
DIVISION 16

ELECTRICAL

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ELECTRICAL GENERAL REQUIREMENTS

1. GENERAL

1.1 Work Included

- .1 Complete and operational electrical system as required by the drawings and as herein specified.

1.2 Related Work

- | | | |
|----|-----------------------|-------------|
| .1 | General Requirements: | Division 01 |
| .2 | Site Work: | Division 02 |
| .3 | Concrete: | Division 03 |
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| .7 | Equipment: | Division 11 |
| .8 | Mechanical: | Division 15 |

1.3 Drawings and Specifications

- .1 The General Conditions, Supplementary Conditions and Division 01 are a part of this specification and shall apply to this Division.
- .2 The intent of the drawings and specifications is to include all labour, products and services necessary for complete work, tested and ready for operation.
- .3 Symbols used to represent various electrical devices often occupy more space on the drawing than the actual device does when installed. In such instances, do not scale locations of devices from electrical symbols. Install these devices with primary regard for usage of wall space, convenience of operation and grouping of devices.
- .4 These specifications and the drawings and specifications of all other divisions shall be considered as an integral part of the accompanying drawings. Any item or subject omitted from either the specifications or the drawings but which is mentioned or reasonably specified in and by the others, shall be considered as properly and sufficiently specified and shall be provided.
- .5 Provide all minor items and work not shown or specified but which are reasonably necessary to complete the Work.

ELECTRICAL GENERAL REQUIREMENTS

- .6 If discrepancies or omissions in the drawings or specifications are found, or if the intent or meaning is not clear, advise the Consultant for clarification before submitting tender.
- .7 Responsibility to determine which Division provides various products and work rests with the Contractor. Additional compensation will not be considered because of differences in interpretation of specifications.

1.4 Quality Assurances

.1 Codes, Rules, Permits & Fees

- .1 Comply with all laws, ordinances, rules, regulations, codes and orders of all authorities having jurisdiction relating to this work.
- .2 Comply with all rules of the Canadian Electrical Code, CSA Standard C22.1 and the applicable building codes. Do Overhead Lines in accordance with CAN/CSA-C22.3 No. 1 and Underground Systems in accordance with CAN/CSA-C22.3 No. 7 except where specified otherwise.
- .3 Quality of work specified and/or shown on the drawings shall not be reduced by the foregoing requirements.
- .4 Immediately after award of contract and prior to installation, verify location, arrangement and point of attachment for service and service entrance equipment with supply authority and inspection departments. Failure to do so will render this Division responsible for any corrections necessary without additional compensation.
- .5 Give all required notices, submit drawings, obtain all permits, licenses and certificates and pay all fees required for this work.
- .6 Furnish a Certificate of Final Inspection and approvals from inspection authority to the Consultant.

.2 Standard of Workmanship:

- .1 Execute all work in a competent manner and to present an acceptable appearance when completed.
- .2 Employ a competent supervisor and a sufficient number of licensed tradesmen to complete the Work in the required time.
- .3 Arrange and install products to fit properly into designated building spaces.
- .4 Unless otherwise specified or shown, install products in accordance with recommendations and ratings of manufacturers.

ELECTRICAL GENERAL REQUIREMENTS

1.5 Submittals

- .1 Prior to delivery of any products to job site and sufficiently in advance of requirements to allow ample time for checking, submit shop drawings for review as specified in Division 01. Submit shop drawings for all equipment as required in each section of this specification.
- .2 Prior to submitting the shop drawings to the Consultant, the Contractor shall review the shop drawings to determine that the equipment complies with the requirements of the specifications and drawings.
- .3 The term "shop drawing" means drawings, diagrams, illustrations, schedules, performance characteristics, brochures and other data which are to be provided by the Contractor to illustrate details of a portion of the Work.

Indicate materials, methods of construction and attachment of support wiring, diagrams, connections, recommended installation details, explanatory notes and other information necessary for completion of Work. Where equipment is connected to other equipment, indicate that such items have been coordinated, regardless of the section under which the adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.

Adjustments made on shop drawings by the Consultant are not intended to change the contract price. If adjustments affect the value of the work state such in writing to the Consultant prior to proceeding with the Work.

- .4 Manufacture of products shall conform to revised shop drawings.
- .5 Keep one complete set of shop drawings at job site during construction.

