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Prepared for:

City of Coquitlam
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Request for Proposal

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Project No. 20-228

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END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 This Section describes the Common Work Results applicable to electrical disciplines.

1.2 GENERAL

.1 The general conditions and general requirements together with all amendments and supplements contained in the General Specifications shall form an integral part of the electrical specification and will be made part of this contract.

.2 Reference to “Electrical Divisions” shall mean all Divisions 26 in the Master Format or the Canadian Master Specifications.

.3 The word "Provide" shall mean "Supply and Install" the products and services specified. "As Indicated" means that the item(s) specified are shown on the drawings.

.4 Review mechanical plans and specifications for the extent of electrical work required to make mechanical systems complete and include this work in the tender sum.

.5 Review existing record plans and site conditions for limitations of penetrations or inclusions of electrical equipment. In tender sum, allow for avoiding critical areas with electrical equipment.

.6 Comply with the requirements of the General Contract, and coordinate the installation with all other trades on site.

.7 Confirm on-site the exact location of equipment, outlets, and fixtures and the location of outlets for equipment supplied by other trades.

1.3 WORK INCLUDED

.1 This work shall include the supply and installation of all the necessary materials and apparatus for complete operating systems as indicated on the plans or mentioned in this specification, with the exception of materials or apparatus specifically mentioned to be omitted or to be supplied by owner.

.2 Items obviously necessary or reasonably implied to complete the work, shall be included as if shown on drawings and noted in the specifications.

.3 All materials, tools, appliances, scaffolding, apparatus and labour necessary for the execution, erection and completion of the systems described herein shall be furnished. This includes providing lighting and power for own work.

.4 This contract shall include, but is not confined to, the following scope of work:

.1 Power distribution equipment

.2 Power connections and outlets

.3 Emergency generator system

.4 Mechanical equipment connections

.5 Complete all electrical connections to equipment and accessories pertaining to this contract and leave all in operating condition to the electrical Consultant's satisfaction.

.6 Remove all existing electrical equipment and material made redundant by this contract or in conflict with work to be carried out. Reroute, reinstall or replace existing electrical material that becomes necessary due to work carried out by this contract so a complete working electrical system will be retained in all areas affected by this installation.

1.4 WORK EXCLUDED

.1 The contract scope of work shall not include the following:

.1 Low voltage mechanical systems control wiring where indicated in electrical and mechanical specifications to be done by controls contractor shall be excluded from the electrical contractor work as noted.

.1 However, this works shall be included in the mechanical sub-contractors scope of work.

1.5 DRAWINGS AND SPECIFICATIONS

.1 The drawings and specifications compliment each other and what is called for by one is binding as if called for by both. If there is any doubt as to meaning or true intent due to a discrepancy between the electrical drawings and specifications, and all other contract documents, obtain written ruling from Consultant prior to tender closing. **Failing this, the most expensive alternative is to be allowed for.**

.2 The plans show the approximate location of outlets and apparatus but the right is reserved to make such changes in location as may be necessary to meet the emergencies of construction in any way. No extra will be allowed for such changes to any piece of electrical equipment unless the distance exceeds 3 metres, or if the relocation is required after initial installation is complete.

.3 It is imperative that the contractor visit the site and completely familiarize himself as to the work to be undertaken.

1.6 CODES AND STANDARDS

.1 All electrical work shall be carried out in accordance with the latest edition of the CEC C22.1 (Canadian Electrical Code) as amended and adopted by the Province of British Columbia and to the satisfaction of the Electrical Inspection Authority having jurisdiction, except where specified or specifically stated otherwise.

.2 All work shall be carried out in accordance with the British Columbia Building Code current edition (including all local amendments) to the satisfaction of local building inspector authority having jurisdiction.

.3 Any electrical material and/or equipment supplied by any contractor or sub-contractor for installation on this project must bear evidence of CSA approval or special CSA certification acceptable to the Chief Electrical Inspector for the Province of British Columbia.

1.7 CARE, OPERATION AND START-UP

.1 Instruct the Operating Personnel in the operation, care and maintenance of systems, system equipment and components.

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

.1 These services shall be provided for the generators and ATS systems.

.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.

1.8 VOLTAGE RATINGS

.1 Operating voltages: to CAN3-C235 latest edition.

.2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard. Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

1.9 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 all associated fees.

.3 Fees will cover all routine inspections by the Electrical Inspector. Any fees for follow-up inspections found to be necessary by the Electrical Inspectors as a result of incorrect work shall be borne by this contractor without any cost to the owner.

.4 Notify Consultant of changes required by Electrical Inspection Department prior to making changes.

.5 Furnish Certificates of Acceptance from Electrical Inspection Department or Authorities Having Jurisdiction on completion of work to Consultant.

.6 Submit to Electrical Inspection Department necessary number of drawings and specifications for examination and approval prior to commencement of work. Obtain electrical permit and pay associated fees.

.7 Consultant will provide drawings and specifications required by Electrical Inspection Department at no cost to the Contractor.

.8 Furnish to Consultant on completion of work Certificates of Acceptance from Electrical Inspection Department.

1.10 WASTE MANAGEMENT AND DISPOSAL

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

.2 Collect and separate for disposal: paper, plastic, polystyrene, corrugated

cardboard and packaging material in appropriate on-site bins for recycling.

.3 Divert unused metal and wiring materials from landfill to metal recycling facility approved by Consultant.

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

1.11 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.

1.12 CONDUIT AND CABLE INSTALLATION

.1 Install flashing and gooseneck assembly for all roof penetrations for running cables to serve roof mounted equipment.

.2 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.

.3 Any penetrations through exterior wall assemblies shall be adequately waterproofed.

.4 Any exposed conduit on the exterior of the building shall be Schedule 40 Rigid Galvanized Steel.

1.13 EXTRA WORK

.1 Any extra work ordered to be done shall be governed by this specification unless specific instructions or clauses are contained in the Change Order. In such cases, these instructions or clauses shall supersede those of the specification for this particular application only.

1.14 FIELD QUALITY CONTROL

.1 All electrical work to be carried out by qualified, licensed electricians or supervised 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 conducted.

.3 Conduct and pay for following tests:

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

.2 Circuits originating from branch distribution panels.

.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 350V with a 500V instrument.

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

.3 Check resistance to ground before energizing.

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

.7 Submit test results for Consultant's review.

1.15 CO-ORDINATION OF TRADES

.1 Consult with Construction Manager and all subtrades involved to confirm the location of the various outlets and equipment, and cooperate fully to ensure that no conflict arises during the installation.

.2 Special care shall be taken that equipment, outlets, junction boxes or pullboxes will not be obstructed by other structure, equipment, pipes or ducts installed under this general contract by other trades.

.3 Check drawings of all trades to verify space and headroom limitations for work to be installed. Coordinate work with all trades and make changes to facilitate a satisfactory installation. Make no deviations to the design intent involving extra cost to the Owner, without the Consultant’s written approval.

.4 The drawings indicate the general location and route to be followed by the electrical services. Where details are not shown on the drawings or only shown diagrammatically, the services shall be installed in such a way as to conserve head room and interfere as little as possible with the free use of space through which they pass. Service lines shall run parallel to building lines. All services in the ceiling shall be kept as tight as possible to beams or other limiting members at high level. All electrical services shall be coordinated in elevation to ensure that they are concealed in the ceiling or structural space provided unless detailed otherwise on drawings.

.5 Work out jointly all interference problems on the site and coordinate all work before fabricating, or installing any material or equipment. Where necessary, produce interference/coordination drawings showing exact locations of electrical systems or equipment within service areas, shafts and the ceiling space. Distribute copies of the final interference/coordination drawings to the Architect and the Consultant and all affected parties.

.6 Ensure that all materials and equipment fit into the allotted spaces and that all equipment can be properly serviced and replaced, if and when required. Advise the Consultant of space problems before installing any material or equipment. Demonstrate to the Consultant on completion of the work that all equipment installed can be properly, safely serviced and replaced, if and when required.

1.16 SUBSTITUTIONS

.1 Unless otherwise noted on the plans or specifications, substitutions may be approved by the Consultant if requested by the contractor or by

equipment suppliers, for items specified by the manufacturer's catalogue number.

.2 Requests for approval of such substitutions shall be submitted at least five (5) working days prior to the tender closing date.

.3 Complete description and data sheets of proposed substitution shall accompany the application and supplier must be prepared to submit samples for approval on short notice.

.4 Proposed substitutions must be at least of equal quality to that of the specified item. The manufacturer's specification of the specified item shall apply for comparison if no other clause of this specification applies. The decision of the Consultant to accept or reject shall be final.

.5 Off-the-shelf items such as standard boxes, EMT, which are specified by description only or indicated on the drawings, without any manufacturer, model, type or catalogue number, do not require approval prior to the tender closing date.

.6 Submit list of alternates used, within one week after acceptance of tender.

1.17 PROTECTION OF EQUIPMENT

.1 This contractor shall provide and ensure maximum protection of electrical equipment on the site. Electrical equipment, including existing electrical equipment, shall be kept clean and dry at all times and caution shall be taken to ensure no mechanical damage is done to the equipment. Equipment shall not be delivered to the site until it can be stored safely or placed in final position and the space is clean.

1.18 DAMAGES

.1 If the finish of electrical equipment is damaged either when received or during installation, have such equipment completely refinished and restored to its original condition at no cost to the owner.

.2 Irreparably damaged equipment shall be replaced at no cost to the owner.

1.19 SHOP DRAWINGS

.1 Submit shop drawings, product data and samples in accordance with the contract specifications.

.2 Shop drawings and product data shall indicate details of construction, dimensions, capacities, weights and electrical performance characteristics of equipment or material.

.3 Where applicable, include wiring, single line and schematic diagrams.

.4 Include wiring drawings or diagrams showing interconnection with work of other sections.

.5 Prior to manufacture of any item made specifically for this job, submit detailed drawings of the item through the Construction Manager.

.6 Shop drawings must be received by the Consultant at a date early enough to permit reasonable study prior to approval and manufacture, or to permit alterations where necessary. Late submissions of shop drawings will be sufficient reason for a stoppage of construction pending approval, or

removal and replacement of any unsatisfactory item at the contractor's expense.

.7 Shop drawings/product data content:

.1 Shop drawings submitted title sheet.

.2 Data shall be specific and technical.

.3 Identify each piece of equipment.

.4 Information shall include all schedule data.

.5 Advertising literature will be rejected.

.6 The project and equipment designations shall be identified on each document.

.7 The shop drawings/product data shall include:

.1 Dimensioned construction drawings with plans and sections showing size, arrangement and necessary clearances, with all equipment weights and mounting point loads.

.2 Mounting arrangements.

.3 Control explanation and internal wiring diagrams for packaged equipment.

.4 A written description of control sequences relating to the schematic diagrams.

1.20 CUTTING AND PATCHING

.1 This contractor is responsible for all cutting or blocking out required to install electrical equipment.

.2 If this contractor makes excessive cuts or does not coordinate work so that finished work requires cutting or patching, then this contractor shall pay for all patching to original condition.

.3 Any dispute resulting from this shall be referred to the Consultant for decision.

.4 Prior to any major cutting of walls or floor, review the proposed location, size and method with the Consultant. This includes notification when cutting or coring into any fire rated construction.

1.21 FIRESTOPPING

.1 Submit Product Data: Manufacturer's specifications and technical data for each material including the composition and limitations, documentation of ULC S115 or cUL firestop systems to be used and manufacturer's installation instructions.

.2 Submit material safety data sheets provided with product delivered to job-site.

.3 Engage an experienced Installer who is certified, licensed, or otherwise qualified by the firestopping manufacturer as having the necessary training to install manufacture’s products per specified requirements. A supplier’s willingness to sell its firestopping products to the Contractor or to an Installer engaged by the Contractor does not in itself confer qualification on the buyer.

