards, equipment cabinets, cable trays, etc. in ANSI 61 grey enamel unless otherwise specified.

.2 Apply primer on all items which are to be finished on the job.

.3 Touch up all damaged painted finishes with matching lacquer, or, if required by the Consultant, completely repaint damaged surface.

2.6 Use of Products During Construction

.1 Any equipment used for temporary or construction purposes shall be approved by the Construction Manager and in accordance with the General Conditions, "Use of Premises." Clean and restore to "as new" condition all equipment prior to the time of substantial completion.

.2 The warranty period shall not begin until the date of substantial performance of the work.

2.7 Non-Specific Date/Time Compliance

.1 All equipment, hardware, software and firmware (for the purposes of this clause #, the "Product") delivered or deliverables resulting from any services provided are fully Date Compliant and the Product will not adversely or materially effect the daily business operations as a result of a date related computer problem (for the purposes of this clause #, the "Warranty"). Date Compliant means that the Product accurately and correctly processes and stores date/time data (including, but not limited to, calculating, comparing, displaying, recording and sequencing operations) including year, century and leap year calculations.

.2 Provide documentary proof of Date Compliance prior to substantial completion listing all equipment and certifying their compliance.

.3 Notwithstanding any other remedy available under this agreement or at law for breach of the Warranty, any Product that is not Date Compliant shall, within twenty-four (24) hours of receipt of notice of the breach, be repaired or replaced at the Contractors sole cost and expense, including parts, labour, transportation and insurance, so as to correct any failure to meet the Warranty.

3. EXECUTION

3.1 Site Examination

.1 Examine the site of work and become familiar with all features and characteristics affecting this work before submitting tender.

.2 No additional compensation will be given for extra work due to existing conditions which such examination should have disclosed.

.3 Report to the Consultant any unsatisfactory conditions which may adversely affect the proper completion of this work.

3.2 Coordination with Other Divisions

.1 Examine the drawings and specifications of all divisions and become fully familiar with their work. Before commencing work, obtain a ruling from the Consultant if any conflict exists, otherwise no additional compensation will be made for any necessary adjustments.

.2 Lay out the work and equipment with due regard to process systems, structural and mechanical features. Architectural and structural drawings take precedence over electrical drawings regarding locations of walls, doors and equipment.

.3 Do not cut structural members without approval of the Consultant.

.4 Coordinate with all Division installing equipment and services, and ensure that there are no conflicts.

.5 Install anchors, bolts, pipe sleeves, hanger inserts, etc. in ample time to prevent delays.

.6 Examine previously constructed work and notify the Consultant of any conditions which prejudice the proper completion of this work. Commencement of this work without such notification shall constitute acceptance of other work.

3.3 Location of Outlets and Luminaires

.1 Electrical drawings are, unless otherwise indicated, drawn to scale and approximate distances and dimensions may be obtained by scaling. Figured dimensions shall govern over scaled dimensions. Where exact dimensions and details are required, refer to Architectural and Structural drawings.

.2 Outlet and equipment locations shown on the drawings are approximate. Locations may be revised up to 3 meters to suit construction and equipment arrangements without additional cost to the Owner, provided that the Contractor is notified prior to the installation of the outlets, or equipment.

.3 Coordinate locations of luminaries to suit the layout of all equipment within the space.

.4 Unless otherwise specified or shown, install products in accordance with recommendations and ratings of manufacturers.

3.4 Separation of Services

.1 Maintain separation between electrical wiring system and building piping, ductwork, etc. so that wiring system is isolated (except at approved connections to such systems) to prevent galvanic corrosion.

.2 In particular, contact between dissimilar metals, such as copper and aluminum, in damp or wet locations is not permitted.

.3 Do not support wiring from process or heating pipes, ductwork, etc. Provide separate support system for all electrical equipment and cabletrays.