1.6 Record Drawings

- .1 Refer to 01720 in Division 1.
- .2 The Contractor shall keep one complete set of white prints at the site office, including all addenda, change orders, site instructions, clarifications and revisions for the purpose of record drawings. As the work on site proceeds, the Contractor shall clearly record in Red Pencil all as-built conditions, which deviate from the original contract documents. Record drawings to include circuiting of all devices, conduit and feeder runs (complete with conductor size and number) and locations of all electrical equipment.
- .3 Prior to substantial performance, the contractor shall certify, in writing, that the as-built record drawings are complete and that they accurately indicate all electrical services, including exposed as well as concealed items.

ELECTRICAL GENERAL REQUIREMENTS

1.7 Operation and Maintenance Manuals

- .1 Operations and Maintenance Manuals are to be prepared as required in Division 1, Section 01300.

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 Refer to Front End documents.
- .2 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 on the Engineer's format. Subsequent requests for payment shall be documented accordingly.

ELECTRICAL GENERAL REQUIREMENTS

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.

ELECTRICAL GENERAL REQUIREMENTS

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.

ELECTRICAL GENERAL REQUIREMENTS

- .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 Demolition of Existing Facilities

- .1 All equipment shown to be removed shall be disconnected and returned to owner, as long as equipment is considered to be in good working condition.
- .2 Wire and conduit removed shall be removed from the site by the contractor.
- .3 All wires to be reused shall be properly terminated, marked and covers shall be applied to junction boxes where necessary.
- .4 All branch circuit wiring and conduit not to be reused is to be removed back to the distribution panel.
- .5 Contractor to ensure the continuity of all circuits outside each area of construction, when demolishing devices.

3.3 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 Engineer 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 architectural, 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 Engineer.

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- .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 Engineer of any conditions which prejudice the proper completion of this work. Commencement of this work without such notification shall constitute acceptance of other work.

3.4 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, Process 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 Maintain luminaire locations wherever possible. Notify the Engineer of conflicts with other services.
- .4 Unless otherwise specified or shown, install products in accordance with recommendations and ratings of manufacturers.

3.5 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 pipes, ductwork, etc. Hangers for suspended ceilings may be used for the support of wiring only when approval is obtained from the Consultant and the ceiling installer, and approved clips or hangers are used.

3.6 Equipment Identification

- .1 3 mm thick plastic lamicoïd name plates, black face, white core, mechanically attached with self tapping screws, 9.5 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)

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

3.7 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.

3.8 Testing

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

3.9 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.

3.10 Instructions to Owner's Personnel

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

ELECTRICAL GENERAL REQUIREMENTS

3.11 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.

3.12 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 General Contractor.

3.13 Sleeves

- .1 Provide sleeves of galvanized steel pipe with machine cut ends of ample size to accommodate conduits 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.

3.14 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.

ELECTRICAL GENERAL REQUIREMENTS

- .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.

3.15 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

CONDUITS, CONDUIT FASTENINGS AND CONDUIT FITTINGS

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 PVC Duct

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

2.4 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).

CONDUITS, CONDUIT FASTENINGS AND CONDUIT FITTINGS

2.5 Zinc Fittings

- .1 Connectors and couplings to be manufactured of No. 3A alloy conforming to ASTM designation B.240 as manufactured by Regal Manufacturing.

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.
 - Three phase motor wiring (Teck cable may also be used for this application).

3.2 E.M.T. Conduit

- .1 Use as raceways for following applications:
 - In surface and concealed areas.
- .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.
 - Wiring installed in areas subject to intermittent or continuous moisture but not surface mounted.
 - Rigid PVC conduit shall not be surface mounted.
- .2 Provide insulated ground wire in all rigid PVC conduits in accordance with the Canadian Electrical Code.
- .3 Where rigid PVC conduit is set in poured concrete, solvent joints must be completed and allowed to set as per manufacturer's instructions.
- .4 Bend rigid conduit in strict accordance with manufacturer's directions. Distorted bends will not be accepted.

CONDUITS, CONDUIT FASTENINGS AND CONDUIT FITTINGS

3.4 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.

3.5 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 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.
- .6 Organize conduit in slabs to minimize crossovers. Obtain approval and minimum concrete cover required from structural engineer prior to installing conduits in slabs.
- .7 Provide Brady underground warning tapes 300 mm below grade above all underground conduits. Tape shall be yellow warning tape, 150 mm wide.
- .8 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.
- .9 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.

