

Part 1 General

1.1 GENERAL

- .1 This Section covers items common to Sections of Divisions 26. This section supplements requirements of Division 1.
- .2 For the proper execution of work, cooperate with other trades and contracts as needed.
- .3 To avoid installation conflicts, thoroughly examine the complete set of contract documents. Resolve conflicts with Departmental Representative prior to installation.
- .4 Prior to installation of feeders to equipment requiring electrical connections, examine the manufacturer's shop drawings, wiring diagrams, product data and installation instructions. Verify that the electrical characteristics detailed in the contract documents are consistent with the electrical characteristics of the actual equipment being installed. When inconsistencies occur request clarification from Departmental Representative.
- .5 Examine the entire set of contract documents to avoid conflicts with other systems. Determine exact route and installation of electrical wiring and equipment with conditions of construction.
- .6 Should the electrical documents indicate a condition conflicting with the governing codes or regulations, refrain from installing that portion of the work until clarified by Departmental Representative.
- .7 Definitions:
 - .1 Provide - To furnish and install complete and ready for intended use.
 - .2 Furnish - Supply and deliver to project site, ready for unpacking, assembly and installation.
 - .3 Install - Includes unloading, unpacking, assembling, erecting, installation, applying, finishing, protecting, cleaning and similar operation at the project site to complete items of work furnished.
- .8 All correspondence and documents shall be submitted in English. Copies in other languages shall be provided where indicated.
- .9 The entire bid package is considered related to all disciplines and shall be examined prior to bid and followed throughout construction and thereafter. Related sections listed hereinafter in this specification shall not be considered as relieving any Division from the above - indicated responsibility.
- .10 Equivalent or equal products: Where either of these terms are used to reference acceptable material, proof of equality in the form of manufacturer representative's supplied itemized table or letter, to illustrate or certify that the product meets or exceeds each and every specification item is required for review prior to approval. Manufacturer's raw catalog pages and the like are not acceptable substitute for the above-indicated table or letter and will be returned as insufficient for review.
- .11 Sufficiency of drawings and specifications:
 - .1 Hold the Drawings and Specifications to determine the general character and general arrangement of the Work.
 - .2 Drawings and Specifications indicate the general scope of the Project in terms of the dimensions of the Work, the type of structural, mechanical, electrical utility

systems and the architectural elements of construction. The Drawings and Specifications do not necessarily indicate or describe all Work required for the full performance and completion of the requirements of the Contract Documents. On the basis of the general scope indicated, stated, described or implied, furnish all items required for the proper execution and completion of the Work.

- .3 The Contract Documents are issued to facilitate construction by expressing the design intent. The Drawings and Specifications do not necessarily contain all of the details required to construct the project, and contractor supplied detail in the form of detailed construction documents (referred to in the Contract Documents as the Contractors supplied shop drawings, submittals, and field coordination drawings) is required for construction of the Work; all of which set out the specific and final details required for placing and constructing the finished Work. By contrast, the Drawings and Specifications are provided to reflect the finished design of the Work. The Drawings and Specifications are not intended to be used as a set of detailed instructions on how to construct the Work. Construction means, methods, techniques, sequences, procedures, and site safety
- .4 Precautions are the responsibility of the Contractor.
- .5 Shop Drawings, Product Data, Samples and similar submittals provided by the Contractor are not Contract Documents. The purpose of these submittals is to demonstrate the way by which the Contractor proposes to conform to the design intent expressed in the Contract Documents.
- .6 Examine the Drawings and Specifications to satisfy yourself regarding the design intent and the extent of the proposed Work, and by personal examination of the existing building, site and surroundings make your own estimate of the facilities condition and difficulties attending the performance and completion of the Work.
- .12 Make known in writing to the Consultant ten (10) days prior to the tender closing date any materials specified or are required to complete the work, which are not currently available or will not be available for use as called for herein or on drawings. Failing to do so, it will be assumed that the most expensive compliant alternate has been included in the tender price.
- .13 For the sake of clarity, electrical symbols are typically shown larger than they would be at the actual scale of the drawing. Therefore, do not scale electrical drawings. Where exact dimensions are required, refer to dimensioned architectural plans or civil drawings. Failed to do so, bear all resulted costs and make good of the work.
- .14 The general contractor who has contractual relationship with the Owner shall be responsible for providing complete and workable systems as outlined on drawings and in specifications. The Consultant will not recognize any sub-contractor as such, but will consider all persons engaged on the work to be under the control of general contractor. The Consultant will not under any circumstances, enter into discussions concerning the responsibility of subtrades or the apportionment of work. No claim based on the division of work between specification sections or subtrades will be considered.

1.2 CODES AND STANDARDS

- .1 Unless otherwise indicated, all references to standards and codes throughout this specification is to the latest applicable edition at the time of bid closing.