3.5 Equipment Identification

.1 3 mm thick plastic lamicoid name plates, black face, white core, mechanically attached with self tapping screws, 6 mm high lettering, to be attached to the front face of the following equipment:

- Distribution Centres (Indicate designation, bus capacity, voltage)
- MCC's (Designation, voltage)
- Starters, contactors, Disconnects (Designation, voltage, load controlled)
- Panelboard (Designation, voltage, Bus Capacity)
- Automatic transfer switch (designation, voltage, rating)
- Terminal cabinets and pull boxes (system, voltage)
- Transformers (designation, capacity, primary and secondary voltage)

.2 Color code exposed conduits, junction and pull boxes, and teck cables with paint or plastic tape (25 mm wide band) at 15 metre intervals. Color coding to be as follows:

SYSTEM	MAJOR BAND	MAJOR BAND
347/600 V Normal	Dk. Blue	
347/600 V Emerg.	Dk. Blue	White
120/208 V Normal	Lt. Blue	
120/204 V Emerg.	Lt. Blue	Black
UPS System	Lt. Blue	White
Fire Alarm System	Red	
Telephone	Lt. Green	
Building Alarm	Pink	
Low Level Paging (Ceiling Speakers)	Dk. Green	
Security Systems	Dk. Green	Lt. Brown
Data	Black	Yellow

.3 Provide neatly typed circuit directories in panelboards to indicate the area or equipment controlled by each branch circuit.

.4 All conductors shall be identifiable by coloured insulation and permanent markers at every terminal and accessible points throughout its entire run.

Conductors:

Equipment Grounding – Green
Neutral Conductor – White

347/600 Volt System	120/208 Volt System
Phase A – Orange	Phase A – Red
Phase B – Brown	Phase B – Black
Phase C – Yellow	Phase C – Blue

.5 Low Voltage Wiring: per manufacturer's standard, i.e., Douglas low voltage relay switching system.

.6 Install yellow plastic warning tape, 300 mm below grade, above all underground ducts.

3.6 Wiring to Equipment Supplied by Others

.1 Equipment supplied by the Owner or under other Division will be moved to the installation site by others. However, the electrical connection to the equipment shall be done by this Division.

3.7 Testing

.1 Refer to Section 16980 - Testing, Adjusting and Balancing of Electrical Equipment and Systems.

3.8 Single Line Diagram

.1 Provide and mount a framed as-built single line diagram to be located adjacent to the main electrical equipment. Use a clear plexiglass cover. The diagram shall be 914 mm x 600 mm minimum, with all lettering Leroyed.

3.9 Instructions to Owner's Personnel

.1 Refer to Section 16990 - Electrical Equipment and Systems Demonstration and Instruction.

3.10 Access Panels

.1 Where electrical equipment, junction boxes, remote ballasts or the like are concealed, access panels shall be supplied. Panels shall be of adequate size for servicing of the electrical work and complete with necessary frames and hinged doors held closed with captive fasteners. Coordinate type and size of panels with the Consultant.

.2 In removable ceiling areas, provide markers on ceiling tile to locate equipment requiring access. Markers shall be of a type approved by the Consultant.

3.11 Mounting Heights

.1 Unless a conflict exists, use the following as mounting heights from finished floors to centre of device.

Receptacles in Mechanical Rooms	1000 mm
Receptacles and Telephone Outlets in offices	300 mm
Light Switches	1350 mm
Fire Alarm Manual Stations	1350 mm
Fire Alarm Bells	2300 mm
Clocks	2300 mm
Data Outlets	300 mm
Intercom	1400 mm
Thermostats	1400 mm
Door Entry Push-Buttons	1400 mm
Wall-mounted speakers	2300 mm
Panelboards, starters, and disconnects (to top of cover)	2000 mm
End of Line Resistors	1800 mm
Outlets above Counters	175 mm above countertop or backsplash

3.12 Sealing of Wall and Floor Openings

.1 All conduit and cable entries through outside walls of buildings, through partition walls separating electrical rooms from other areas, through fire separations, and through floors above grade shall be sealed to prevent passage of moisture, dust, gasses, flame, or to maintain pressurization.

.2 Openings shall be sealed when all wiring entries shown on the drawings have been completed.

.3 Sealing material shall be fire resistant and shall not contain any compounds which will chemically affect the wiring jacket or insulating material. Cable penetrations through fire separations to be sealed.