.4 The work is to be installed by a contractor with at least one of the following qualifications:

.1 FM 4991 Approved Contractor

.2 UL Approved Contractor

.3 Hilti Accredited Fire Stop Specialty Contractor

.5 Installer shall have minimum 3 years of experience with fire stop installation.

.6 Seal all openings for conduit or sleeve penetrations in fire rated and smoke rated separations using approved materials.

.7 All block outs and access slots to be sealed using approved fire stopping assembly. Provide full details for all fire stopping applications as they relate to each application.

.8 Provide shop drawings for all fire stopping products, including assembly details as it relates to each application. Products shall be ULC approved as an assembly.

.9 Allow for the destructive testing of 10% of fire stopping applications. Should installations not conform to manufacturer's details, an additional 25% of installation will be destructively tested and should there be more failures, the contractor will be responsible to remove all fire stopping products and reinstall products correctly, at no additional cost to the owner.

1.22 PROTECTION OF EXPOSED LIVE EQUIPMENT

.1 Protect exposed live equipment during construction for personnel safety.

.2 Shield and mark live parts "LIVE 120 VOLTS", or with appropriate voltage.

.3 Arrange for installation of temporary doors for rooms containing electrical distribution equipment. Keep these doors locked except when under direct supervision of electrician.

1.23 SPRINKLER PROTECTION

.1 Provide drip covers or CSA Type 2 enclosure for all new surface mounted panelboards and cabinets in sprinklered rooms.

.2 Provide drip covers for all communications backboards in sprinklered rooms.

.3 Provide sprinkler covers for all communications racks in sprinklered rooms.

1.24 INSPECTIONS AND TESTS

.1 Notify the Consultant and authorities having jurisdiction at least five (5) working days in advance when the installations will be ready for inspection or testing.

.2 Test reports, signed by all attending authorities, shall be submitted to the Consultant through the General Contractor after successful completion of an inspection or test.

.3 Conduct all tests in a thorough and complete manner to the satisfaction of the Consultant and pay for any fees incurred to complete tests.

.4 Furnish the Consultant with a copy of Certificate of Inspection from B.C. Electrical Safety Branch indicating that all work has been satisfactorily completed and issued prior to final connection.

1.25 CLEAN UP

.1 Vacuum clean all new raceways and any electrical equipment. Ensure that no debris or spare parts are left in any electrical equipment.

.2 Any scrap material shall be removed from the site and disposed of by the Contractor.

.3 At time of final cleaning, clean lighting reflectors, lenses and other lighting surfaces that have been exposed to construction dust and dirt.

1.26 SURPLUS MATERIALS

.1 All material removed from existing site and not being reused in this contract shall be the property of the owner and delivered as directed by the owner's representative. Material as it becomes surplus shall be reviewed by the owner or owner's representative and that part considered of value to the owner shall be classed as surplus material, all other becomes scrap material, and shall be disposed of by the contractor.

1.27 SPARE PARTS

.1 This contract calls for spare parts or material. These are to be provided new in unopened cartons to the owner at the time of substantial completion of the contract.

.2 Provide spare parts as noted in the generator section.

.3 Obtain a signed receipt from the owner's representative for all these parts or materials and include a copy in the front of the maintenance manual. Without this receipt these items will be treated as a deficiency and the cost withheld at twice the estimated value by the Consultant.

1.28 SUBSTANTIAL PERFORMANCE

.1 Provide request to Consultant in writing that a Substantial Performance Inspection shall be carried out.

.2 Do not issue this written request until the following have been completed and/or submitted to Consultant:

.1 As-installed drawings (CAD files or Revit model) have been provided.

.2 All deficiencies noted during job inspections have been completed.

.3 Warranty Certificates have been provided.

.4 All systems have been tested and are ready for operation.

.5 All Inspection Certificates have been furnished including Final Electrical Inspection Certificate.

.6 The Owner's personnel have been instructed in the operation and maintenance of all systems.

.7 All equipment identification has been completed.

.8 The cleaning up is finished in all respects.

.9 All spare parts and replacement parts specified have been provided and receipt of same acknowledged.

.10 Copies of Seismic Consultant's Schedules B1, B2 and CB have been submitted.

.11 Fire Alarm System is verified and operational. Copy of Verification Report submitted to Consultant.

1.29 AS-BUILT DRAWINGS

.1 Obtain two (2) sets of white prints for the sole purpose of recording changes in installation as they occur. One (1) set is to be used in the field for day-to-day recording, and one (1) set for submittal after completion.

.2 These plans shall be kept up-to-date as changes occur and shall be available to be inspected by the Consultant.

.3 Arrange and pay for the incorporation of any "as-built" changes to reproducible plans and AutoCAD (Revit) disks. These changes shall be of similar quality of presentation as the original plans. NOTE: All plans whether requiring as-built changes or not, shall be included in this set.

.4 Should the contractor require the Electrical Consultant to prepare the as-built CAD drawings, the cost would be $350 per plan, unless excessive changes have been required. Costs associated with such excessive changes should be included with the change orders.

.5 These amended drawings shall be given to the Consultant at time of final inspections.

.6 "As-built" drawings shall include the location and circuit numbers of junction boxes in ceiling spaces, and all conduit placed in or under poured concrete. Note normal depth of conduits below top of concrete slab.

1.30 OPERATING AND MAINTENANCE MANUALS

.1 Submit **four sets** of operating and maintenance manuals for equipment or as requested by the general section of the contract. Include descriptive and technical data, all shop drawings, operating procedures, routine and preventative maintenance, wiring diagrams, spare parts lists, warranties, service companies, suppliers for replacement parts, test results, fire alarm certificate of verification, electrical inspection authority certificate and contract guarantee.

.2 Submit documentation in **green colored** heavy duty three ring binders, with lettering on spine identifying: "OPERATING AND MAINTENANCE MANUAL", project title and system names.

.3 Submit one copy for approval by Consultant prior to assembly of final sets.

.4 Submit one soft copy of maintenance manuals vie electronic file transfer or USB drive.

1.31 DEMONSTRATION OF SYSTEMS

.1 Instruct Consultant and operating personnel in the operation, care and maintenance of equipment.

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

.3 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with all aspects of its care and operation.

1.32 WARRANTY

.1 Within a period of one year from the date of final acceptance of work, replace or repair at own expense any defect in workmanship or material. Reused material shall be operating satisfactorily at the time of final acceptance but subsequent failures are not the responsibility of this contractor.

.2 Warranties for equipment having more than one year guarantee shall be made out to owner, and copies shall be provided in the maintenance manuals.

.3 Maintenance from manufacturer and contractor of all equipment shall be included for first year, including all lamps except incandescent.

1.33 PAINTING

.1 Arrange and pay for the painting of the devices noted in these specifications, in particular:

.1 exposed conduits and conduit fittings on the exterior of the building.

.2 Painting shall be to match colour and finish of adjacent walls, with at least two coats of sprayed enamel paint to the satisfaction of the Consultant and architect.

1.34 CO-ORDINATION OF PROTECTIVE DEVICES

.1 Provide a coordination/protective study and short circuit study of all equipment specified herein and submit for review.

.2 Include the following:

.1 347/600 and 120/208V panelboards, MCCs, emergency generator and switchgear, connecting feeder cables

.2 Generator overcurrent device, generator short circuit curves

.3 Any additional data necessary for successful completion of the coordination and short circuit study

.3 Data shall clearly state the operating time in cycles of each breaker and indicate whether the time current curves for relays are inclusive of breaker tripping times or otherwise.

.4 Prepare a summation chart showing all ratings and settings with easy reference to the appropriate curve.

.5 Symmetrical and asymmetrical fault current calculations shall be submitted to verify the correct choice of the protective elements of the system.

.6 Prepare a systems single line diagram on which the resultant short circuit values, device numbers and equipment ratings are shown.

.7 Include a list of recommended settings for each relay.

.8 Prepare an arc fault analysis including all labelling for equipment.

.1 Arc fault labels to indicate system voltage, fault level and PPE level required.

.9 Qualifications

.1 This study shall be provided by the supplier of the main switchboard.

.2 This study shall be performed by and bear the stamp and signature of a Professional Engineer registered in the Province of British Columbia.

.3 Relay style, CT ratios and fuse sizes have been selected on a preliminary basis for design purposes. Final selection shall be based on the results of this study and shall be included at no extra cost.

.10 Submittals

.1 Submit the complete study for review prior to carrying out calibration and verification.

.2 Submit typed results of coordination and short circuit study in maintenance manuals.

1.35 BUILDING MANAGEMENT SYSTEM INTERFACE

.1 The ATS system interface with the and Building Management System (BMS) is part of this contract. The division of work is as follows:

.1 The ATS shall have backnet IP compatibility.

.2 The Cat6 cabling will be provided by others. Electrical contractor shall be responsible

Part 2 Products

2.1 MANUFACTURERS AND CSA LABELS

.1 Visible and legible, after equipment is installed.

2.2 MATERIALS AND EQUIPMENT

.1 Equipment and material to be CSA certified. Where there is no alternative to supplying equipment which is not CSA certified, obtain special approval from Electrical Inspection Department.

.2 Factory assemble control panels and component assemblies.

2.3 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

.1 Supplier and installer responsibility is indicated in Motor, Control and Equipment Schedule on the electrical drawings and related mechanical responsibility is indicated on Mechanical Equipment Schedule.

.2 Control wiring and conduit is specified in Divisions 26 except for conduit, wiring and connections below 50 V which are related to control systems specified in Mechanical Specifications and shown on mechanical drawings.

2.4 WARNING SIGNS

.1 As specified and to meet the requirements of the BC Electrical Inspection Authority and the Consultant.

.2 Decal signs, minimum size 175mm x 250mm.

2.5 FINISHES

.1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.

.1 Paint outdoor electrical equipment "equipment green" finish to EEMAC Y1-1-1955.

.2 Paint indoor switchgear and distribution enclosures light grey to EEMAC 2Y-1-1958.

.2 Clean and touch up surfaces of shop-painted 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.

2.6 EQUIPMENT IDENTIFICATION

.1 Identify electrical equipment with [nameplates] [and] [labels] as follows:

.2 Nameplates:

.1 Lamicoid 3mm thick plastic engraving sheet, mechanically attached with self tapping screws.

.2 Nameplate colors shall be as follows:

.1 Normal power: Black face with white letters;

.2 Life safety emergency power: Red face with white letters;

.3 Standby power: Blue face with white letters.

.3 Nameplate sizes shall be as follows

Size 1	10 x 50 mm	1 line	3 mm high letters
Size 2	12 x 70 mm	1 line	5 mm high letters
Size 3	12 x 70 mm	2 lines	3 mm high letters
Size 4	20 x 90 mm	1 line	8 mm high letters
Size 5	20 x 90 mm	2 lines	5 mm high letters
Size 6	25 x 100 mm	1 line	12 mm high letters
Size 7	25 x 100 mm	2 lines	6 mm high letters

.3 Labels:

.1 Embossed plastic labels with 6mm high letters unless specified otherwise.

.4 Wording on nameplates and labels to be approved by 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: indicate equipment being controlled and voltage.

.9 Terminal cabinets and pull boxes: indicate system and voltage.

2.7 WIRING IDENTIFICATION

.1 Identify wiring with permanent indelible identifying markings, either numbered or coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.

.2 Maintain phase sequence and colour coding throughout.

.3 Colour code: to CSA C22.1.

.4 Use colour coded wires in communication cables, matched throughout system.

2.8 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.

Part 3 Execution

3.1 PROJECT CLOSEOUT REQUIREMENTS

.1 The following items are required for the Contractor to provide to the Electrical Consultant prior to releasing a Schedule C-B.

- .1 Final record drawings (as-built)
- .2 Maintenance manual
- .3 Warranty letter
- .4 System briefing to Owner
- .5 Electrical final from AHJ
- .6 Fire alarm verification
- .7 Fire stopping letter
- .8 Seismic restraint
- .9 Coordinated life safety system demonstration

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 This section specifies materials and installation for seismic restraint systems for electrical installations.