- .2 Do complete installation in accordance with CSA C22.1. In case of a conflict between the code requirements and the contract documents, request clarification prior to proceeding with the work.
- .3 Do overhead and underground systems in accordance with CSA C22.3 No.1 except where specified otherwise.
- .4 Abbreviations for electrical terms: to CSA Z85 - Abbreviations for Scientific and Engineering Terms.
- .5 Coordinate with other disciplines and provide plenum rated equipment and devices and plenum rated raceway, wiring and installation methods in all plenum spaces.
- .6 Material and installations shall comply with the requirements of the following codes and standards, codes and standards mentioned in other sections of this specification, as well as other applicable codes and standards to the satisfaction of the Authorities Having Jurisdiction (AHJ):
 - .1 Alberta Building Code (ABC);
 - .2 Alberta Fire Code (AFC);
 - .3 Canadian Electrical Code (CEC);
 - .4 Canadian Standards Association (CSA); and
 - .5 Underwriters Laboratories of Canada (ULC).
- .7 Provide the site office with a current copy of the following documents, codes and standards. These documents shall remain on site throughout the duration of construction for electricians and others reference and use. The maintenance of these codes on site may be checked at each site visit.
- .8 Absence of one or more such documents will be indicated on the field review report as deficiency and non-compliance with contract requirements.
 - .1 Project's electrical specifications;
 - .2 Project's up to date electrical RFIs and responses, SIs and CCNs;
 - .3 Canadian Electrical Code;

1.3 QUALITY ASSURANCE

- .1 Conform to the requirements of CEC with amendments by local Authorities Having Jurisdiction (AHJ).
- .2 Conform to the requirements of the ABC with amendments by local AHJ.
- .3 Obtain and pay for the electrical permits, and inspection from local AHJ.

1.4 CARE, OPERATION AND START-UP

- .1 Instruct operating personnel in the operation, care and maintenance of systems, system equipment and components.
- .2 Arrange and pay for services of manufacturer's 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 all aspects of its care and operation.
- .4 Upon completion of instruction process, obtain written confirmation from the Owner that the above-indicated service has been provided satisfactorily. Submit a copy to Consultant and include the original and copies in the Operation & Maintenance manuals.

1.5 VOLTAGE RATINGS

- .1 Operating voltages: to CAN3-C235 Preferred Voltage Levels for AC Systems 0 to 50kV.
- .2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by the above indicated standard. Equipment to operate in extreme operating conditions established in above-indicated standard without damage to equipment.

1.6 PERMITS, FEES AND INSPECTION

- .1 Submit to Electrical Inspection Department and Supply Authority necessary number of drawings and specifications for examination and approval prior to commencement of work.
- .2 Pay associated fees.
- .3 Consultant will provide drawings and specifications required by Electrical Inspection Department and Supply Authority at no cost.
- .4 Notify Departmental Representative of changes required by Electrical Inspection Department prior to making such changes.
- .5 Furnish Certificates of Acceptance from authorities having jurisdiction on completion of work to Consultant.
- .6 Obtain Alberta Department of Labour, Electrical Protection Branch Permit and submit a copy followed by the certificate of acceptance from the inspection branch to the Departmental Representative.

1.7 MATERIALS AND EQUIPMENT

- .1 Provide materials and equipment in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Equipment and material to be certified by a SCC (Standard Council of Canada) accredited Certification body. Where there is no alternative to supplying equipment, which is not certified as indicated; obtain special approval from Electrical Inspection Department.
- .3 Equipment and material to be in compliance with the current applicable federal and local (Provincial or Territorial) laws, regulations and acts.
- .4 Custom manufactured items shall be inspected and approved by a certification authority acceptable to the local Authorities Having Jurisdiction in the Province of Alberta as required by the Canadian Electrical Code rule 2-024 before being installed.
- .5 Factory assemble control panels and component assemblies.
- .6 Provide material and equipment that is acceptable to AHJ as suitable for the use indicated. For example provide wet label equipment in wet locations.

- .7 Include special features, finishes, accessories and other requirements as described in the contract documents regardless of the items listed catalog number.
- .8 Provide incidentals not specifically mentioned herein or noted on drawings, but needed to complete the system, in a safe and satisfactory working condition.
- .9 Install electrical equipment complete and per manufacturer's instructions. Obtain installation instructions from manufacturer and thoroughly examine the instructions prior to rough in. When instructions conflict with contract documents, request clarification from Departmental Representative prior to proceeding with the installation.

1.8 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

- .1 Supplier and installer responsibility is indicated in Motor, Control and Equipment Schedule on electrical drawings and related mechanical responsibility is indicated on Mechanical Equipment Schedule on mechanical drawings.
- .2 Control wiring and conduit is specified in Division 26 except for conduit, wiring and connections below 50 V, which are related to control systems specified in Division 23 and shown on mechanical drawings.
- .3 Except where otherwise indicated, provide all feeders, breakers, disconnects, starters, overloads and power relays as indicated on drawings or required by applicable codes, whichever more stringent.

1.9 FINISHES

- .1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.
- .2 Clean and touch up surfaces of devices and equipment scratched or marred during shipment or installation, to match original paint.
- .3 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.
- .4 All electrical fittings, supports hanger rods, pullboxes, channel frames, conduit racks, outlet boxes, brackets, clamps, etc. to have galvanized finish or enamel paint finish over corrosion-resistant primer.
- .5 All 120/208 volt equipment to be finished to match Grey ANSI 61.

1.10 EQUIPMENT IDENTIFICATION

- .1 Identify electrical equipment with nameplates as follows:
- .2 Nameplates: Lamicoid 3 mm thick plastic engraving sheet, black face, white core, mechanically attached with self-tapping screws.

NAMEPLATE SIZES

Size 1	10 x 50 mm	1 line	3 mm high letters	Type C
Size 2	12 x 70 mm	1 line	6 mm high letters	Type B
Size 4	20 x 90 mm	1 line	9.5 mm high letters	Type A

- .3 Labels: Embossed plastic labels with 6 mm high letters unless specified otherwise.