3.13 Housekeeping Pads

.1 All floor mounted electrical equipment installed by this Division shall be mounted on concrete housekeeping pads which , unless otherwise noted, shall be the responsibility of the Contractor.

.2 The Contractor shall determine the extent of the housekeeping pads required and supply all information and details as to size and locations to the Consultant within thirty days after the award of the Contract.

3.14 Sleeves

.1 Provide sleeves of galvanized steel pipe with machine cut ends of ample size to accommodate conduits and cables passing through walls, partitions, ceilings, floors, etc.

.2 For wall, partitions and ceilings the ends shall be flush with the finish on both sides but for floors they shall extend 4" above finished floor level.

.3 The space between the sleeve and the conduit shall be filled with Dow Corning silicone RTV foam for fire stop and caulked around the top and bottom with approved permanently resilient, non-flammable and weatherproof silicone base compound and ensure that the seal is compatible with the floor and ceiling finishes.

.4 Locate and position sleeves exactly prior to construction of walls, floors.

.5 Failure to comply with the above requirements shall be remedied at this Division's expense.

3.15 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.

.3 Check resistance to ground before energizing.

.4 Carry out tests in presence of Consultant.

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

.6 Submit test results for Consultant's review.

3.16 Load Balance

.1 Measure phase current to panelboards with normal loads (lighting) operating at time of acceptance. Adjust branch circuit connections as required to obtain best balance of current between phases and record changes.

.2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.

.3 Submit, at completion of work, report listing phase and neutral currents on panelboards, dry-core transformers and motor control centres, operating under normal load. State hour and date on which each load was measured, and voltage at time of test.

END OF SECTION

1. GENERAL

1.1 References

.1 CAN3-G12, Zinc-Coated Steel Wire Strand.

.2 CAN/CSA C83, Communication and Power Line Hardware.

.3 CAN/CSA O80 Series, Wood Preservation.

.4 CSA O15.1, Eastern White Cedar Poles.

.5 CSA O15.2, The Physical Properties of Western Red Cedar Poles and Reinforcing Stubs.

.6 CSA O15.3, The Physical Properties of Jack, Lodgepole, and Red Pine Poles and Reinforcing Stubs.

.7 CSA O15.4, The Physical Properties of Douglas Fir and Western Larch Poles and Reinforcing Stubs.

.8 CSA O116, Power and Communication Sawn Wood Crossarms.

.9 CSA O124, The Physical Properties of Power and Communication Wood Insulator Pins.

1.2 Submittals

.1 Submit shop drawings in accordance with specification section 16010 - Electrical General Requirements.

2. PRODUCTS

2.1 Height

.1 Structures shall be of sufficient height to accommodate all circuits for which they are intended, and to maintain clearances under maximum sag and loading conditions between circuits and between the lowest conductor and ground.

2.2 Equipment Identification

.1 Rustproof marker attached with rustproof nails to mark each pole with 50 mm high designated number.

2.3 Treatment

.1 Structures shall have coatings and/or preservation treatment which:

.1 Are suitable for service conditions and planned service life of the structure, and

.2 Do not cause corrosion of pole line hardware.

.2 Wood poles shall be full-length treated.

.3 The treatment of wood poles shall conform to the requirements of CAN/CSA 080.

.4 Notwithstanding Subrules (2) and (3), other treatment methods may be accepted upon submission of specifications for approval by an Inspector.

2.4 Setting Gain

.1 Poles shall be marked in accordance with CSA 015.2, 015.3, or 015.4 or shall be provided with a setting gain 3.6 m (12') from the butt to indicate the depth of setting.

2.5 Pole Selection

.1 Wood poles shall be Western Red Cedar, Yellow Cedar, Lodgepole Pine or Douglas Fir with dimensions not less than those given in CSA 015.2, 015.3, 015.4 respectively.

.2 Wood poles used for primary lines shall be a minimum of Class 5 and at least 10.5 m (35') in length.

.3 Wood poles used for transmission lines, shall be of a class and length suitable for the service conditions and the design loads as defined in CAN/CSA C22.3 No. 1 or as dictated by specific local conditions.