1.2 REGULATORY REQUIREMENTS

.1 Restraints shall meet the requirements of the latest edition of the British Columbia Building Code and amendments.

.2 The Seismic Engineer shall be able to provide a proof of professional insurance and the related practice credentials upon request, with a commitment to notify the Engineer of Record if there is any change to insurance.

.3 The Seismic Engineer shall be familiar with SMACNA, ECABC & NFPA guidelines as well as the BC Building Code requirements.

.4 The Contractors Seismic Engineer shall submit original signed BC Building Code “Letters of Assurance” “Schedules S-B and S-C” to the Electrical Consultant.

.5 The above requirements shall not restrict or supplant the requirements of any local bylaws, codes, or other certified agencies which may have jurisdiction over all or part of the installation.

1.3 SCOPE

.1 It is the responsibility of equipment manufacturers to design their equipment so that the strength and anchorage of internal components of the equipment exceeds the force level used to restrain and anchor the unit itself to the supporting structure.

.2 Manufacturer's shop drawings to be submitted with seismic information on equipment structure, bracing and internal components and as required by Division 01.

.3 Provide restraint on all equipment and machinery, which is part of the building electrical services and systems, to prevent injury or hazard to persons and equipment in and around the structure. Restrain all such equipment in its normal position in the event of an earthquake.

.4 The total electrical seismic restraint design and field review and inspection will be by a B.C. registered professional structural engineer who specializes in the restraint of building elements. Contractor to allow for coordination, provision of seismic restraints, as well as all costs for the services of the Seismic Restraint Engineer. This Engineer, herein referred to as the Seismic Engineer, will provide normal engineering functions as they pertain to seismic restraint of electrical installations.

.5 The Contractor shall be aware of, and comply with, all current seismic restraining requirements and make provision for those that may come into effect during construction of the project. Make proper allowance for such conditions in the tender.

.6 The Seismic Engineer shall provide detailed seismic restraint installation shop drawings to the Contractor. Copies of the shop drawings to be included in the final project manual.

.7 Provide seismic restraints on all equipment, and/or installations or assemblies, which are suspended, pendant, shelf mounted, freestanding and/or bolted to the building structure or support slabs.

.8 The Seismic Engineer shall provide inspections during and after installation. The Contractor shall correct any deficiencies noted without additional cost to the contract.

.9 Include all costs associated with the Seismic installation and certification in the base tender.

1.4 SHOP DRAWINGS & SUBMITTALS

.1 Submit shop drawings of all seismic restraint systems including details of attachment to the structure, either tested in an independent testing laboratory or approved by the seismic Engineer.

.2 Submit all the proposed types and locations of inserts or connection points to the building structure or support slabs. Follow the directions and recommendations of the Seismic Engineer.

Part 2 Execution

2.1 GENERAL

.1 All seismic restraints systems shall conform to local authority having jurisdiction and all applicable code requirements.

2.2 CONDUITS

.1 Provide restraint installation information and details on conduit and equipment as indicated below:

.2 Vertical Conduit:

.1 Attachment - Secure vertical conduit at sufficiently close intervals to keep the conduit in alignment and carry the weight of the conduits and wiring. Stacks shall be supported at their bases and, if over 2 stories in height, at each floor by approved metal floor clamps.

.2 At vertical conduit risers, wherever possible, support the weight of the riser, at a point or points above the center of gravity of the riser. Provide lateral guides at the top and bottom of the riser, and at intermediate points not to exceed 9.2 m (30 ft0 o.c.

.3 Riser joints shall be braced or stabilized between floors.

.3 Horizontal Conduits:

.1 Supports - Horizontal conduit shall be supported at sufficiently close intervals to keep it in alignment and prevent sagging.

.2 EMT tubing - tubing shall be supported at approximately 1.2 m (4 ft) intervals for tubing.

.4 Provide transverse bracing at 12.2 m (40 ft) intervals maximum unless otherwise noted. Provide bracing at all 90° bend assemblies, and pull box locations.

.5 Provide longitudinal bracing at 24.4 m (80 ft) intervals maximum unless otherwise noted.

.6 Do not brace conduit runs against each other. Use separate support and restraint system.

.7 Support all conduits in accordance with the capability of the pipe to resist seismic load requirements indicated.

.8 Trapeze hangers may be used. Provide flexible conduit connections where conduits pass through building seismic or expansion joints, or where rigidly supported conduits connect to equipment with vibration or seismic isolators.

.9 A conduit system shall not be braced to dissimilar parts of a building or two dissimilar building systems that may respond in a different mode during an earthquake. Examples: wall and a roof; solid concrete wall and a metal deck with lightweight concrete fill.

.10 Provide large enough conduit sleeves through walls or floors to allow for anticipated differential movements with firestopping where required.

.11 It is the responsibility of the contractor to ascertain that an appropriate size restraint device be selected for each individual piece of equipment. Submit details on shop drawings. Review with seismic Engineer and submit shop drawings to consultants for their reference.

2.3 FLOOR MOUNTED EQUIPMENT

.1 Bolt all equipment, e.g. transformers, switchgear, generators, motor control centres, free standing panelboards, control panels, capacitor banks, etc. to the structure. Design anchors and bolts for seismic force applied horizontally through the center of gravity to a seismic force of 0.5g. For equipment which may be subject to resonances, use a nominal 1.0 g seismic force.

.2 Provide flexible conduit connections between floor mounted equipment to be restrained and its adjacent associated electrical equipment.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 This section includes materials and installation for tested firestopping systems as follows:

.1 Penetrations for the passage of duct, cable, cable tray, conduit, piping, electrical busways and raceways through fire-rated separations.

1.2 REFERENCES

.1 Test Requirements: CAN/ULC-S115-05, "Fire Tests of Fire Stop Systems"

1.3 QUALITY ASSURANCE

.1 Contractor's certified installer, or manufacturer's direct installation trainer to assist with initial installation of firestop systems to ensure appropriate contractor system selection and installation procedures.

.2 Firestop System application, products and installation must meet requirements of a listed system in accordance with CAN/ULC-S115, tested to provide the appropriate fire (and temperature if applicable) rating for the penetrated assembly. Systems may be approved by any Standards Council of Canada approved testing agency.

1.4 SUBMITTALS

.1 Submit Product Data: Manufacturer's specifications and technical data for each material including the composition and limitations, documentation of ULC or cUL firestop systems to be used and manufacturer's installation instructions.

.2 Submit material safety data sheets provided with product delivered to job-site.

1.5 INSTALLER QUALIFICATIONS

.1 Engage an experienced Installer who is certified, licensed, or otherwise qualified by the firestopping manufacturer as having the necessary training to select and install manufacture's products per applicable requirements. A supplier's willingness to sell its firestopping products to the Contractor or to an Installer engaged by the Contractor does not in itself confer qualification on the buyer. Qualification should consist of training, successful completion of testing based on the Firestopping Contractors International Association Manual of Practice, and continuing education.

.2 The work is to be installed by a contractor with at least one of the following qualifications:

.1 ULC Qualified Firestop Contractor

.2 Hilti Accredited Fire Stop Specialty Contractor

.3 Nuco Accredited Fire Stop Installer

.4 Other approved manufacturer qualification program

.3 Installer shall have minimum 3 years of experience with fire stop installation. Contractor/installer to submit certificate demonstrating qualification with

the approved products listed above in addition to the list of qualifying projects. Contact the consultant if unclear, prior to tender close.

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Deliver materials undamaged in manufacturer's clearly labeled, unopened containers, identified with brand, type, and ULC or cUL label where applicable.

.2 Coordinate delivery of materials with scheduled installation date to allow minimum storage time at job-site.

.3 Store materials under cover and protect from weather and damage in compliance with manufacturer's requirements.

.4 Comply with recommended procedures, precautions or remedies described in material safety data sheets as applicable.

.5 Do not use damaged or expired materials.

1.7 PROJECT CONDITIONS

.1 Do not use materials that contain flammable solvents.

.2 Scheduling

.1 Schedule installation of other firestopping materials after completion of penetrating item installation but prior to covering or concealing of openings.

.3 Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding.

.4 Weather conditions: Do not proceed with installation of firestop materials when temperatures exceed the manufacturer's recommended limitations for installation printed on product label and product data sheet.

.5 During installation, provide masking and drop cloths to prevent firestopping materials from contaminating any adjacent surfaces.

Part 2 Products

2.1 FIRESTOPPING, GENERAL

.1 Provide firestopping composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the firestopping under conditions of service and application, as demonstrated by the firestopping manufacturer based on testing and field experience.

.2 Provide components for each firestopping system that are needed to install fill material. Use only components specified by the firestopping manufacturer and approved by the qualified testing agency for the designated fire-resistance-rated systems.

2.2 ACCEPTABLE MANUFACTURERS

.1 Hilti (Canada) Corporation

.2 Nuco

.3 3M

.4 Specified Fire Technologies (STI EZ-Path)

.5 Grace / Flamesafe

.6 Legrand (Flamestopper)

2.3 MATERIALS

.1 Use only firestop products that have been tested and approved for specific fire-rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire-rating involved for each separate instance.

Part 3 Execution

3.1 PREPARATION

.1 Verification of Conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.

.1 Verify penetrations are properly sized and in suitable condition for application of materials.

.2 Surfaces to which firestop materials will be applied shall be free of dirt, grease, oil, rust, laitance, release agents, water repellents, and any other substances that may affect proper adhesion.

.3 Provide masking and temporary covering to prevent soiling of adjacent surfaces by firestopping materials.

.4 Comply with manufacturer's recommendations for temperature and humidity conditions before, during and after installation of firestopping.

.5 Do not proceed until unsatisfactory conditions have been corrected.

3.2 COORDINATION

.1 Coordinate location and proper selection of cast-in-place Firestop Devices with trade responsible for the work. Ensure device is installed before placement of concrete.

.2 Responsible trade is to provide adequate spacing of field run pipes to allow for installation of cast-in-place firestop devices without interference.

3.3 INSTALLATION

.1 Regulatory Requirements: Install firestop materials in accordance with ULC Fire Resistance Directory or equivalent.

.2 Manufacturer's Instructions: Comply with manufacturer's instructions for installation of through-penetration and construction joint materials.

.1 Seal all holes or voids made by penetrations to ensure an air and water resistant seal.

.2 Consult with mechanical engineer, project manager, and damper manufacturer prior to installation of ULC firestop systems that might hamper the performance of fire dampers as it pertains to duct work.

.3 Protect materials from damage on surfaces subjected to traffic.

3.4 FIELD QUALITY CONTROL

.1 Examine sealed penetration areas to ensure proper installation before concealing or enclosing areas.

.2 Keep areas of work accessible until inspection by authority having jurisdiction.

.3 Inspection of through-penetration firestopping shall be performed in accordance with ASTM E 2174, “Standard Practice for On-Site Inspection of Installed Fire Stops” or other recognized standard.

.4 Perform under this section patching and repairing of firestopping caused by cutting or penetrating of existing firestop systems already installed by other trades.

3.5 IDENTIFICATION

.1 Identify through-penetration firestop systems with pressure-sensitive, self-adhesive, preprinted vinyl labels. Attach labels permanently to surfaces of penetrated construction on both sides of each firestop system installation where labels will be visible to anyone seeking to remove penetrating items or firestop systems. Include the following information on labels:

.1 The words: "Warning -Through Penetration Firestop System-Do Not Disturb. Notify Building Management of Any Damage."

.2 Contractor's Name, address, and phone number.

.3 Through-Penetration firestop system designation of applicable testing and inspecting agency.

.4 Date of Installation.

.5 Through-Penetration firestop system manufacturer's name.

.6 Installer's Name.

END OF SECTION

Part 1 General

1.1 SCOPE OF WORK

.1 Remove all redundant or abandoned electrical equipment, devices, wiring, cabling, raceways, wireways, and luminaires in those portions of the existing building or site that are being renovated or demolished. This shall include all electrical equipment outside the area of actual renovation or demolition that serves the renovated area, except breakers that become surplus in existing panels. These breakers shall be labeled as spares, unless specifically stated to be reused.