CONDUITS, CONDUIT FASTENINGS AND CONDUIT FITTINGS

- .10 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.
- .11 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.
- .12 Where possible, install conduits so that they are not trapped, cap turned up conduits to prevent the entrance of dirt or moisture during construction. Swab out conduit and thoroughly clean internally before wires and cables are pulled.
- .13 Take extreme care in reaming ends of all conduit to ensure a smooth interior finish that will not damage the insulation of the wires.
- .14 Use insulated non-metallic bushings on all conduit terminations 25mm and larger.
- .15 Ensure electrical continuity in all conduit systems.
- .16 Install a 90 lb. test line in all conduits left empty by this contractor including those which others will pull cables, wires, etc.
- .17 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.
- .18 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.
- .19 Where drawings show cable designations, these conduits shall be identified at each point of termination with Thomas & Betts "Ty-Rap" No. TY532M labels.
- .20 Where conduit finish is damaged, repair or replace.
- .21 All branch circuit wiring, home-runs, communication and data to be minimum 20 mm diameter unless otherwise stated.
- .22 Provide necessary flashing and pitch pockets, making watertight joints where conduits pass through roof or watertight membranes.

END OF SECTION

WIRES AND CABLES 0 - 1000 V

1. GENERAL

1.1 Work Included

- .1 Provide a complete system of wiring, making all connections necessary for the installation shown on drawings.

1.2 References, Codes and Standards

- .1 CSA C22.2 No. 0.3, Test Methods for Electrical Wires and Cables.
- .2 Install and rate cables in accordance with the Canadian Electrical Code requirements, or in accordance with ICEA requirements where permissible.

1.3 Product Data

- .1 Submit product data in accordance with Section 16010 – Electrical General Requirements.

2. PRODUCTS

2.1 Building Wires

- .1 Conductors: stranded for 10 AWG and larger. Minimum size: 12 AWG.
- .2 Copper conductors: size as indicated, with 600 or 1000 V insulation of chemically cross-linked thermosetting polyethylene (XLPE) material rated RW90.

2.2 Teck Cable

- .1 Conductors:
 - .1 Grounding conductor: copper.
 - .2 Circuit conductors: copper, size as indicated.
- .2 Insulation:
 - .1 Chemically cross-linked thermosetting polyethylene rated type RW90, 600 or 1000 V.
- .3 Inner jacket: polyvinyl chloride material.
- .4 Armour: interlocking galvanized steel or aluminum.
- .5 Overall covering: Thermoplastic polyvinyl chloride material.
- .6 Fastenings:
 - .1 One hole steelstraps to secure surface cables 50 mm and smaller. Two hole steel straps for cables larger than 50 mm.

WIRES AND CABLES 0 - 1000 V

- .2 Channel type supports for two or more cables at 1500 mm centers.
- .3 Six mm dia. threaded rods to support suspended channels.
- .7 Connectors:
 - .1 Watertight or explosion proof depending on location, approved for TECK cable.

2.3 Control Cables

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

2.4 Luminaire Wire

- .1 Type TEW: Copper conductors, #12 AWG, with thermoplastic and asbestos insulation, flame retardant, heat and moisture resistant, rated 600 Volts, 105°C.

3. EXECUTION

3.1 General

- .1 Minimum conductor size #12 AWG.

3.2 Installation of Building Wires

- .1 Install wiring as follows:
 - .1 In conduit systems, underground ducts, and overhead service conductors in accordance with the requirements of this division.

3.3 Installation of Teck Cable 0 - 1000 V

- .1 Install cables with watertight or explosion proof sealable glands to suit the area of installation.
- .2 Group cables wherever possible on channels.
- .3 Terminate cables in accordance with the requirements of this division.

3.4 Workmanship

- .1 Before pulling wire, ensure conduit is dry and clean. If moisture is present, thoroughly dry out conduits; vacuum if necessary. To facilitate pulling, recognized specially manufactured wire pulling lubricants may be used. Do not use grease. Employ suitable techniques to prevent damage to wire when ambient temperature is below the minimum permitted for each insulation type. Do not pull wires into incomplete conduit runs.