- .4 Wording on nameplates to be approved by Departmental Representative/Consultant prior to manufacture.
- .5 Allow for average of twenty-five (25) letters per nameplate and label.
- .6 Identification to be English.
- .7 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.
- .8 Disconnects', starters' and contactors' label to include:
 - .1 Load ID as shown on drawings;
 - .2 Voltage, Voltage, phase and number of wires;
 - .3 The words "FED FROM PANEL" followed by the source ID; and
 - .4 The abbreviations "CCT #" followed by the circuit number or numbers as applicable.
- .9 Motors and other mechanical loads: Similar to disconnects.
- .10 Terminal cabinets and pull boxes: indicate system, voltage and circuit number(s).
- .11 Identifications shall match what is shown on drawings as to the letters, numbers, sequence, indentation and other formatting attributes.

1.11 WIRING IDENTIFICATION

- .1 Identify each conductor at each end where they are spliced or terminated in a junction box, panelboard, fitting or device.
- .2 Identify conductors that pass through a pullbox in that box.
- .3 Identify wiring with permanent indelible identifying markings as indicated hereinafter.
- .4 Identification tag to indicate the panel designator and circuit number or wire number on each conductor. Information shall be printed in permanent legible form.
- .5 Tag neutral conductor with the circuit number that it serves.
- .6 Maintain phase sequence and colour coding throughout for all systems.
- .7 Colour code the wiring per CSA C22.1 as follows:
 - .1 120/208 volt system phase wires - Red, Black and Blue.
- .8 Colour coding of phase conductors:
 - .1 Number 10 AWG conductors and smaller shall be Red, Black, Blue, Orange, Brown, Yellow, White as required.
 - .2 Number 8 to 3 AWG conductors shall be Red, Black, Blue, White for 120/208 volt systems.
 - .3 Larger than number 3 AWG conductors can be black with appropriate banding.
- .9 Use colour coded wires in communication cables, matched throughout system.

1.12 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.
- .4 Colour coding to be as follows:
 - .1 208/120 volt normal power - grey band.
 - .2 208/120 volt stand-by power - grey and orange band.
 - .3 280/120 volt emergency power - grey and red band.

1.13 WIRING TERMINATIONS

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

1.14 MANUFACTURERS AND SCC LABELS

- .1 Visible and legible, after equipment is installed.

1.15 PROTECTION

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

1.16 FIRE STOPPING

- .1 Provide fire stopping per ABC section 3 and other applicable codes and standards.
- .2 For additional requirements see Fire Stopping in Division 7. In case of inconsistency between the requirements of this article and the requirements of Division 7, the more stringent requirements apply.
- .3 Requirements:
 - .1 Conform to the following requirements to maintain the continuity of fire separations whether or not shown on the drawings.
 - .2 Fire separations may not be pierced by electrical or similar services except in accordance with the local building code.
 - .3 Where a fire separation is required to be of non-combustible construction and terminates at the exterior wall, the underside of floor, ceiling or roof structure, and at floors, the opening shall be fire stopped with non-combustible material as required by applicable codes.
 - .4 Combustible members, fasteners and similar items shall not be used to anchor fixtures to fire separations.
 - .5 Openings for non-combustible pipes and ducts through a fire separation shall be fire stopped around the pipe and duct with ULC labeled and approved fire stopping sealant, insulation or other material approved by local authorities having jurisdiction to maintain the integrity of fire separation.
 - .6 Maintain existing fire separations as such, and seal penetrations to retain the separation's integrity.
 - .7 Refer to technical sections for specific requirements for sealing penetrations and joints of smoke and fire separations.

- .4 Fire Test Response Characteristics:
 - .1 For assemblies or materials having fire resistance rating, provide material and construction identical to those tested in assembly indicated according to CAN/ULC-S101 as verified by an independent testing and inspecting agency acceptable to authorities having jurisdiction for fire resistance ratings of specific assemblies.
 - .2 Fire resistance rated assemblies and materials shall bear a label and proof of acceptance as indicated by design designations from ULC list of equipment and materials or Warnock Hersey/Intertek directory of listed products. Where no design designation is provided, use only time assigned to materials listed in Appendix D of the Building Code.
 - .3 Fire resistance rated assemblies and materials bearing an Underwriters Laboratories Inc. (UL) or Warnock Hersey/Intertek (WHI) label will be acceptable for use on this project provided that the label indicates acceptance under Underwriters Laboratories of Canada (ULC) and having either a CUL, CULUS, CWHI or CWHIUS marking.
 - .4 Materials that only have a UL, ULUS, WHI or WHIUS marking are not acceptable.
- .5 Foam Sealant: Listed and approved for the application per CAN/ULC-S115 "Fire Tests of Fire Stop Systems". For use around conduit and other penetrations to prevent passage of smoke, fire, toxic gas or water; To maintain seal before, during and after fire; In and around conduit for thermal break at penetration of barrier between heated and unheated spaces. To be Chase Technology Corp., Fire Foam, Thomas & Betts or approved.
- .6 Mechanical Fire Stop Systems:
 - .1 Arrayed within a frame type fire stop assembly;
 - .2 Listed and approved for the application per CAN/ULC-S115 "Fire Tests of Fire Stop Systems".
- .7 Notwithstanding other requirements of this specifications, seal around optical fiber cables, electrical wires and cables, electrical raceways, electrical boxes and other similar building electrical services that penetrate fire separation or a membrane forming part of an assembly required to have a fire-resistant rating, with moldable fire stop putty pads or other listed and approved to CAN/ULC-S115 rated to maintain the fire resistance rating of the fire separation or assembly.
 - .1 Outlet boxes that penetrate opposite sides of a wall assembly shall be offset where necessary to maintain the integrity of the fire separation.
 - .2 Fire stop putty to be of fast installation type applied by hand, non-curing with no volatile solvents and no asbestos fibers.
 - .3 Standard of acceptance: HILTI CP617 series or equal.
- .8 Provide shop drawings for all fire stop material for review per Section 26 05 01 - Common Work Results - Electrical.
- .9 At completion of work, provide certificate stating that penetrations through fire separations have been sealed with certified fire stopping materials in compliance with Alberta Building Code and Contract requirements.