.2 The Electrical Division shall take note that the demolition and renovation will be done in an occupied building that is normally occupied during the day. Maintain electrical and communication systems as required to minimize services disruption.

.3 The Electrical Division shall also take note of the dust containment requirements as required.

.4 Electrical tender documents do not show all existing luminaires, wiring devices, conduit, boxes or wire. Conduit routing and wire grouping is not known. During demolition, the Electrical trade(s) are to deactivate all existing electrical and communication systems affected in such a manner that complete systems are not deactivated and system circuits affected in party wall partitions to be reactivated immediately on a temporary or permanent basis as site conditions dictate.

.5 Any discrepancies appearing on the drawings or in this specification are to be brought to the attention of the Consultant who will provide instruction.

.6 Where devices are not shown on the new plans in walls that are not being removed, such devices are to be reinstated and remain.

.7 **All** existing branch circuits for **existing panelboards** designated **"existing circuit"** as noted in Panelboard Schedules in specifications are to be tested and traced to source/termination point to confirm circuit is currently in use and in operation. **All existing unused redundant branch circuits wiring shall be completely removed and the related breakers labelled as "spare"**. Provide upgraded typed panel directories to the satisfaction of the Engineer.

.8 All surplus electrical equipment, devices, and luminaires shall be considered Owner's property. Determine from the Owner which materials are required to be retained, and transport and store such items at a location as directed by the Owner. All other surplus materials such as conduit, wiring, devices, etc. shall be removed from the site. Request a signed receipt for surplus material turned over to the Owner and provide a copy of same to engineer.

.9 Continuity of power and communication shall be maintained or restored promptly where services to other portions of a site are affected by renovation or demolition that is outlined on the electrical and mechanical plans or specifications.

.10 Remove and reinstall electrical equipment that becomes necessary due to renovation of architectural finishes or resurfacing. Include for extension rings, new junction boxes or outlet boxes, etc. to accommodate such changes.

.11 Where new receptacles, switches, or outlets are added to existing areas, replace the remainder of receptacles, switches, and outlets in that area to match new.

.12 Test all concrete slabs requiring cutting or coring by **x-ray testing** and opening a small sample area to obtain the depth of conduit runs. Avoid excessive cutting of slabs to depths that may interfere with existing conduits that are to be retained. Repair all damaged conduits and wiring that are to be retained. Allow for such repair in tender sum. The engineer may consider an extra if an unexpected large number of conduits are unavoidably damaged.

.13 When any cutting of walls, ceiling, or floor in electrical rooms is part of the contract **all** electrical equipment shall be sealed from dust. At completion of work the room and all electrical components shall be fully vacuumed out, except primary voltage gear (exceeding 750 volts). Primary gear shall be cleaned out if the project requires that the gear be de-energized. At time of cleaning, a visual check shall be made of all terminations, and any discolouring brought to the attention of the engineer.

.14 Wash and wipe clean all existing luminaires, reflectors, and lenses in areas adjacent to new renovation work.

1.2 RELATED SECTIONS

.1 Common Work Results – Electrical 26 05 00.

1.3 COMPLETENESS

.1 The electrical installation and reinstallation shall be carried out to present codes and to at least as good a workmanship level as the original.

.2 Test the completed installation to ensure all aspects are fully functional. Unless noted in writing to the Engineer before the work is commenced, all systems are assumed to function fully and correctly and must do so at completion of contract.

.3 All existing branch circuits made redundant by removals of branch circuit wiring as a result of renovation work are to be identified at the respective panelboards with the redundant breakers being labelled as “spare”.

1.4 ASBESTOS

.1 If during renovations / demolition, asbestos is discovered (or material suspected to be asbestos), all work in that area shall immediately cease and the Consultant advised.

1.5 PCB (POLYCHLORINATED BIPHENYLS)

.1 Carefully remove any electrical items containing PCB’s (eg light fixture ballasts) from equipment or fixtures to be renovated or demolished. Removed items (containing PCB’s) shall be catalogued and stored on site in approved labelled storage containers in accordance with regulations.

Part 2 Products

2.1 STANDARDS

.1 Refer to applicable material standards in other specification sections and/or as detailed on drawings.

Part 3 Execution

3.1 DEMOLITION

.1 Demolition shall be carried out in strict conformance to provincial, local and municipal authorities and Part 8 of the BC Building Code current edition.

.2 All redundant electrical components in the areas of demolition excluding those specifically identified in the following clauses shall become the property of the Electrical Division and shall be removed from site.

3.2 DISRUPTION TO OPERATIONS

.1 Contractor to issue a scheduled shutdown time and coordinate installation of the new equipment as appropriate. All equipment installed and modified requires testing before startup.

.2 Contractor to provide temporary connections to all required equipment for temporary power during the installation of any new equipment.

3.3 INTERRUPTION TO EXISTING SERVICES

.1 Circuit: power, voice/data, fire alarm, control etc. which are disrupted during demolition and are essential, shall be made good immediately. The Electrical Contractor shall identify these circuits to the Consultant. Specific tasks involving the demolition of essential circuits will require that the contractor obtain permission from the Owner before proceeding.

.2 Circuits disrupted by floor cutting or drilling (ie. buried cables) to be brought to the attention of the consultant. Obvious systems disturbed because due care and attention was not followed, shall be repaired immediately at no additional cost to owner.

.3 Where interruption of existing services is necessary as a part of the renovation, contractor must coordinate timing with base building maintenance 10 working days prior to interruption.

3.4 ABANDONED SERVICES

.1 All abandoned conduit and wire shall be removed and disposed of by the Electrical Contractor.

.2 Remove all accessible (eg. Surface) wiring and cables back to source.

.3 Remove abandoned outlets and raceway, even if in or behind drywall, where they are located behind millwork or in locations unsuitable for reuse i.e. not at standard heights for switches or outlets.

.4 All remaining circuits to be rerouted as required and suitably secured to the building structure.

.5 Any cabling, including voice/data wiring, presently resting on any suspended ceiling system to be removed as part of the renovation process and shall be neatly bundled, protected and permanently secured to building structure. No cabling is permitted to rest on the ceiling system.

3.5 FIRE ALARM SYSTEM

.1 Construction/demolition activities in existing building may require that select fire alarm devices are protected from construction dust, damage etc. Coordinate with the Owners representative as required to protect components of the fire alarm system to prevent nuisance operation and alarms.

.2 Provide, install and test temporary heat detectors in the area of construction where the construction area is not protected by an active supervised fire protection sprinkler system. The “construction” detectors shall be removed and discarded at the end of the project.

.3 Provide temporary replacement of smoke detectors with heat detectors including interim programming and testing and final re-verification where deemed necessary to minimize false alarms and to ensure other occupants of the building are protected.

.4 Maintain existing fire alarm system in areas under construction where practical. Relocate, rewire and provide interim connections as required while installing the new system to replace the existing. Provide temporary fire alarm devices and audible signals to suit any temporary exiting provisions.

.5 Contractor shall check in with the Owners representative at the start and end of each working day to confirm the fire alarm status in the area of work. Arrange for the related fire alarm zone card or area to be deactivated either to suit the progress of the work and/or where dust will be present on a day to day basis. Bag and protect fire detectors in dusty areas during construction. Remove any bagging at the end of the work day. Any existing detectors subject to construction dust shall be immediately vacuumed and marked to be replaced at the end of the project. Any fire alarm devices subject to moisture shall be replaced immediately.

.6 The fire alarm system is to be fully functional in the area of construction when the Contractor is neither on site nor after the Contractors normal work hours. (ie overnight, holidays, weekends).

.7 If the fire alarm system is not functioning when site is unoccupied, a fire watch shall be provided.

.8 Where project phasing requires multiple fire verification, the Electrical Contractor shall include this in the contract bid amount.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 This section specifies the materials and installation for wire and box connectors, rated to 1000V.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CAN/CSA-C22.2No.18 latest edition, Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware.

.2 CSA C22.2No.65 latest edition, Wire Connectors.

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

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

.3 National Electrical Manufacturers Association (NEMA)

Part 2 Products

2.1 MATERIALS

.1 Pressure type wire connectors to: CSA C22.2No.65, with current carrying parts of copper alloy sized to fit copper conductors as required.

.2 Fixture type splicing connectors to: CSA C22.2No.65, with current carrying parts of copper alloy 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 copper conductors.

.2 Clamp for stranded copper conductors.

.3 Stud clamp bolts.

.4 Bolts for copper conductors.

.5 Sized for conductors as indicated.

.4 Clamps or connectors for armoured cable and flexible conduit as required to: [CAN/CSA-C22.2No.18].

Part 3 Execution

3.1 INSTALLATION

.1 Remove insulation carefully from ends of conductors and:

.1 Apply coat of zinc joint compound on aluminum conductors prior to installation of connectors.

.2 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.

.3 Install fixture type connectors and tighten. Replace insulating cap.

.4 Install bushing stud connectors in accordance with NEMA guidelines.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 This section specifies copper, ACM alloy and aluminum conductors rated up to 1000 Volts and the most common electrical insulation and covering materials.

.2 This section does not include marine, hazardous, mining, instrumentation, communication and fire alarm wiring.

1.2 REFERENCES

.1 CAN/CSA C22.2 No .0.3 latest edition, Test Methods for Electrical Wires and Cables.

.2 CAN/CSA C22.2 No. 38-05, Thermoset Insulated Wires and Cables (Tri-National Standard, with UL 44 and ANCE NMX-J-451)

.3 CAN/CSA C22.2 No. 75-08 Thermoplastic Insulated Wires and Cables

.4 CAN/CSA C22.2 No 188-04 (R2009), Splicing Wire and Cable Connectors

.5 CAN/CSA C22.2 No. 203.1-94 (R2004) Manufactured Wiring Products

.6 CAN/CSA C22.2 No. 124-04 (R2009) Mineral Insulated Cable

Part 2 Products

2.1 GENERAL

.1 Building wiring: 98% conductivity copper conductors; size as indicated with 600V insulation, cross linked thermosetting polyethylene material rated RW90.

.1 Use RW90XLPE for interior installations

.2 Use RWU90XLPE for underground installations.

.2 All conductor sizes indicated on drawings are based on copper conductors unless otherwise noted.

.1 Aluminium conductors only permitted where approved in an addendum or where indicated on drawings and then only for feeder conductors larger than 100 A.

.3 Teck cable may only be used where specifically indicated on the drawings or in the specifications. Where permitted, Teck wiring to be PVC jacketed armoured cable, multi-copper conductor type Teck90 1000 volt having a PVC jacket with FT-4 flame spread rating.

.4 Provide all control wiring except HVAC controls as specified in Mechanical Divisions.

.1 Refer to Equipment Schedule(s) for detailed responsibilities.

.5 Non-metallic sheathed wiring is not to be used on this project.

.6 2-Hour Fire-Rated shall be compliant to CAN/ULC-S139 and CSA 38-95 (Draka Lifeline, Raychem RHW, or Shawflex). Cabling shall be low smoke halogen free. Conduit to be sized and installed as per manufacturers' requirements for these specialized cables and assemblies regardless of the size indicated on

drawings. Use this cable for life safety systems, including but not limited to the following:

.1 Between the generator and manual transfer switch

.2 Between the manual transfer switch and emergency distribution panel/automatic transfer switch.

.7

2.2 WIRING GUIDELINES

.1 Conductors:

.1 Stranded for 10 AWG and larger. Minimum size #12 AWG.

.2 Site services sub-circuits, including site lighting, to be minimum #10 AWG for power and #12 AWG for controls.

.3 For DC emergency lighting, minimum size #10 AWG and in compliance with equipment manufacturer.

.4 Increase wiring size for length and/or loaded circuits so that system will not exceed the maximum voltage drop as per the Canadian Electrical Code CSA 22.1 (latest edition).