.4 Class 6 wood poles shall not be longer than 12.5 m (40').

2.6 Equipment Structures

.1 For each crossarm:

.1 Insulator pins: to CSA O124.

.2 Two – [32 x 6] mm galvanized steel braces.

.3 One – [9 x 38] mm galvanized steel lag screw.

.4 Two – [9 x 114] mm galvanized steel bolts.

.5 Through bolts and double arm bolts as required.

2.7 Insulators and Hardware

.1 General

.1 Insulators and hardware shall be:

.1 Supplied and installed by Utility Company.

2.8 Guys and Anchors

.1 General

.1 A guy assembly shall be provided at each dead-end construction and at any pole where the line angle is greater than 5 degrees, and shall be located as close as practicable to the centre of the load that the guy is intended to sustain.

.2 Guy Strand

.1 Guy strand shall have adequate tensile strength and shall be galvanized steel wire not less than 6 mm (1/4") in diameter, or other similar material.

.3 Anchors

.1 An anchor shall have sufficient strength to sustain the load at the point of attachment independent of the strength of the pole.

.2 An anchor shall be:

.1 A plate of an expanded anchor; or

.2 A power installed screw anchor; or

.3 A treated log not less than 300 mm in diameter and 2 m long buried horizontally at a depth of 2 m minimum and at right angles to the pull; or

.4 A rock anchor or other anchor designed to provide adequate support.

.4 Installation

.1 Plate and expanding anchors shall be installed against an undercut to bear on firm undisturbed soil.

.2 Guys assemblies shall be installed before any conductors are attached to the pole and located so that the guys will not be abraded by rubbing against any wire, pole, or structure.

.3 Guys located so that there is a possibility of contact with supply conductors due to the failure of guys or conductors shall be effectively insulated.

.4 Guys and conductors shall be fitted with guards in any locations where there is a possibility of vehicle or pedestrian access such as on or near sidewalks, playgrounds, ski areas, and similar locations, except that where more than one guy is attached to a pole in the same direction, only the outer guy need be fitted with a guard.

.5 Guy strain insulators shall be installed so that:

.1 If the guy is hanging vertically, the lowest insulator will be at least 2.5 m above ground; and

.2 If the guy should break loose from its anchor, there will be an insulator between the primary and secondary or ground conductors.

3. EXECUTION

3.1 Preparation of Poles

.1 Where poles require shortening, cut piece from top only.

.2 Roof top of poles with single slope bevelled top.

.3 Treat roof top, gains, bored holes with preservative before assembly.

.4 Cut parallel plane crossarm gains in face of pole for single and double arming, spacing as indicated.

.5 Bore hole in center of each gain for crossarm bolt.

.6 Drill crossarms for pins, through bolts, double arm bolts and brace bolts. Pre-drill treated crossarms to standard spacing.

.7 Fasten wood insulator pins to crossarms with galvanized steel nails.

.8 Install crossarms and braces.

3.2 Installation

.1 Locate and dig pole holes. Make holes large enough to allow space for tamping backfill.

.2 Pole Setting.

.1 The setting depth of a pole shall be at least 10% of the pole length plus 0.6 m, except that for a pole set in rock the setting depth shall be at least 10% of the pole length but not less that 1.2 m.

.2 Notwithstanding Subrule 1., poles erected in a manner to provide equivalent strength will be accepted.

.3 Align poles with crossarms at right angles to pole line on straight runs.

END OF SECTION

1. GENERAL

1.1 Work Included

.1 Provide a complete system of conduit and fittings for installation of wiring.

2. PRODUCTS

2.1 Rigid Steel Conduit

.1 Galvanized with threaded joints and connections.

.2 Connections in dry locations: steel or malleable iron locknuts inside and outside enclosures. Insulated bushings Thomas & Betts Series 222 or approved alternate.

.3 Connectors subjected to moisture interior and exterior: liquid and dust tight with insulated throat, Thomas & Betts "Bullet Hub" 370 Series or approved alternate.