1.17 WARNING SIGNS

- .1 As specified and to meet requirements of Electrical Inspection Department and Departmental Representative.
- .2 Minimum size 175 x 250 mm.

1.18 MOUNTING HEIGHTS

- .1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.
- .2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.

1.19 CONDUIT AND CABLE INSTALLATION

- .1 Install cables, conduits and fittings to be embedded or plastered over, neatly and close to building structure so furring can be kept to minimum.
- .2 Obtain prior approval from Consultant before installing any equipment or conduit through roofing membrane. Provide approved pitch pockets or roof jacks where approval is given.
- .3 Seal around conduit penetrations through non-rated walls with caulking material matching the wall finish colour.

1.20 FIELD QUALITY CONTROL

- .1 All electrical work to be carried out by qualified, licensed electricians or apprentices as per the conditions of the Provincial Act respecting manpower vocational training and qualification. Employees registered in a Provincial apprentices program shall be permitted, under the direct supervision of a qualified licensed electrician, to perform specific tasks - the activities permitted shall be determined based on the level of training attained and the demonstration of ability to perform specific duties.
- .2 The work of this division to be carried out by a contractor who holds a valid Master Electrical contractor license as issued by the Province that the work is being contracted.
- .3 Conduct and pay for all testing unless otherwise indicated.
- .4 Furnish manufacturer's certificate or letter confirming that entire installation as it pertains to each system has been installed to manufacturer's instructions.
- .5 Insulation resistance testing:
 - .1 Megger circuits, feeders and equipment up to 300 V with a 500 V instrument.
 - .2 Megger 300-600 V circuits, feeders and equipment with a 1000 V instrument.
 - .3 The instrument shall be sufficiently large to thoroughly saturate the circuit under test.
 - .4 Check resistance to ground before energizing.
 - .5 Electronic instruments shall not be subjected to a megger test. Damaged electronic instrument(s) caused by megger test(s) shall be replaced at contractor's expense.

- .6 Consider ambient temperature and weather conditions, and apply proper correction factors to the measured insulation resistance values.
- .6 When directed to do so, carry out tests in presence of Consultant.
- .7 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.
- .8 Complete all deficient items noted on reports provided by the local authority having jurisdiction.
- .9 Submit test results for Departmental Representative's review.

1.21 DEMONSTRATION AND OPERATING AND MAINTENANCE INSTRUCTIONS

- .1 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.
- .2 Manufacturers to provide demonstrations and instructions where specified.
- .3 Contact operating personnel at the beginning of the project and encourage them to come on site at least once a week for the duration of the project. During these periods, give them full explanation of the various systems as the project progresses.
- .4 Maintain log of all site visits. Maintenance personnel to log in/out and be witnessed by Contractor. Present log when requested.
- .5 Obtain signed certificate of completion of the demonstration and operating and maintenance instruction from Owner for each system. Submit a signed copy to Consultant as the evidence of completion of such work prior to request for substantial completion field review.

1.22 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit to the Departmental Representative for his review, shop drawings, product data and samples called for by the contract documents and for such other items as the Departmental Representative may request. Do not proceed with work until related submission has been reviewed by the Departmental Representative.
- .2 Shop Drawings:
 - .1 Shop drawings means technical data specially prepared for work of this contract including drawings, diagrams, performance curves, data sheets, schedules, templates, patterns, reports, calculations, instructions, measurements and similar information not in standard printed form.
 - .2 Submit shop drawings presented in a clear and thorough manner to appropriately illustrate the work.
 - .3 Identify shop drawings by appropriate references to sheet, detail, schedule or room number. Maximum allowable drawing size 11" x 17". Provide a clear area of 100mm x 75mm (4" x 3") on each shop drawing for Departmental Representative's review stamp.

.3 Product Data:

- .1 Product data means standard printed information describing materials, products, equipment and systems, not specially prepared for work of this contract, other than the designation of selections.
- .2 Product data consisting of manufacturers' standard schematic drawings, catalogue sheets, diagrams, schedules, performance charts, illustrations and descriptive data will be accepted in lieu of shop drawings provided that:
 - .1 Information not applicable to the work of this contract is deleted, or the applicable information is clearly marked; and
 - .2 Standard information is supplemented with information specifically applicable to work of this contract.