.2 Conductors to be colour-coded. Conductors No.10 gauge and smaller shall have colour impregnated into insulation at time of manufacture. Conductors size No.8 gauge and larger may be colour-coded with adhesive colour coding tape, but only black insulated conductors shall be employed in this case, except for neutrals which shall be white wherever possible. Where colour-coding tape is utilized, it shall be applied for a minimum of 50 mm at terminations, junctions and pullboxes and conduit fittings. Conductors not to be painted.

.3 Computer Equipment Receptacles and other dedicated ground/dedicated neutral receptacles: Provide separate neutral and separate ground wires for every circuit; 12AWG minimum size for neutral wires or to match circuit conductor size if larger; minimum 12 AWG ground wires.

2.3 TECK CABLE

.1 Cable: to CAN/CSA-C22.2 No. 131 (latest edition).

.2 Conductors:

.1 Grounding conductor: copper.

.2 Circuit conductors: copper, size as indicated.

.3 Insulation:

.1 Type: ethylene propylene rubber.

.2 Chemically cross-linked thermosetting polyethylene rated type RW90, 600V.

.4 Inner jacket: polyvinyl chloride material.

.5 Armour: interlocking galvanized steel or aluminum.

.6 Overall covering: thermoplastic polyvinyl chloride material.

.7 Fastenings:

.1 One hole steel straps to secure surface cables 50 mm and smaller. Two hole steel straps for cables larger than 50 mm.

.2 Channel type supports for two or more cables at 1000 mm centers.

.3 Threaded rods: 6 mm dia. to support suspended channels.

.8 Connectors:

.1 Watertight approved for TECK cable.

2.4 MINERAL-INSULATED CABLES

.1 Conductors: solid bare soft-annealed copper, size as indicated.

.2 Insulation: compressed powdered magnesium oxide to form compact homogeneous mass throughout entire length of cable.

.3 Overall covering: annealed seamless copper sheath, Type M1 rated 600 V, 250°C.

.4 Outer jacket: PVC applied over sheath.

.5 Two hour fire rating.

.6 Connectors: as recommended by cable manufacturer.

.7 Termination kits: as recommend by manufacturer.

2.5 GENERAL CONNECTORS

.1 Pressure type connectors, fixture type splicing connectors, cable clamps, as required

.2 Connectors for conductors 4 AWG or larger: FCI/Burndy Hylug Type YA or acceptable alternate. Lugs using threaded type pressure connections will not be acceptable.

.3 Connectors for conductors up to and including 6 AWG: Scotchlok spring type

Part 3 Execution

3.1 INSTALLATION OF BUILDING WIRES

.1 Conductor length for parallel feeders must be identical.

.2 Lace or clip groups of feeder conductors at all distribution centres, pull boxes, wireways and other locations

.3 Lace wire and cable neatly in switchboards, panel boards, cabinets, wireways and other similar enclosures.

.4 Provide permanent plastic nametag indicating load fed in accordance with Section 26 05 00

.5 Follow manufacturer's recommended method of installation and ground at one end only for cables sized 1/0 or larger, for single conductor cables.

3.2 INSTALLATION OF TECK CABLE 0 -1000 V

.1 Install cables.

.1 Group cables wherever possible on channels.

.2 Secure TECK cables to Unistrut supports.

.1 Either provide new supports as required

.2 Or secure TECK cables to existing Unistrut supports. Seismic Engineer shall cover seismic anchorage and restraints of existing support system in Seismic Letters of Assurance.

.3 Terminate cables in accordance with Section 26 05 21 - Wire and Box Connectors - 0 - 1000 V.

3.3 INSTALLATION OF MINERAL-INSULATED CABLES

.1 Run cable concealed where possible, securely supported by straps.

.2 Support 2 h fire rated cables at 1m intervals.

.3 Make cable terminations by using factory-made kits.

.4 At cable terminations use thermoplastic sleeving over bare conductors.

.5 Secure TECK cables to Unistrut supports.

.1 Either provide new supports as required

.2 Or secure TECK cables to existing Unistrut supports. Seismic Engineer shall cover seismic anchorage and restraints of existing support system in Seismic Letters of Assurance.

.6 Do not splice cables.

3.4

3.5 COLOUR CODING SCHEDULE

.1 Colour code throughout the building, same colour for the same phase throughout, by insulation colour or permanently applied colour banding at all distribution panels and outlet boxes.

.2 Colours

.1 Equipment Grounding Conductor – Green

.2 Neutral Conductor – White

.3 Phase Wires – in accordance with CEC

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 This section specifies U shape support channels either surface mounted, suspended or set in poured concrete walls or ceilings; and general conduit supports.

Part 2 Products

2.1 SUPPORT CHANNELS

.1 U shape support channels:

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

.2 Suspended support systems, trapeze style for cable tray or conduit rack

.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.

.2 Conduit supports

.1 Single runs: Galvanized conduit straps or ringbolt type hangers

.2 Multiple runs: Conduit rack with 25% spare capacity

.3 Vertical runs: Channel support with conduit fittings/clamps

.4 Conduit rack: as above U-shape support channel with conduit fittings/clamps

Part 3 Execution

3.1 INSTALLATION

.1 Installation of U Shaped Support Channels:

.1 Secure equipment to surfaces with lead anchors or nylon shields as required.

.2 Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.

.3 Secure surface mounted equipment with twist clip fasteners to inverted T bar ceilings. Ensure that T bars are adequately supported to carry weight of equipment specified before installation. Provide additional support where required.

.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 steel straps to secure surface conduits and cables 50 mm and smaller.

.2 Two-hole steel straps for conduits and cables larger than 50 mm.

.3 Beam clamps to secure conduit to exposed steel work.

.6 Suspended support systems

.1 Support individual cable or conduit runs with threaded rods and spring clips

.2 Support 2 or more cables or conduits on channels supported by threaded rod hangers where direct fastening to building construction is impractical

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

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

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

.10 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Consultant.

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

.2 Support Spacing

.1 Spacings:

.1 Cable Tray: 2.4m o/c and at bends and Tee Fittings

.2 Conduit runs: Vertical and Vertical racks: 1.5m o/c

.3 Conduit runs: Horizontal and Horizontal racks: 1.5m o/c and at all changes in direction

.2 Where building structure, equipment details or mass dictate, spacings shall be closer

.3 General Installation

.1 Install above ceiling space in finished areas or to maintain head room in service areas, with neat mechanical appearance and to support equipment loads

.2 Do not secure equipment or supports from:

.1 Bottom of precast concrete tees

.2 Bottom of cast-in-place concrete pan webs

.3 From the edge of the cords of open web steel joist

.4 From suspended gypsum board ceilings

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 This section specifies materials and installation for splitters, junction boxes, pull boxes and cabinets.

1.2 PRODUCT DATA

.1 Product Data: submit manufacturer's product data sheets indicating dimensions, materials, and finishes, including classifications and certifications.

.2 Shop Drawings: submit shop drawings for custom manufactured items showing materials, finish, dimensions, accessories, layout, and installation details.

Part 2 Products

2.1 SPLITTERS

.1 Sheet metal enclosure, welded corners and formed hinged cover suitable for locking in 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 A.

2.2 JUNCTION AND PULL BOXES

.1 Welded steel construction with screw-on flat covers for surface mounting.

.2 Covers with 25 mm minimum extension all around, for flush-mounted pull and junction boxes.

2.3 CABINETS

.1 Sheet steel cabinet, with full length hinged door, latch, lock, 2 keys, containing 19 mm G1S fir plywood backboard (if required) for surface or flush mounting as required.

.2 Include filtered vents and/or fan-cooling when enclosed equipment is heat producing.

Part 3 Execution

3.1 SPLITTER INSTALLATION

.1 Install splitters and mount plumb, true and square to the building lines.

.2 Extend splitters full length of equipment arrangement except where indicated otherwise.

3.2 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 required.

.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.

3.3 IDENTIFICATION

.1 Provide equipment identification in accordance with Section 20 05 00 – Common Work Results - Electrical.

.2 Install size 2 identification labels indicating system name, voltage and phase, as appropriate to clearly indicate the enclosure use.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 This section specifies rigid and flexible fasteners, fittings and installation.

Part 2 Products

2.1 OUTLET AND CONDUIT BOXES – GENERAL

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

.2 102 mm square or larger outlet boxes as required for special devices.

.3 Gang boxes where wiring devices are grouped. Do not use sectional boxes.

.4 Blank cover plates for boxes without wiring devices.

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

2.2 SHEET STEEL OUTLET BOXES

.1 Electro-galvanized steel single and multi-gang device boxes for flush installation, minimum size 76 x 51 x 38 mm or as indicated.

.2 Larger 102 mm square x 54mm deep outlet boxes to be used for single gang when more than one conduit enters one side, or for flush mounting devices in finished plaster and/or tile walls. Provide raised device covers as required.

.3 For larger boxes use pre-ganged 102 mm high x 51 mm deep solid type as required. Allow extra gang for telecommunication outlets.

.4 Provide extension and plaster rings as required.

2.3 MASONRY BOXES

.1 Electro-galvanized steel masonry single and multi gang type shallow or deep boxes for devices flush mounted in exposed block walls, minimum 95 mm high x 63 mm deep.

2.4 CONCRETE BOXES

.1 Electro-galvanized sheet steel concrete type boxes for flush mount in concrete with matching extension and plaster rings as required.

2.5 SURFACE CONDUIT BOXES

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

2.6 FITTINGS – GENERAL

.1 Bushing and connectors with nylon insulated throats.

.2 Knock-out fillers to prevent entry of foreign materials.

.3 Conduit outlet bodies for conduit up to 35 mm. Use pull boxes for larger conduits.

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

Part 3 Execution

3.1 INSTALLATION

.1 Typical outlet box mounting heights are indicated in Section 26 05 00 or refer to wiring device and communication specification sections and to architectural layouts for particular mounting heights of outlet boxes where indicated.

.2 Support boxes independently of connecting conduits.

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

.4 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Reducing washers are not to be used.

.5 All outlet boxes to be flush mounted in all areas, excluding mechanical rooms, electrical rooms, and above removable ceilings.

.6 No sectional or handy boxes to be installed.

.7 Provide vapour barrier wrap or boots behind outlets mounted in exterior walls. Maintain integrity of the vapour barrier and insulation to prevent condensation through boxes.

.8 Separate outlets located immediately alongside one another to be mounted at exactly the same height above finished floor. Similarly, outlets mounted on a wall in the same general location at varying heights to be on the same vertical centre-line unless otherwise noted.

.9 Where outlet boxes penetrate an assembly with a fire-resistance rating (fire separation), ensure that the boxes are externally tightly fitted with an approved non-combustible material to prevent passage of smoke or flame in the event of a fire. Such boxes may not exceed 0.016 mm2 per NBCC 3.1.9.2.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 This section specifies rigid and flexible conduits, fasteners, fittings and installation.

1.2 REFERENCES

.1 Outlet Boxes, Conduit Boxes, and Fittings and Associated Hardware: to CSA C22.2 No. 18.

.2 Rigid metal conduit (RMC): to CSA C22.2 No. 45.

.3 Electrical metallic tubing (EMT): to CSA C22.2 No. 83.

.4 Flexible metal conduit (FMC): to CSA C22.2 No. 56.

1.3 BASIC WIRING METHODS

.1 Motors, transformers and all vibrating equipment:

.1 Short (600mm to 1200mm) PVC jacketed flexible conduit with liquid tight connectors shall be used. Allow sufficient slack to avoid strain on connectors at extreme extension of equipment movement.

.2 Surface raceways - interior:

.1 All surface raceways shall be EMT, except if located without protection in areas susceptible to damage, which shall be rigid steel conduit.

.3 Surface raceways - exterior:

.1 All surface raceways shall be Schedule 40 Rigid Galvanized Steel conduits.

1.4 LOCATION

.1 Electrical drawings are diagrammatic and do not show all conduits, wire, cable, etc. Electrical contractor to provide conduit, wire cable, etc., for a complete operating job to meet in all respects the intent of the drawings and specifications.