.4 Fittings: cast metal "Condulet" as manufactured by Crouse-Hinds Canada Ltd. including gasketted covers in damp locations.

.5 Expansion joints: cast metal Crouse-Hinds type XJ or approved alternate.

2.2 E.M.T. Conduit

.1 Fittings in dry locations: Steel or zinc set screw connectors with insulated throat. Steel or zinc set screw couplings.

.2 Fittings in wet locations: steel rain-tite connectors with insulated throat. Steel rain tite couplings.

2.3 Rigid P.V.C. Conduit

.1 Conduit: rigid non-metallic conduit of unplasticized polyvinyl chloride as manufactured C.G.E. "Sceptre" Schedule 40.

.2 Fittings: threaded male or female solvent weld connectors and solvent weld couplings, as supplied by conduit manufacturer.

.3 Solvent: as recommended by conduit manufacturer.

2.4 Flexible Conduit

.1 Connectors: slip-proof, insulated throat or non-metallic bushings, steel, Thomas & Betts Ltd. "Tite-Bite", Series 300.

2.5 Rigid PVC Duct

.1 Duct: Rigid non-metallic conduit of unplasticized polyvinyl chloride Type DB-2, conforming to CSA Standard manufactured by Canron Plastics Ltd.

.2 Accessories: Bell ends, couplings, adapters, bends and other fittings of same material as duct. Use solvent recommended by manufacturer. Horizontal, vertical and foundation spacers as manufactured by Pilgrim Products Ltd.

2.6 Liquid-Tight Flexible Conduit

.1 Conduit: flexible metal conduit with liquid-tight PVC jacket. Industrial Wire & Cable "Liquiseal".

.2 Connectors: captive sealing jacket and ground cone insulated throat, steel (Thomas & Betts Ltd. "Super-Tight", Series 6000).

3. EXECUTION

3.1 Rigid Steel Conduit

.1 Use as raceways for following applications:

- In all areas exposed to weather.
- Locations where mechanical damage may occur and in mechanical rooms to a height of 1 metre.

3.2 E.M.T. Conduit

.1 Use as raceways for following applications:

- In surface and concealed areas or in poured concrete above ground level.

.2 It may not be used in damp locations, corrosive atmosphere, underground, outdoors, nor in areas exposed to mechanical damage.

3.3 Rigid P.V.C. Conduit

.1 Use as raceways for following applications

- In poured concrete floors and walls and on underground runs exterior to the buildings unless otherwise noted.
- Rigid PVC conduit shall not be surface mounted.

.2 Use strictly in accordance with the Canadian Electrical Code. Do not use in return air plenums and for exit and fire escape lights.

.3 Provide insulated ground wire in all rigid PVC conduits in accordance with the Canadian Electrical Code.

.4 Where rigid PVC conduit is set in poured concrete, solvent joints must be completed and allowed to set as per manufacturer's instructions.

.5 Bend rigid conduit in strict accordance with manufacturer's directions. Distorted bends will not be accepted.

3.4 Flexible Conduit

.1 Use as raceways for following applications:

- Connections to f.h.p. motors in dry locations.
- Flexible connections to luminaires.

.2 Provide a separate insulated ground wire in all flexible conduits.

3.5 Rigid PVC Duct

.1 Provide a separate green insulated copper ground wire in all ducts sized as required by the Code.

.2 Arrange ducts in a horizontal layer separated by plastic spacers to provide spacing between duct centres, as shown on the drawings.

.3 Support duct bank on plastic spacers 35 mm between ducts. Foundation spacers to maintain at least 76 mm clearance between ducts and exterior coverage.

.4 Make joints with tapered couplings to provide a secure watertight connection. Stagger all joints to provide 200 mm vertical and horizontal clearance between adjacent couplings. Where needed, use factory bends to provide bends of radius required.

.5 When all ducts are installed, brace whole assembly at each spacer group to prevent duct floating when concrete is placed.

.6 Terminate ducts with standard bell ends where ducts enter cable pits, junction boxes and building interiors.

.7 Cap ends of unused ducts with plug ends of same material as ducts.