.4 General:

- .1 Review, stamp with approval and sign shop drawings before submission to Departmental Representative. Stamping and signing the transmittal only, is not acceptable. By approving and submitting shop drawings, contractor represents that field measurements, field construction criteria, material, catalogue numbers and similar data have been verified and that shop drawings have been checked and coordinated with requirements of the work and contract documents regardless of what the stamp disclaims.
- .2 At the time of submission, inform Departmental Representative in writing of any deviations in shop drawings from requirements of Contract Documents.
- .3 Departmental Representative will review shop drawings for the sole purpose of ascertaining conformance with general design concept of the project and with information given in Contract Documents. Departmental Representative's review of a separate item shall not indicate acceptance of an assembly in which the item functions. This review by Departmental Representative shall not mean that Departmental Representative approved the detail design inherent in the shop drawings, responsibility for which shall remain with the Contractor submitting same, and such review shall not relieve the Contractor of his responsibility for errors or omissions in the shop drawings or his responsibility for meeting all requirements of the Contract documents as well as applicable federal and provincial/territorial laws, regulations and acts.
- .4 Make corrections which Departmental Representative may require, consistent with Contract Documents, and resubmit modified shop drawings until reviewed.
- .5 Direct specific attention in writing on re-submitted shop drawings to revisions requested by Departmental Representative on previous submissions.
- .6 Be responsible for dimensions to be confirmed and correlated at job site for information that pertains solely to fabrication processes or to techniques of construction and installation and for coordination of the work of all Sections.
- .7 Shop drawings submitted in Imperial will be returned to the contractor not reviewed until they are submitted in Metric Units (SI).
- .8 Shop drawings which require the approval of a legally constituted authority having jurisdiction shall be submitted by Contractor to such authority for approval. Such shop drawings shall receive final approval of authority having jurisdiction before receiving Departmental Representative's final review.

- .9 NOTE: Boiler plate copies of manuals or drawings shall not be accepted. Shop drawings to only contain information relevant and applicable to the system as covered in these documents. It is the responsibility of the contractor or his suppliers under the contractor's supervision to filter out the boiler plate documents, select the relevant pages, mark suggested products and submit such information only. Price this effort in the bid and deliver accordingly. Non-compliant suggestions will be rejected and the consequential delay shall be caught up with by the contractor.
- .10 No work requiring a shop drawing submission shall commence until the submission has received Departmental Representative's final review. All such work shall be in accordance with reviewed shop drawings.
- .11 Provide submittals for review for all electrical material and equipment.
- .5 Do not resubmit shop drawings or parts thereof, which have received favorable review again independently or as part of a resubmission. The entire package will be rejected if this requirement is breached.
- .6 Allow at least an average of one week for the Consultant to review each shop drawing submission. For submissions in excess of 50 pages, allow an extra day for each 20 pages or fraction thereof.

1.23 RECORD DRAWINGS

- .1 Provide 1 set of marked up electrical site record drawings. Provide sets of white prints of the construction drawings and use for record drawings. Mark thereon all changes as work progresses and as changes occur. This shall include changes to all electrical systems as constructed, including any revisions from addenda or change orders. Ensure that items marked correspond to the drawing title.
- .2 Use different colour waterproof ink for each service on a per drawing basis.
- .3 Make mark-ups available for reference purposes and inspection at all times.
- .4 Present finalized record drawings to Consultant at time of substantial completion site review.

1.24 CLEANING

- .1 Thoroughly clean the interior and the exterior of all panelboards, cabinets, wireways and gutters, enclosures, boxes and the like in accordance with manufacturer's instructions.
- .2 Vacuum construction dust, dirt and debris out of all electrical equipment and device enclosures including but not limited to the above-mentioned list.
- .3 Where enclosure finish is damaged, touch up finish with matching paint in accordance with manufacturer's specifications and installation instructions, and as specified herein.

1.25 FIELD REVIEWS

- .1 The electrical subtrade bidding this project as well as its subcontractors shall be qualified firms with certified journeymen personnel with considerable experience in similar construction work.
- .2 The firms should have internal quality control methods in place to ensure their material is in compliance with the construction documents and their installation is in compliance

with all applicable codes including but not limited to the Canadian Electrical Code, Alberta Building Code, Alberta Fire Code and all other codes and standards referenced in this specifications, and in the Canadian Electrical Code, Alberta Building Code and Alberta Fire Code applicable to different aspects of this project, and contract documents, prior to inviting the Consultant for field reviews and witnessing verifications and tests.

- .3 Prior to each field review request, inspect all installations, identify and rectify all code deficiencies. Request field review in writing. Indicate in the request that such quality control has been performed and identify the name and rank of the person performing such quality control. Submit reports mentioned in the other sections of this specification with the request for field review.
- .4 Electrical Consultant will conduct one field review for this project at substantial completion.
- .5 Costs for additional field reviews, where necessary due to deficiencies, additional supervision of Contractor's work quality and the like to the discretion of the Consultant shall be paid by the contractor, at no extra cost to the Owner, at cost plus at the hourly rate of the Consultant's staff member performing the field review. Reimburse the associated disbursements at cost plus 10% administration fee.

1.26 REQUIREMENTS FOR SUBSTANTIAL PERFORMANCE FIELD REVIEW

- .1 Notwithstanding the legal requirements as well as the other requirements of the specification sections included herein and other Divisions of the contract documents, follow the following to the letter and price accordingly:
- .2 Prior to submitting written request for substantial performance of the work:
 - .1 Test, verify, commission and start-up all systems and prove out all components, interlocks and safety devices.
 - .2 Submit a letter certifying that all work is complete for the intended use, operational, clean and all required submissions have been completed.
- .3 The work will not be considered to be ready for use for the purpose intended, in other words substantially complete, until the following requirements have been met:
 - .1 All the work called for in contract documents as well as the approved site instructions and change orders have been completed;
 - .2 All deficiencies have been corrected;
 - .3 All code requirements have been met;
 - .4 Operating and Maintenance Manuals have received favorable review;
 - .5 Record documents have received favorable review;
 - .6 Systems' programming, adjusting, balancing, start-up and commissioning have been completed;
 - .7 All demonstrations, trainings and specified seminars have been completed;
 - .8 All documentation have been completed.
- .4 Departmental Representative's Schedule C2 (letter of Assurance) will not be issued until the following requirements have been met:
 - .1 All items listed in this article have been completed and addressed;