.2 All raceways and wiring shall be installed concealed in building fabric, except for mechanical and electrical rooms where they shall be installed on the surface.

.3 All junction boxes and other raceway access devices shall be mounted to avoid being visible from public areas. Obtain approval from Consultant for any and all junction boxes that, due to the building design, cannot be concealed.

.4 All junction boxes mounted, out of necessity, on surface of solid walls shall be painted to match adjacent surface, with junction boxes painted to match designated systems.

Part 2 Products

2.1 EMT RACEWAY

.1 Electrical Metallic Tubing (EMT) shall be galvanized steel of sufficient quality and thickness to allow smooth field formed bends.

.2 EMT couplings, connectors and fittings shall be steel. Cast type units shall not be used on this installation.

2.2 FLEXIBLE ELECTRIC NON-METALLIC (ENT) TUBING

.1 Flexible electrical non-metallic tubing (ENT) **shall not** be used on this project.

2.3 OUTLET BOXES AND JUNCTION BOXES

.1 Except as noted for rigid PVC raceways, all outlet boxes and junction boxes shall be one piece formed or welded.

.2 Outlet boxes to be galvanized steel.

.3 Junction boxes to be galvanized steel or aluminum.

2.4 ACCESS HATCHES

.1 Provide and install access hatches in drywall ceilings to access junction boxes. Coordinate with other trades and check locations with architect before installing.

.2 Access hatches shall have the following specifications:

.1 Door: aluminum frame with gypsum board inlay.

.2 Frame: Recessed aluminum

.3 Finish: to receive the same finish and paint as the surrounding surface.

.4 Hinge: concealed, non-corroding.

.5 Latch: flush screwdriver cam latch.

.3 Access hatches to be of a size to suit but not less than 305mm square.

2.5 CONDUIT FASTENINGS

.1 One hole steel straps to secure surface conduits 50 mm and smaller. Two hole steel straps for conduits larger than 50 mm.

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

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

.4 Threaded rods, 6 mm dia., to support suspended channels.

2.6 CONDUIT FITTINGS

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

.2 Factory "ells" where 90° bends are required for 25 mm and larger conduits.

.3 Watertight connectors and couplings for EMT in all exterior applications. Set-screws are not acceptable.

2.7 EXPANSION FITTING FOR RIGID CONDUIT

.1 Weatherproof expansion fittings with internal bonding assembly suitable for 100mm linear expansion.

.2 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm deflection in all directions.

.3 Weatherproof expansion fittings for linear expansion at entry to panel.

2.8 FISH CORD

.1 Polypropylene.

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 rigid galvanized steel threaded conduit except where specified otherwise.

.4 Use epoxy coated conduit underground corrosive areas.

.5 Use electrical metallic tubing (EMT) except in cast concrete and above 2.4 m not subject to mechanical injury.

.6 Use rigid pvc conduit underground, in corrosive areas, and surface mounted in wet areas not subject to damage.

.7 Use flexible metal conduit for connection to motors in dry areas, connection to recessed incandescent fixtures without a prewired outlet box, connection to surface or recessed fluorescent fixtures and work in movable metal partitions.

.8 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations.

.9 Use explosion proof flexible connection for connection to explosion proof motors.

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

.11 Minimum conduit size for lighting and power circuits: 19mm.

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

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

.14 Install fish cord in empty conduits.

.15 Run 2-25 mm spare conduits up to ceiling space and 2-25 mm spare conduits down to ceiling space from each flush panel. Terminate these conduits in junction boxes in ceiling space or in case of an exposed concrete slab, terminate each conduit in [flush concrete] [surface] type box.

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

.17 Dry conduits out before installing wire.

.18 Conduits shall be installed mechanically continuous from outlet to outlet and without pockets. All the necessary standard bushings, elbows and bends shall be provided. All conduit bends shall have a radius of not less than six (6) times the internal diameter of the conduit and in no case shall the equivalent of

more than four quarter bends from outlet to outlet be made. For all conduit sizes to be used for low voltage raceway, the conduits shall have a minimum bending radius of 230mm.

.19 Conduit bends shall be made with no more than 10% flattening of the conduit. Bends shall be smooth throughout deformations.

.20 On surface wall runs, all conduit shall be installed in true vertical or horizontal direction and on ceilings in true 90 degree angles or parallel to the walls. Crossings of conduits shall also be made at 90 degree angles. Parallel running conduit shall be kept on equal spacing on the entire length of run including bends.

.21 All conduits shall be fastened to structure with steel straps (no cast type straps allowed).

.22 Where more than three conduits are run parallel in ceiling cavity, they shall be installed on cantruss type channel, complete with all manufacturers fittings to secure channel to structure and to conduit.

.23 Raceways extending out concrete slabs shall be securely protected using rebar stubs or similar material. All duct stubs are to be kept sealed during construction

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 or surface channels.

.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.

3.3 CONCEALED CONDUITS

.1 Run parallel or perpendicular to building lines.

.2 Do not install horizontal runs in masonry walls.

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

3.4 FIRESTOPPING

.1 Apply ULC approved fire stopping assembly to all conduit penetrations passing through fire rated walls and floors.

.2 Provide shop drawings showing details for each type of application on the project. Shop drawings shall include catalogue data and installation details.

.3 For all communication sleeves accessible via ceilings or in stacked closets/rooms passing through floors, provide 2 hour rated STI EZ-PATH assembly. Where quantity is not indicated on plans, provide minimum two sleeves between each floor and each communication closet/room.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials for moulded-case circuit breakers

1.2 REFERENCES

.1 Canadian Standards Association (CSA International).

.1 CSA-C22.2 No. 5-[02], Moulded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, tenth edition, and the second edition of NMX-J-266-ANCE).

1.3 SUBMITTALS

.1 Include time-current characteristic curves for breakers with ampacity of 400 A and over or with interrupting capacity of 22,000 A symmetrical (rms) and over at system voltage.

Part 2 Products

2.1 BREAKERS GENERAL

.1 Moulded-case circuit breakers, to CSA C22.2 No. 5

.2 Bolt-on moulded case circuit breaker: quick- make, quick-break type, for manual and automatic operation.

.3 Common-trip breakers: with single handle for multi-pole applications.

.4 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting.

.5 Circuit breakers with interchangeable trips

.6 Circuit breakers to have minimum symmetrical rms interrupting capacity rating per drawings.

2.2 THERMAL MAGNETIC BREAKERS

.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.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Diesel engine driven generator sets above 600V from 250 to 750kVA.

1.2 REFERENCES

.1 American National Standards Institute (ANSI)/American Petroleum Institute (API)

.1 ANSI/API 650-1988(A2000), Welded Steel Tanks for Oil Storage Tenth Edition; Addendum 1.

.2 American National Standards Institute (ANSI)/National Electrical Manufacturers' Association (NEMA)

.1 ANSI/NEMA MG1-1998, Motors and Generators.

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-3.6-[2000], Regular Sulphur Diesel Fuel.

.4 International Organization for Standardization (ISO)

.1 ISO 3046-1-[2002], Reciprocating Internal Combustion Engines - Performance - Part 1: Declarations Of Power, Fuel And Lubricating Oil Consumptions, And Test Methods.

.5 National Electrical Manufacturers Association (NEMA)

.6 Underwriters' Laboratories of Canada (ULC)

.1 ULC-S601-[00], Standard for Shop Fabricated Steel Aboveground Horizontal Tanks for Flammable and Combustible Liquids.

.2 CAN/ULC-S603-[92], Standard for Steel Underground Tanks for Flammable and Combustible Liquids.

.7 Canadian Standards Association (CSA Group)

.1 CSA C22.1-18 Canadian Electrical Code

.2 CSA C282:19 Emergency electrical power supply for buildings

.3 CSA Z32-15 Electrical safety and essential electrical systems in health care facilities

1.3 SCOPE OF WORK

.1 The overall scope of work is to replace the existing generators at the new emergency generators rated as per drawings, diesel generator to backup the entire facility with emergency & standby power. The new generator shall be custom size to ensure it fits on the existing concrete pad within the existing generator room.

.2 It is the intent of this specification to secure an engine-driven generator set that has been prototype tested, factory built, production-tested, and site-tested together with all accessories necessary for a complete installation as shown on the plans and drawings and specified herein.

.3 The Generator shall come as a custom size complete with a custom sub-base fuel tank and critical grade silencer to fit within the existing generator room and meet all code required clearances. Refer to drawings for maximum generator height. **Suppliers must provide detailed shop drawings**

with exact dimensions and room layout to show that the generator fits within the room as a part of their tender submittal for the generator procurement.

.4 Any and all exceptions to the published specifications shall be subject to the approval of the Departmental Representative.

.5 The power system shall be furnished by a single manufacturer who shall be responsible for the design, coordination, and testing of the complete system. The entire system shall be built and installed as shown on the plans, drawings, and specifications herein.

.6 The equipment shall be produced by a manufacturer who has produced this type of equipment for a period of at least 10 years and who maintains a service organization available twenty-four hours a day throughout the year.

.7 Exterior located generator shall be complete with Level 2 sound attenuated enclosure. Enclosure shall be complete with block heater and battery heaters as required.

1.4 GENERAL REQUIREMENTS

.1 It is the intent of this specification to secure a generator set system that has been tested during design verification, in production, and at the final job site. The generator set will be a commercial design and will be complete with all of the necessary accessories for complete installation as shown on the plans, drawings, and specifications herein. The equipment supplied shall meet the requirements of the Canadian Electrical Code, CSA C282 .

.2 The generator manufacturer shall be a North American manufacturer and the generator system production and testing shall be done in North America. All equipment shall be new and of current production by a national firm that manufactures the generator sets and controls, transfer switches, and switchgear, and assembles the generator sets as a complete and coordinated system. There will be one-source responsibility for warranty, parts, and service through a local representative with factory-trained servicemen.

1.5 SYSTEM DESCRIPTION

.1 Generating system consists of:

.1 Diesel engine.
.2 Alternator.
.3 Alternator control panel.
.4 Battery charger and battery.
.5 Automatic engine enclosure ventilation system.
.6 Fuel supply system.
.7 Exhaust system.
.8 Custom Steel mounting base.
.9 Custom Sub-base fuel tank
.10 Hospital grade silencer.
.11 Weather proof level to enclosure for exterior generator

.2 System designed to operate as an unattended emergency standby unit.

1.6 SHOP DRAWINGS

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

.2 Include:

- .1 Engine: make and model, with performance curves.
- .2 Alternator: make and model.
- .3 Voltage regulator: make, model and type.
- .4 Manual bypass switch: make and model.
- .5 Battery: make, type and capacity.
- .6 Battery charger: make, type and model.
- .7 Alternator control panel: make and type of meters and controls.
- .8 Governor type and model.
- .9 Automatic engine enclosure ventilation system.
- .10 Cooling air requirements in m^3/s.
- .11 British standard or DIN rating of engine.
- .12 Flow diagrams for:
  - .1 Diesel fuel.
  - .2 Cooling air.
- .13 Dimensioned drawing showing complete generating set mounted on steel base, including vibration isolators, exhaust system, drip trays, sub-hose fuel tank and total weight.
- .14 Continuous full load output of set at 0.8PF lagging.
- .15 Description of set operation including:
  - .1 Automatic starting and transfer to load and back to normal power, including time in seconds from start of cranking until unit reaches rated voltage and frequency.
  - .2 Manual starting.
  - .3 Automatic shut down and alarm on:
    - .1 Overcranking.
    - .2 Overspeed.
    - .3 High engine temp.
    - .4 Low lube oil pressure.
    - .5 Short circuit.
    - .6 Alternator overvoltage.
    - .7 Lube oil high temperature.
    - .8 Over temperature on alternator.
  - .4 Manual remote emergency stop.
- .16 Weatherproof enclosure for exterior generator

1.7 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance data for diesel generator for incorporation into manual specified in Section 26 05 00 – Common Work Results - Electrical.