.8 Seal all joints in ducts with solvent cement.

3.6 Liquid-Tight Flexible Conduit

.1 Use as raceways for following applications:

- At all motors, pipe mounted control devices, and other devices subject to movement or water.

.2 At all motors provide a short length before connecting to the motor terminal box. Minimum length shall be 450 mm plus 4 times the conduit diameter.

.3 Provide a separate ground wire within flexible conduit, bonded to motor frames and system ground.

3.7 Workmanship

.1 Install all conduit and wiring concealed, unless otherwise shown on the drawings. Do not recess conduit in columns, except as noted, without permission.

.2 Where conduit is run exposed, run parallel to building lines. Where conduits are grouped (two or more), space evenly, make bends concentric and mount on Unistrut racks.

.3 Lay out conduit to avoid interference with other work. Maintain a minimum clearance of 150 mm from steam or hot water piping, vents, etc.

.4 Slabs on grade: Install rigid PVC conduit in the gravel base below concrete slabs. Provide mechanical protection around stub-ups through slab and extend 150 mm beyond concrete. When rigid steel conduit is installed in contact with earth it shall be protected by Polykin #940 tape. Extend taping 300 mm above finished grade.

.5 Metal conduit installations in concrete pours: Tie down conduit to prevent shifting. All joints are to be made up tight to ensure ground continuity. To prevent concrete entry, seal EMT set screw fittings with tape, pack outlet boxes and cap conduit terminations both in boxes and stub-ups. Apply Polykin #940 tape to the conduit 152 mm both sides of the point of leaving slab.

.6 Do not place conduit in concrete slabs in which slab thickness is less than four times conduit diameter. Place conduits larger than this size under floor. Conduits to have minimum 25 mm concrete cover.

.7 Organize conduit in slabs to minimize crossovers. Obtain approval and minimum concrete cover required from structural engineer prior to installing conduits in slabs.

.8 At all recessed panels cap 2 - 25 mm and 4 - 19 mm empty conduits from panel into ceiling above and below for future use.

.9 Provide Brady underground warning tapes 300 mm below grade above all underground conduits. Tape shall be yellow warning tape, 150 mm wide.

.10 Where conduits or ducts enter or exit concrete structures below grade provide 16 mm x 1500 mm steel reinforcing dowels to prevent shearing. Extend dowel 1000 mm beyond concrete and band conduit to dowel. The first 3 meter length of conduit extending from the structure to be Polykin wrapped rigid steel.

.11 Where conduit is installed in floor slabs to run up at equipment or motors, carefully check all conduit locations. Verify conduit locations for mechanical equipment from shop drawings or detail drawings. Brace all stub-ups. Stub-ups shall be rigid steel.

.12 Where steel conduit is required to be bent, do not heat, and do not bend conduit in such a way as to reduce pipe cross section area at any point. Radii of bends shall be as per Canadian Electrical Code.

.13 For all runs of conduits, do not include more than equivalent of 4 - quarter bends. Provide conduit fittings, pullboxes and junction boxes where necessary. Pulling elbows shall not be used except by special permission.

.14 Where possible, install conduits so that they are not trapped, cap turned up conduits to prevent the entrance of dirt of moisture during construction. Swab out conduit and thoroughly clean internally before wires and cables are pulled.

.15 Take extreme care in reaming ends of all conduit to ensure a smooth interior finish that will not damage the insulation of the wires.

.16 Use insulated non-metallic bushings on all conduit terminations.

.17 Ensure electrical continuity in all conduit systems.

.18 All conduit shown exposed in finished areas is to be free of unnecessary labels and trade marks.

.19 Install a 90 lb. test line in all conduits left empty by this contractor including those which others will pull cables, wires, etc.

.20 Conduits and ducts crossing building expansion joints shall have conduit expansion fittings to suit the type of conduit used, and shall be Crouse-Hinds, Sceptre, or approved fitting.

.21 Seal conduits with duct seal where conduits are run between heated and unheated areas. Where conduits, cables, or cable trays pierce fire separations, seal openings with Dow Corning 3-6548 sealant or approved equal.