- .2 Certificate stating that penetrations through fire separations have been sealed with certified fire stopping materials in compliance with Alberta Building Code and Contract requirements, is issued by the contractor;
- .3 Where there are deficiencies existing that to the discretion of the Departmental Representative are not of life safety nature, contractor must obtain the Owner's sign-off on the list of such deficiencies confirming the Owner's approval of the Contractor's certificate of Substantial Performance. Submit this confirmation to the Departmental Representative;
- .4 Certificate of inspection from AHJ is submitted;
- .5 Certificate of Substantial Performance is issued by the Contractor and Delivered to the Owner;
- .6 Obtain and submit to Departmental Representative a copy of the Owner's signed-off walk-through inspection.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 .1 Materials and installation for wire and box connectors.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International):
 - .1 CAN/CSA C22.2 No. 18, Outlet Boxes, Conduit Boxes and Fittings and Associated Hardware.
 - .2 CSA C22.2 No. 65, Wire Connectors.
- .2 National Electrical Manufacturers Association (NEMA).

Part 2 Products

2.1 MATERIALS

- .1 Pressure type wire connectors to: CSA C22.2 No.65, with current carrying parts of copper sized to fit copper conductors as required.
- .2 Fixture type splicing connectors to: CSA C22.2 No.65, with current carrying parts of copper sized to fit copper conductors 10 AWG or less.
- .3 Bushing stud connectors: to EEMAC 1Y-2 to consist of:
 - .1 Connector body and stud clamp for stranded or round solid copper conductors as required.
 - .2 Clamp for stranded or round copper conductors as required.
 - .3 Stud clamp bolts.
 - .4 Bolts for copper conductors bar.
 - .5 Sized for conductors as indicated.
- .4 Clamps or connectors for armoured cable, as required to: CAN/CSA-C22.2 No.18.

Part 3 Execution

3.1 INSTALLATION

- .1 Remove insulation carefully from ends of conductors and:
 - .1 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CSA C22.2 No. 65.
 - .2 Install bushing stud connectors in accordance with EEMAC 1Y-2.
- .2 Torque all connections to manufacturer specifications or where available, to code required values. Include a copy of the implemented torque values for all items in the O&M manuals.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 CSA C22.2 No .0.3, Test Methods for Electrical Wires and Cables.
- .2 CAN/CSA-C22.2 No. 131, Type TECK 90 Cable.

1.2 PRODUCT DATA

- .1 Submit product data in accordance with Section 26 05 01 - Common Work Results - Electrical.

Part 2 Products

2.1 BUILDING WIRES

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

2.2 CONTROL CABLES

- .1 Conductors: multiconductor, PVC insulated, PVC jacketed, copper, unshielded pair, overall shield, minimum size to be #16 AWG.
- .2 Insulation: 105°C Flame retardant PVC.
- .3 Aluminum foil/polyester shield with tinned copper drain wire.
- .4 Jacket to be UL listed, sunlight and moisture resistant, sequentially marked, nylon ripcord for jacket removal.
- .5 Conductors are to be black/white number coded, rated for 300V at 105°C.

Part 3 Execution

3.1 INSTALLATION OF BUILDING WIRES

- .1 Install wiring as follows:
 - .1 In conduit systems in accordance with Section 26 05 34.

3.2 INSTALLATION OF CONTROL CABLES

- .1 Install control cables in conduit .
- .2 Ground control cable shield.
- .3 All costs associated with the supply and installation of low voltage control wiring for 50V and under and related materials to be carried by Divisions 23 and 25 unless otherwise noted in the project documents.

- .4 Provide line voltage control wiring, raceway and terminations. Coordinate with Divisions 23 and 25 at the time of tender and bid accordingly. Failed to do so, provide all necessary whatsoever at no extra cost.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 American National Standards Institute (ANSI)/Institute of Electrical and Electronics Engineers (IEEE)
- .2 Canadian Standards Association, (CSA International)

Part 2 Products

2.1 EQUIPMENT

- .1 Insulated grounding conductors: green, stranded copper type RW90-XLPE.
- .2 Grounding connectors: Hydraulic compression tool applied connectors or exothermic welding process connector or listed mechanical type connectors. Manufacturer: Burndy Hyground Compression System, Erico/Cadweld, Amp Ampact Grounding System or approved.

Part 3 Execution

3.1 EQUIPMENT BONDING

- .1 Install grounding connections to typical equipment included in, but not necessarily limited to following list:
 - .1 Frames of motors;
 - .2 Starters;
 - .3 Control panels;
 - .4 Motor shaft grounding devices where provided. See motor specifications in Division 25.