.2 Include in Operation and Maintenance Manual instructions for particular unit supplied and not general description of units manufactured by supplier and:

.1 Operation and maintenance instructions for engine, alternator, control panel, automatic transfer switch, manual bypass switch, battery charger, battery, fuel system, engine room ventilation system, exhaust system and accessories, to permit effective operation, maintenance and repair.

.2 Technical data:

.1 Illustrated parts lists with parts catalogue numbers.

.2 Schematic diagram of electrical controls.

.3 Flow diagrams for:

.1 Fuel system.

.2 Lubricating oil.

.3 Cooling system.

.4 Certified copy of factory test results.

.5 Maintenance and overhaul instructions and schedules.

.6 Precise details for adjustment and setting of time delay relays or sensing controls which require on site adjustment.

1.8 WARRANTY

.1 For Work of this Section, warranty period shall be extended to 60 months or 1500 operating hours, whichever occurs first. Parts and labour shall be covered in full during the full 5year warranty program.

.2 The warranty for the generator set shall guarantee against defective material and workmanship in accordance with the manufacturer's published warranty from date of startup.

.3 The generator set manufacturer and its distributor shall maintain a 24-hour parts and service organization. This organization shall regularly engage in maintenance contract programs to perform preventive maintenance and service on equipment similar to that specified. A service agreement shall be available and shall include system operation under simulated operating conditions; adjustment to the generator set, transfer switch, and switchgear controls as required, and certification in the owner's maintenance log of repairs made and function tests performed on all systems.

1.9 EXTRA MATERIALS

.1 Provide maintenance materials in accordance with the manufacturer’s recommendations.

.2 Include, at a minimum:

.1 2 sets fuel filter replacement elements and associated/required accessories.

.2 2 sets of lube oil filter replacement elements and associated/required accessories.

.3 2 sets of air cleaner filter elements and associated/required accessories.

.4 Any additional spare parts recommended by the manufacturer.

Part 2 Products

2.1 GENERATOR SYSTEM EQUIPMENT DETAILS

.1 The generators shall operating at 600 volts, 60 Hz, .8 power factor. The generator set shall be capable of a Standby 130°C rating while operating in an ambient condition of less than or equal to 27°C.

.2 The maximum width of the generator system, including the sub-base fuel tank and mounting base shall not exceed dimensions on drawings.

.3 The generator shall come with breakers to feed the building distribution and one spare for load bank connection. The breaker feeding building distribution shall be LSIG type. The load bank breaker shall have a shunt trip and shall be wired to trip the breaker if normal power fails during load testing.

.4 Motor starting performance and voltage dip determinations shall be based on the complete generator set. The generator set shall be capable of supplying 105 LRKVA for starting motor loads with a maximum instantaneous voltage dip of 30%, as measured by a digital RMS transient recorder in accordance with IEEE standard 115. Motor starting performance and voltage dip determination that does not account for all components affecting total voltage dip i.e. engine, alternator, voltage regulator and governor will not be acceptable. As such, the generator set shall be prototype tested to optimize and determine performance as a generator set system.

.5 Mason Seismic Vibration isolators shall be provided between the engine-alternator and heavy-duty steel base.

2.2 DIESEL ENGINE

.1 Diesel Engine: to ISO 3046-1.

.1 Engine: standard product of current manufacture, from company regularly engaged in production of such equipment.

.2 Naturally aspirated, synchronous speed 1800 r/min.

.3 Capacity:

.1 Rated continuous power in kW at rated speed, after adjustment for system losses in auxiliary equipment necessary for engine operation; to be calculated as follows: Rated continuous output = Generator kW divided by Generator efficiency at full load.

.1 Under following site conditions:

.1 Altitude: 150 m.

.2 Ambient temperature: -28 to +40 degrees C.

.3 Relative humidity: 80%.

.2 Engine overload capability 110% of continuous output for 1 hour within 12 hours period of continuous operation.

.4 Cooling System:

.1 Liquid cooled: heavy duty industrial radiator mounted on generating set base with engine driven pusher type fan to direct air through radiator from engine side, with ethylene glycol anti-freeze non-sludging above minus 46 degrees C.

.2 Air cooled: air cooling duct enveloping cylinder walls with pressure cooling by engine driven blower.

.3 To maintain manufacturer's recommended engine temperature range at 10% continuous overload in ambient temperature of 40 degrees C.

.4 Block heater: thermostatically controlled lube oil or liquid coolant heater connected to line side of automatic transfer switch to allow engine to start in room ambient minus 10 degrees C.

.1 Switch and fuse in heater circuit, mounted in engine-alternator control cubicle and fed from line side of automatic transfer switch.

.5 Fuel:

.1 Type A fuel oil: to CAN/CGSB-3.6.

.2 Arctic Grade 1: to CAN/CGSB-3.6.

.6 Fuel system: solid injection, mechanical fuel transfer pump with hand primer, fuel filters and air cleaner, fuel rack solenoid energized when engine running.

.7 Governor:

.1 Mechanical hydraulic with:

.1 Steady state speed band of plus or minus 0.5%.

.2 Speed regulation no load to full load 5% maximum.

.3 Electronic load sharing type, electric actuator, speed droop externally adjustable from isochronous to 5%, temperature compensated with steady state speed maintenance capability of plus or minus 0.25%.

.8 Lubrication system:

.1 Pressure lubricated by engine driven pump.

.2 Lube oil filter: replaceable, full flow type, removable without disconnecting piping.

.3 Lube oil cooler.

.4 Engine sump drain valve.

.5 Oil level dip-stick.

.9 Starting system:

.1 Positive shift, gear engaging starter 12 or 24V dc.

.2 Cranking limiter to provide 3 cranking periods of 10s duration, each separated by 5 s rest.

.3 Lead acid, 12 or 24V storage battery with sufficient capacity to crank engine for 1min at 0 degrees C without using more than 25% of ampere hour capacity.

.4 Battery charger : constant voltage, solid state, two stage from trickle charge at standby to boost charge after use. Regulation: plus or minus 1% output for plus or minus 10% input variation. Automatic boost for 6h every 30 days. Equipped with dc voltmeter, dc ammeter and on-off switch. Minimum charger capacity: 7 A.

.10 Vibration isolated engine instrument panel with:

.1 Lube oil pressure gauge.

.2 Lube oil temperature gauge.

.3 Lube oil level gauge.

.4 Coolant temperature gauge.

.5 Coolant level gauge.

.6 Running time meter: non-tamper type.

.11 Guards to protect personnel from hot and moving parts. Locate guards so that normal daily maintenance inspections can be undertaken without their removal.

2.3 ALTERNATOR

.1 Alternator: to ANSI/NEMA MG1.

.2 Rating: 600 V, 3 phase 4 wire, 60Hz, at 0.8PF.

.3 Output at 40 degrees C ambient:

.1 100% full load continuously.

.2 110% full load for 1h.

.3 150% full load for 1 min.

.4 Revolving field, brushless, single bearing.

.5 Drip proof.

.6 Amortisseur windings.

.7 Synchronous type.

.8 Dynamically balanced rotor permanently aligned to engine by flexible disc coupling.

.9 Exciter: rotating brushless.

.10 NEMA class H insulation on windings.

.11 Thermistors embedded in stator winding and connected to alternator control circuitry. Alternator temp to be displayed on generator control panel.

.12 Voltage regulator: thyristor-controlled rectifiers with phase-controlled sensing circuit:

.13 Alternator: capable of sustaining 300% rated current for period not less than 10s permitting selective tripping of down line protective devices when short circuit occurs.

2.4 CONTROL PANEL

.1 Totally enclosed, mounting base isolated from diesel generator.

.2 Instruments:

.1 Digital indicating type 2% accuracy, rectangular face, flush panel mounting:

.1 Voltmeter: ac, scale 0 to 750 V.

.2 Ammeter: ac, scale 0 to 1200 A.

.3 Wattmeter scale 0 to 750 kW.

.4 Frequency meter: scale 55 to 65Hz.

.5 kW.h meter.

.2 Voltmeter selector switch: Digital

.3 Ammeter selector switch: Digital

.4 Instrument Transformers

.1 Potential-dry type for indoor use:

.1 Ratio: 600 to 120.

.2 Rating: 600 V, 60Hz.

.2 Current-dry type for indoor use:

.1 Ratio: 600 to 5.

.2 Rating: 600 V, 60Hz.

.3 Positive action automatic short-circuiting device in secondary terminals.

.3 Controls:

.1 Engine start button.

.2 Selector switch: Off-Auto-Manual

.3 Engine emergency stop button and provision for remote emergency stop button.

.1 Alternator output breakers:

.1 Circuit breakers: 100% rated, LSIG bolt-on, moulded case, temperature compensated for 40 degrees C ambient, dual thermal-magnetic trip.

.2 Voltage control rheostat: mounted on inside of control panel.

.3 Operating lights, panel mounted:

.1 "Normal power" pilot light.

.2 "Emergency power" pilot light.

.3 Green pilot lights for breaker on and red pilot lights for breaker off.

.4 Solid state indicator lights for alarm with [1set] manually reset NO/NC contacts wired to terminal block for remote annunciation on:

.1 Low fuel level.

.2 Low battery voltage.

.3 Ventilation failure.

.4 Low coolant temperature.

.5 Low DC voltage.

.6 High DC voltage.

.7 Ground fault.

.8 Fuel leak.

.5 Solid state controller for automatic shutdown and alarms with 1set manually reset NO/NC contacts wired to terminal block for remote annunciation on:

.1 Engine overcrank.

.2 Engine overspeed.

.3 Engine high temperature.

.4 Engine low lube oil pressure.

.5 Short circuit.

.6 AC over voltage.

.7 Fail to crank.

.8 Emergency stop.

.6 Lamp test button.

.7 Provision for remote monitoring.

.8 The alarms and conditions for shut down indicated in items .4 and .5 shall be available on digital display panel on the control panel.

.9 The control system shall include time delay start and time delay stop functions. The time delay start shall be adjustable 0-300 seconds, factory set at 3 seconds. The time delay stop shall be adjustable 0-600 seconds, factory set at the manufacturer's recommended setting.

.10 The control system shall include sender failure monitoring logic for speed sensing, oil pressure and engine temperature and be capable of discriminating between failed sender or wiring components and an actual failure conditions.

.11 The control system to have data logging and display provision to allow logging of the last 10 warning or shutdown indications on the generator set as well as the total time of operation at various loads as a percent of the standby rating of the generator set.

.12 Three sets of NO/NC relays to be provided, one for common alarm one for the running condition one for low fuel condition.

.13 The controls shall include a load shed control, to operate a set of dry contacts when the generator is overload.

.14 Provide BACnet/BACnet-IP and other interface required in order to connect the generator control panel to the BMS in the Building. The BMS must be able to read all the monitoring and operation signals from genset. This contractor is responsible for all the conduit and wires to the BMS panel and coordinate with Division 15 for final connection.

2.5 STEEL MOUNTING BASE

.1 Complete generating set mounted on structural steel base of sufficient strength and rigidity to protect assembly from stress or strain during transportation, installation and under operating conditions on suitable level surface.

.2 Assembly fitted with vibration isolators and control console resiliently mounted.

.1 Mason Seismic isolators with adjustable side snubbers and adjustable for levelling. Installed between generator and base.

.3 Sound insulation pads for installation between isolators and concrete base.

.4 The generator set with base shall be customized to fit within existing generator room and meet the minimum 1m clearance requirements around generator for maintenance.

.5 Painting of hoses, clamps, wiring harnesses, and other non-metallic service parts shall not be acceptable. Fasteners used shall be corrosion resistant and designed to minimize marring of the painted surface when removed for normal installation of service work.

.6 The fueling tank and generator manufactured and assembled by the same manufacturer and must be available for inspection before delivery to the site.

2.6 EXHAUST SYSTEM

.1 Heavy duty (hospital grade), horizontally mounted exhaust silencer with flex, condensate drain, plug and flanged couplings.