WIRES AND CABLES 0 - 1000 V

- .2 Installation to be free of opens and grounds. Before energization, measure insulation resistance and comply with the Canadian Electrical Code. Submit data sheet with values measured.
- .3 Do not install any conductor smaller than #12 AWG, except where specifically indicated otherwise, i.e., for fire alarm system station circuits, P.A. wiring, etc.
- .4 Provide sizes of conductors as shown on drawings. Voltage drop from lighting panels to farthest outlet must not exceed 2% at full load in any case. Advise Consultant if problem is foreseen.
- .5 Exercise care in stripping insulation from wire. Do not nick conductors.

3.5 Identification, Coding and Balancing

- .1 For branch circuit wiring, follow identification system shown on the drawings and as specified in Section 16010 – Electrical General Requirements.
- .2 Connect single phase equipment to minimize imbalance on feeders. Adjust branch circuiting shown as required for optimum balancing. Record all changes on "record" drawings.
- .3 Colour code all feeders at all terminations, at all points where taps are made, and at all panelboards, switchboards, motor control centres, etc. Use two wraps of 3M #471 plastic film tape 48 mm wide.
- .4 Conductors sized No. 2 AWG and smaller are required to be factory coloured, not taped on site.
- .5 For direct current wiring use red for positive and black for negative.

3.6 Testing

- .1 All power and control wiring shall be tested for insulation resistance value with a 1000 volt megger. Resistance values shall be as recommended by the cable manufacturer.
- .2 All wire test results shall be properly tabulated, signed, dated, and submitted to the Consultant.

END OF SECTION

SPLITTERS, JUNCTION BOXES PULL BOXES AND CABINETS

1. GENERAL

1.1 Work Included

- .1 Provide a complete system of splitters boxes and cabinets for the installation of wiring and equipment.

1.2 Shop Drawings and Product Data

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

2. PRODUCTS

2.1 Junction Boxes and Pull Boxes, Weatherproof

- .1 Materials:
 - .1 Cast steel, Crouse Hinds, WBJ Series.

2.2 Junction Boxes and Pull Boxes, Indoor Dry Locations

- .1 Materials:
 - .1 Code gauge sheet steel, welded construction, phosphatized and factory paint finish.
- .2 Components:
 - .1 For flush mounting, covers to overlap box by 25 mm minimum all around with flush head cover retaining screws.
 - .2 Use rolled edges for surface boxes.
- .3 Junction boxes mounted in exterior walls shall be complete with box vapour barriers.

2.3 Cabinets

- .1 Materials:
 - .1 Cabinets: Code gauge sheet steel, welded construction, phosphatized and factory paint finish, suitable for field painting.
 - .2 Locks: to match panelboards.
 - .3 Backboards: 19 mm GIS fir plywood, one piece per cabinet, covering entire cabinet interior.
- .2 Components:

SPLITTERS, JUNCTION BOXES PULL BOXES AND CABINETS

- .1 With hinged door and return flange overlapping sides, with handle, lock and catch for surface mounting, size as indicated or to suit.
- .2 Surface or flush with trim and hinged door, latch and lock and two keys, size as indicated or to suit. Keyed to match panelboard keys 19 mm GIS Fir Plywood backboard.

2.4 Splitters

- .1 Materials:
 - .1 Code gauge sheet steel, welded construction, phosphatized and factory paint finish.
- .2 Components:
 - .1 Formed hinged cover suitable for locking in the closed position.
 - .2 Main and branch lugs to match required size and number of incoming and outgoing conductors as indicated.
 - .3 At least three spare terminals on each set of lugs in splitters less than 400 AMP.

3. EXECUTION

3.1 Installation

- .1 Junction Boxes and Pull Boxes:
 - .1 Supply all pull boxes and junction boxes shown on the drawings or required for the installation.
 - .2 Install in inconspicuous but accessible locations, above removable ceilings or in electrical rooms, utility rooms or storage areas.
 - .3 Identify with system name and circuit designation as applicable.
 - .4 Size in accordance with the Canadian Electrical Code, as a minimum.
- .2 Cabinets:
 - .1 Mount cabinets with top not greater than 1980 mm above finished floor, coordinated with masonry, panelboards, fire hose cabinets and similar items. Securely fasten backboards to cabinet interiors.
 - .2 Install terminal block where indicated.

**SPLITTERS, JUNCTION BOXES
PULL BOXES AND CABINETS**

.3 Splitters

.1 None required.

.4 Identification

.1 Provide equipment identification in accordance with Section 16010 – Electrical General Requirements.

END OF SECTION