3.2 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 01 - Common Work Results - Electrical.
- .2 Perform tests before energizing electrical system.
- .3 Disconnect ground fault indicator during tests.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Canadian Standards Association, (CSA International)

Part 2 Products

2.1 SUPPORT CHANNELS

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

Part 3 Execution

3.1 INSTALLATION

- .1 Secure equipment to hollow masonry, tile and plaster surfaces with lead anchors or nylon shields.
- .2 Secure equipment to poured concrete with expandable inserts.
- .3 Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.
- .4 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.
- .5 Fasten exposed conduit or cables to building construction or support system using straps:
 - .1 One-hole malleable iron steel straps to secure surface conduits and cables 53 mm and smaller.
 - .2 Two-hole steel straps for conduits and cables larger than 53 mm.
 - .3 Beam clamps to secure conduit to exposed steel work.
- .6 Suspended support systems:
 - .1 Support individual cable or conduit runs with 6 mm dia threaded rods and spring clips.
 - .2 Support 2 or more cables or conduits on channels supported by 6 mm dia threaded rod hangers where direct fastening to building construction is impractical.
- .7 For surface mounting of two or more conduits use channels at 1.5 m on centre spacing.
- .8 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.
- .9 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.
- .10 Do not use wire lashing or perforated strap to support or secure raceways or cables.
- .11 Do not use supports or equipment installed for other trades for conduit or cable support except where allowed by applicable codes, with permission of other trade and approval of Departmental Representative.

- .12 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.
- .13 Where screw fastenings are used on metal decking, screws are to be set in lower flutes only.

END OF SECTION

Part 1 General

1.1 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and product data for cabinets in accordance with Section 26 05 01 - Common Work Results - Electrical.

Part 2 Products

2.1 JUNCTION AND PULL BOXES

- .1 Code gauge metal construction and/or cast corrosion-resistant type, conforming to Canadian Electrical Code, with screw on or hanged cover.
- .2 Welded steel construction with screw-on flat covers for surface mounting.
- .3 Covers with 25 mm minimum extension all around, for flush-mounted pull and junction boxes.

Part 3 Execution

3.1 JUNCTION, PULL BOXES AND CABINETS INSTALLATION

- .1 Install pull boxes in inconspicuous but accessible locations.
- .2 Mount cabinets with top not higher than 2 m above finished floor.
- .3 Install terminal blocks as indicated in Type T cabinets.
- .4 Only main junction and pull boxes are indicated. Install pull boxes so as not to exceed 30 m of conduit run between pull boxes as per the requirements of the Canadian Electrical Code.

3.2 IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 01 - Common Work Results - Electrical.
- .2 Install size 2 identification labels indicating system name, voltage and phase.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Canadian Standards Association (CSA)
 - .1 CAN/CSA C22.2 No. 18, Outlet Boxes, Conduit Boxes and Fittings and Associated Hardware.
 - .2 CSA C22.2 No. 56, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit, steel.
 - .3 CSA C22.2 No. 83, Electric Metallic Tubing.

1.2 LOCATION OF CONDUIT

- .1 Drawings do not indicate all conduit runs. Those indicated are in diagrammatic form only. Determine best routing for conduit on site, ensuring requirements of this specification are met.

Part 2 Products

2.1 CONDUITS

- .1 Electrical metallic tubing (EMT); with couplings.
- .2 Flexible steel conduit and liquid-tight flexible metal conduit.

2.2 CONDUIT FASTENINGS

- .1 One hole malleable iron straps to secure surface conduits 53 mm and smaller. Two hole steel straps for conduits larger than 53 mm.
- .2 Beam clamps to secure conduits to exposed steel work.
- .3 Channel type supports for two or more conduits at 1.5 m OC.
- .4 Threaded rods, 6 mm dia., 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° bends are required for 27 mm and larger conduits.
- .3 Set screw where allowed by code and watertight connectors and couplings elsewhere. Do not use set screw fittings where conduit is used as the grounding means.
- .4 Conduit Moisture Sealant: Sealant to be moisture barrier type, non-toxic, non-shrink, non-hardening, putty type hand applied material providing effective barrier under submerged conditions.

2.4 PULL STRING

- .1 Minimum 6 mm stranded nylon (polypropylene) pull rope, tensile strength 5 kN. Leave pull rope in conduit after cables have been installed.

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 and in unfinished areas.
- .3 Use electrical metallic tubing (EMT) except in cast concrete and where subject to mechanical injury.
- .4 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment.
- .5 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.
- .6 Mechanically bend steel conduit over 21 mm dia. or as recommended by manufacturer, using approved conduit bending machine or hickey.
- .7 Install pull string in empty conduits.
- .8 Remove and replace blocked, crushed, deformed or otherwise injured or damaged conduit sections. Do not use liquids to clean out conduits.
- .9 Where cables or conduits pass through floors and fire rated walls, pack space between wiring and sleeve full with fire rated caulking compound if approved, or other approved fire rated fire stop assembly suitable for the application and to the code requirements.
- .10 Where cables or conduits pass through non-rated walls, pack space between wiring and sleeve full with caulking compound suitable for the application and paint to match the wall finish.
- .11 Where conduits go from heated area to non-heated (outdoor) area seal all conduits.
- .12 Dry conduits out before installing wire.
- .13 Provide plastic bushing at the end of raceway, per CEC rule 12-906, to protect conductors from abrasion where they issue from raceways. This applies to all raceway and all wiring regardless of voltage or application. EMT connector without insulated throat or bushing installed between the conduit and box meets the 12-906 requirement for conductors smaller than #8 AWG.

3.2 SURFACE CONDUITS

- .1 Run parallel or perpendicular to building lines.
- .2 Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.
- .3 Run conduits in flanged portion of structural steel.
- .4 Group conduits wherever possible on suspended channels. Channels to have 25% spare capacity.