.22 Where conduits pass through walls, they shall be grouped and installed through openings. After all conduits shown on the drawings are installed, wall openings shall be closed with material compatible with the wall construction. Review size and quantity of conduit sleeves with the Consultant.

.23 Where drawings show conduit designations, these conduits shall be identified at each point of termination with Thomas & Betts "Ty-Rap" No. TY532M labels.

.24 Where conduit finish is damaged, repair or replace.

.25 All branch circuit wiring, home-runs, communication and data to be minimum 20 mm diameter unless otherwise stated.

.26 Provide necessary flashing and pitch pockets, making watertight joints where conduits pass through roof or watertight membranes.

END OF SECTION

CABLETROUGHS

1. GENERAL

1.1 Description

.1 Provide a complete system of cable trays as shown on the drawings.

.2 Coordinate the location of the support channels so as not to interfere with other services.

1.2 Related Work

.1 Wire and connectors 1000V insulation and under: Section 16141

.2 Fastenings and Supports: Section 16191

1.3 Shop Drawings and Product Data

.1 Submit shop drawings and product data in accordance with Section 16010 - Electrical General Requirements.

.2 Indicate various types of cabletroughs with terminology used in Part 2.

2. PRODUCTS

2.1 Cabletrough

.1 Cabletroughs and fittings: to EEMAC F5-1.

.2 Ladder type, Class C1 to CSA C22.2No.126.

.3 Aluminum with depth of 100 mm and widths as indicated on drawings.

.4 Horizontal elbows, end plates, drop outs, vertical risers and drops, tees, wyes, expansion joints, reducers and other fittings where required. Radii on fittings: 600 mm minimum.

.5 Barriers where different voltage systems or electrical systems are in the same cabletrough, or as indicated.

.6 Approved materials: Pilgrim, Enduro, Canstrut, Pursley, Newton Instrument Co., or approved equal.

2.2 Supports

.1 Provide hardened steel (HS) rod hangers, rod hanger clamps and accessories as required.

.2 Approved materials: Same as cabletrough.

3. EXECUTION

3.1 Installation

.1 Install complete cabletrough system. Provide concrete curbs around openings passing through floors.

.2 Support cabletrough on both sides at 1500mm, on centre, spacings.

.3 Remove sharp burrs or projections to prevent damage to cables or injury to personnel.

.4 Fire stop all penetrations of fire barriers.

3.2 Cables in Cabletrough

.1 Install cables individually.

.2 Lay cables into cabletrough. Use rollers when necessary to pull cables.

.3 Secure cables in cabletrough at 5 m centers, with nylon ties.

.4 Identify cables every 15 m with nameplates in accordance with Section 16010 - Electrical General Requirements.

.5 Mark power and communication runs in accordance with colour coding outlined in Section 16010 - Electrical General Requirements.

3.3 Grounding

.1 Provide #6 green TWH ground conductor the full length of the cabletray.

.2 Make connection to cabletray at 15m intervals.

.3 Terminate ground conductor at the main ground bus in main electrical room.

END OF SECTION

WIREWAYS AND AUXILIARY GUTTERS

1. GENERAL

1.1 Description

.1 Supply and install wireways and auxiliary gutters and fittings as a means for flexible wiring system.

.2 All wireways and gutters to be two piece with removable cover to provide access to wiring.

.3 Wireways, auxiliary gutters and fittings are based on CSA CSS.2, No. 26.

1.2 Submittals

.1 Submit shop drawings in accordance with Section 16010 - Electrical General Requirements.

2. PRODUCTS

2.1 Wireways

.1 Sheet steel with bolted cover to give uninterrupted access.

.2 Finish: based gray enamel.

.3 Elbows, tees, couplings and hanger fittings manufactured as accessories to wireway supplied.

3. EXECUTION

3.1 Installation

.1 Install wireways and auxiliary gutters.

.2 Keep number of elbows, offsets, connections to minimum.

.3 Install supports, elbows, tees, connectors, fittings.

.4 Install barriers to separate different voltages or to separate different systems.

.5 Install gutter to full length of equipment.

END OF SECTION