- .5 Do not pass conduits through structural members except as indicated.
- .6 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Receptacles, wiring devices and their installation.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International):
 - .1 CAN/CSA C22.2 No. 42, General Use Receptacles, Attachment Plugs and Similar Devices.

1.3 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and product data in accordance with Section 26 05 01 - Common Work Results - Electrical.

Part 2 Products

2.1 RECEPTACLES

- .1 Duplex receptacles, CSA type 5-15R, 125 V, 15 A, U ground, to: CSA-C22.2 No.42 with following features:
 - .1 Reinforced thermoplastic base and deep nylon body.
 - .2 Suitable for No. 10 AWG for back and side wiring.
 - .3 Break-off links for use as split receptacles.
 - .4 Four side wiring screws.
 - .5 Triple wipe contacts and riveted grounding contacts.
 - .6 Finish: Ivory.

2.2 COVER PLATES

- .1 Weatherproof while-in-use covers: NEMA 3R when closed over energized plug. Vertical mount for duplex receptacle. Provide continuous use cover with cover capable of closing over energized cord plug with bottom aperture for cord exit. To be UV stabilized polycarbonate cover with closed cell neoprene foam gasket.

Part 3 Execution

3.1 INSTALLATION

- .1 All wiring devices to be fed from "pigtail" splices. Feed through splices utilizing the devices as a splicing terminal is not acceptable.
- .2 Receptacles:
 - .1 Mount receptacles with u-ground on the bottom of the receptacle.

- .2 Do not share neutral between circuits.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Equipment and installation for ground fault circuit interrupters (GFCI).

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International).
- .2 National Electrical Manufacturers Association (NEMA).

1.3 SUBMITTALS

- .1 Submittals in accordance with Section 26 05 01 - Common Work Results - Electrical.
- .2 Submit product data and shop drawings.
- .3 Submit test report for field testing of ground fault equipment to Departmental Representative and a certificate that system as installed meets criteria specified herein.

Part 2 Products

2.1 MATERIALS

- .1 Equipment and components for ground fault circuit interrupters (GFCI): to CAN/CSA-C22.2 No.144.
- .2 Components comprising ground fault protective system to be of same manufacturer.

2.2 GROUND FAULT PROTECTOR UNIT

- .1 Self-contained 15A or 20A as indicated on drawing, 120 V circuit interrupter and duplex receptacle complete with:
 - .1 Solid state Class A ground fault sensing device.
 - .2 Continual automatic self diagnostic.
 - .3 Green Power on LED.
 - .4 Solid red LED indicating a ground fault condition.
 - .5 Flashing red LED indicating malfunction.
 - .6 No power at face if reverse wired.
 - .7 Facility for testing and reset.
 - .8 UL 943-2006 compliant.
 - .9 Flush mounted with face plate.

Part 3 Execution

3.1 INSTALLATION

- .1 Do not ground neutral on load side of ground fault relay.

- .2 Provide independent GFI receptacle where shown on drawings. Feed-thru protection is not acceptable.

3.2 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 01 - Common Work Results - Electrical.
- .2 Demonstrate simulated ground fault tests.

END OF SECTION

Part 1 General

1.1 PRODUCT DATA

- .1 Submit product data in accordance with Section 26 05 01 - Common Work Results - Electrical.

Part 2 Products

2.1 BREAKERS GENERAL

- .1 Bolt-on moulded case circuit breaker: quick- make, quick-break type, for manual and automatic operation with temperature compensation for 40°C ambient.
- .2 Common-trip breakers: with single handle for multi-pole applications.
- .3 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting. Trip settings on breakers with adjustable trips to range from 3-8 times current rating.
- .4 Circuit breakers with interchangeable trips as indicated.
- .5 Circuit breakers to have minimum of 10,000 A symmetrical rms interrupting capacity rating but no less than the value calculated by the study specified in section 26 05 73.

2.2 THERMAL MAGNETIC BREAKERS [DESIGN A]

- .1 Moulded case circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping and instantaneous tripping for short circuit protection.
- .2 Provide ground fault protection where shown on drawings.

Part 3 Execution

3.1 INSTALLATION

- .1 Install circuit breakers as indicated.

END OF SECTION

Part 1 General

1.1 PRODUCT DATA

- .1 Submit product data in accordance with Section 26 05 01 - Common Work Results - Electrical. Products

1.2 DISCONNECT SWITCHES

- .1 Non-fusible, disconnect switch, as identified on drawings in CSA Enclosure type 1 or 3 suitable for the location installed and sprinkler proof, unless indicated otherwise, size as indicated.
- .2 Provision for padlocking in on-off switch position by three locks.
- .3 Mechanically interlocked door to prevent opening when handle in ON position.
- .4 Quick-make, quick-break action.
- .5 ON-OFF switch position indication on switch enclosure cover.
- .6 Horsepower rated for load interruption.
- .7 To include drip shields.

1.3 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 01 - Common Work Results - Electrical.
- .2 Indicate name of load controlled on size 4 nameplate.

1.4 FINISHES

- .1 Apply finishes to enclosure in accordance with Section 26 05 01 - Common Work Results - Electrical.

Part 2 Products

2.1 NOT USED

- .1 Not used.

Part 3 Execution

3.1 INSTALLATION

- .1 Install disconnect switches complete with fuses if applicable.
- .2 Locate disconnect switch in site of the load.

- .3 Connect feeders.
- .4 Test and verify the operation of the switch.

END OF SECTION