.2 Heavy duty flexible exhaust pipe with flanged couplings as required.

.3 Fittings and accessories as required.

.4 Expansion joints: stainless steel, corrugated, of suitable length, to absorb both vertical and horizontal expansion.

.5 A factory-supplied hospital grade exhaust silencer shall be installed inside the room on site. Exhaust connections to the generator set shall be through seamless flexible connections.

2.7 WEATHERPROOF ENCLOSURE (FOR EXTERIOR UNIT ONLY)

.1 The generator set shall be provided with an outdoor weatherproof waterproof enclosure. The package shall comply with the requirements of the Canadian Electrical Code for all wiring materials and component spacing. The total assembly of generator set and enclosure shall be designed to be lifted into place using spreader bars. Housing shall provide ample airflow for generator set operation at rated load in an ambient temperature of 40 degrees C. The housing shall have hinged access doors as required to maintain easy access for all operating and service functions. All doors shall be lockable, and include retainers to hold the door open during service. Enclosure roof shall be cambered to prevent rainwater accumulation. Openings shall be screened to limit access of rodents into the enclosure. All electrical power and control interconnections shall be made within the perimeter of the enclosure.

.2 Painting of hoses, clamps, wiring harnesses, and other non-metallic service parts shall not be acceptable. Fasteners used shall be corrosion resistant, and designed to minimize marring of the painted surface when removed for normal installation of service work.

.3 Enclosure shall be constructed of minimum 12 gauge steel for framework and 14 gauge steel for panels. All hardware and hinges shall be stainless steel.

.4 A factory-mounted exhaust silencer shall be installed inside the enclosure. The exhaust shall exit the enclosure through a rain collar and terminate with a rain cap. Exhaust connections to the generator set shall be through seamless flexible connections.

.5 The enclosure shall include the following maintenance provisions:

.1 Flexible coolant and lubricating oil drain lines, that extend to the exterior of the enclosure, with internal drain valves.

.2 External radiator fill provision.

.6 The fueling tank and generator enclosure manufactured and assembled by the same manufacturer and must be available for inspection before delivery to the site.

2.8 FUEL SYSTEM

.1 Fuel storage tanks: Factory supplied, double-walled UL-142/ULCS601 listed sub-base fuel tank.

.1 Custom integrated sub-base tank sized to max. width of generator (48inches) and max. height (10-12inches) to meet clearance in generator room. The tank to be dual wall sub-base constructed with corrosion resistant steel. The tank shall be completed with drain tap and dip stick (mark in letters and inches) for manually checking the fuel level. The tank shall be completed with a locking (padlock) fuel fill cap and spiral type mechanical fuel gauge next to the fuel cap. The tank also complete with a float type leak detector between the inner and outer wall for detecting any inner wall rupture. The integrated sub-base fuel tank to be on painted steel structural steel support base frame complete with flexible supply and return hoses with connection fittings, fuel filter, vent line connection fittings and 110% containment capacity and accessories specified. Submit the size of tank based on calculated recommendation from manufacturer to consultant for approval. The fuel tank and all accessories to be waterproof.

.2 Factory installed leak detection of day tank and leak alarm kit.

.3 Four level float switch kit for connecting to fuel filling station and controls.

.4 High/Low level alarm kit wired to generator controller.

.5 Integral transfer pump.

2.9 COOLING AIR SYSTEM

.1 Engine ventilating system (by installer):

.1 Recirculating damper assembly with modulating motor.

.2 Cold air inlet damper assembly with modulating motor.

.3 Above noted dampers' actuators shall be hardwired to generator control panel for operation.

.4 Air discharge and intake hoods

.5 Modulating thermostat.

.6 Replaceable air intake filters.

2.10 EQUIPMENT IDENTIFICATION

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

.2 Control panel:

.1 Size 5 nameplates for controls including alternator breakers and program selector switch.

.2 Size 3 nameplates for meters, alarms, indicating lights and minor controls.

2.11 FABRICATION

.1 Shop assemble generating unit including:

.1 Base.

.2 Engine and radiator.

.3 Alternator.

.4 Control panel.

.5 Battery and charger.

2.12 FINISHES

.1 Apply finishes in accordance with Section 26 05 00 - Common Work Results - Electrical.

.2 Alternator control cubicle: paint inside, exterior to match engine and alternator.

.3 Exhaust and inlet air hoods international orange.

.4 Other ducts and racks grey.

.5 Supply 0.25L of touch-up enamel (appropriate colour).

2.13 SOURCE QUALITY CONTROL

.1 Certified summary of prototype unit test report. All representative models of completed generator set assemblies to have passed a rigorous fully documented and certified prototype test program. Manufacturers and/or venders of generator sets that do not have certified prototype test results are not acceptable.

.2 Factory test generator set including engine, alternator, control panels and accessories. Allow for virtual online meeting so Engineer can witness factory test via video conference. Final full factory test report shall be provided to engineer prior to shipping of generator.

.3 Test procedure:

.1 Prepare blank forms and check sheet with spaces to record data. At top of first sheet record:

.1 Date.

.2 Generator set serial no.

.3 Engine, make, model, serial no.

.4 Alternator, make, model, serial no.

.5 Voltage regulator, make and model.

.6 Rating of generator set, kW, kV.A, V, A, r/min, Hz.

.2 Mark check sheet and record data on forms in duplicate as test proceeds.

.3 Consultant Engineer signature on completed forms to indicate concurrence in results of test.

.4 Tests:

.1 With 100% rated load at .8pF, operate set for 6h, taking readings at 30 min intervals, and record following:

.1 Time of reading.

.2 Running time.

.3 Ambient temp in degrees C.

.4 Lube oil pressure in kPa.

.5 Lube oil temp in degrees C.

.6 Engine coolant temp in degrees C.

.7 Exhaust stack temp in degrees C.

.8 Alternator voltage: phase 1, 2, 3.

.9 Alternator current: phase 1, 2, 3.

.10 Power in kW.
.11 Frequency in Hz.
.12 Power Factor.
.13 Battery charger current in A.
.14 Battery voltage.
.15 Alternator cooling air outlet temp.

.2 At end of 5 hours run increase load to 110% rated value, and take readings every 15 min for 1 hour.

.3 After completion of 6 hours run, demonstrate following shut down devices and alarms:

.1 Overcranking.
.2 Overspeed.
.3 High engine temp.
.4 Low lube oil pressure.
.5 Short circuit.
.6 Alternator overvoltage.
.7 Low battery voltage, or no battery charge.
.8 Manual remote emergency stop.
.9 High alternator temperature.

.5 Demonstrate low oil pressure and high engine temperature shutdown devices operation without subjecting engine to these excesses.

Part 3 Execution

3.1 INSTALLATION

.1 Locate generating unit and install as indicated.
.2 Install fuel supply system as indicated.
.3 Complete wiring and interconnections as indicated.
.4 Start generating set, provide load bank and fuel and test to ensure correct performance of components.
.5 Provide power for charger from an emergency power panel.
.6 Provide connection and monitoring to Fire Alarm Panel and annunciator.
.7 Provide connection and monitoring to BMS.

3.2 FIELD QUALITY CONTROL

.1 Notify Engineer 10 working days in advance of test date.
.2 Provide fuel for testing and leave full tanks on acceptance.
.3 Demonstrate:

.1 Unit start, transfer to load, retransfer to normal power, unit shut down, on "Automatic" control.

.2 Unit start and shut down on "Manual" control

.3 Unit start and transfer on "Test" control.

.4 Unit start on "Engine start" control.

.5 Operation of manual bypass switch.

.6 Operation of automatic alarms and shut down devices.

.4 Perform 6 hours load testing of unit on full load to show load carrying ability, stability of voltage and frequency, and satisfactory performance of dampers in ventilating system to provide adequate engine cooling. Record following at 30 minute intervals during the entire test:

.1 Kilowatts

.2 Amperes

.3 Voltage

.4 Frequency

.5 Oil Pressure

.6 Coolant Temperature

.7 Room Temperature

.8 Noise level at 3m from unit

.5 Install continuous strip chart recorders to record frequency and voltage variations during load switching procedures. Each load change delayed until steady state conditions exist. Switching increments to include:

.1 No load to full load to no load.

.2 No load to 70% load to no load.

.3 No load to 20% load to no load.

.4 20% load to 40% load to no load.

.5 40% load to 60% load to no load.

.6 60% load to 80% load to no load.

.6 Record noise level measurements in dB at various locations around the unit and area surrounding the exhaust port.

.7 At end of test run, check battery voltage to demonstrate battery charger has returned battery to full charged state.

.8 After the demonstration, contractor/installer shall refill fuel tank.

.9 Testing of generators shall be done on site. Factory testing shall not be accepted.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 This section specifies materials and installation for automatic load transfer equipment which can monitor voltage on all phases of normal power supply, initiate cranking of standby generator unit, transfer loads and shut down standby unit when normal power is re-established.

.2 The Contractor shall furnish and install the low voltage automatic transfer switch having the ratings, features/accessories and enclosures as specified herein and as shown on the contract drawings.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C282 – Emergency Electrical power Supply for Buildings

.2 CSA C22.2 No.178- latest edition, Automatic Transfer Switches.

.3 CSA C22.2 No. 5.1 Moulded Case Circuit Breakers

1.3 SCOPE OF WORK

.1 Provide and install a breaker or contactor type, open transition automatic transfer switches with bypass isolation, and having the ratings, features/accessories and enclosures as shown on the drawings and as specified herein:

1.4 SYSTEM DESCRIPTION

.1 Automatic load transfer equipment to:

.1 Monitor voltage on phases of normal power supply.

.2 Initiate cranking of standby generator unit on normal power failure or abnormal voltage on any one phase below preset adjustable limits for adjustable period of time.

.3 Transfer load from normal supply to standby unit when standby unit reaches rated frequency and voltage pre-set adjustable limits.

.4 Transfer load from standby unit to normal power supply when normal power restored, confirmed by sensing of voltage on phases above adjustable pre-set limit for adjustable time period.

.5 Shut down standby unit after running unloaded to cool down using adjustable time delay relay.

1.5 SHOP DRAWINGS

.1 Submit shop drawings

.2 Include:

.1 Make, model and type.

.2 Load classification.

.3 Single line diagram showing controls and relays.

.4 Description of equipment operation including:

.1 Automatic starting and transfer to standby unit and back to normal power.
.2 Test control.
.3 Manual control.
.4 Automatic shutdown.

1.6 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance data for automatic load transfer equipment for incorporation into manual.
.2 Detailed instructions to permit effective operation, maintenance and repair.
.3 Technical data:
.1 Schematic diagram of components, controls and relays.
.2 Illustrated parts lists with parts catalogue numbers.
.3 Certified copy of factory test results.

Part 2 Products

2.1 MATERIALS

.1 Instrument transformers: to CAN3-C13.
.2 Contactors: to ANSI/NEMA ICS2.

2.2 CIRCUIT BREAKER TYPE TRANSFER EQUIPMENT (OPTION ONE)

.1 Circuit Breaker Type Transfer Equipment: to CSA C22.2No.5.
.2 Rated: per drawings
.1 Fault withstand rating: per drawings 3 cycles.
.2 One normal- three phase molded-case circuit breaker with thermal magnetic non automatic, mounted on common base, designed for double throw action, motor operated, mechanically held and interlocked, floor mounted enclosure.
.3 One emergency-three phase moulded-case circuit breaker with thermal magnetic trip, motor operated, and interlocked.
.4 Circuit breakers:
.1 Trip free in closed position.
.2 Interrupting rating: per drawings
.5 Dead front construction with access to relays and controls for inspection and maintenance, and manual operating lever for transfer switch.
.6 Main contacts - silver plated, protected by arc disruption means.
.7 Auxiliary contact: silver plated to initiate emergency generator start-up on failure of normal power.
.8 Solid neutral bar, fully rated.

2.3 CONTACTOR TYPE TRANSFER EQUIPMENT (OPTION TWO)

.1 Contact Type Transfer Equipment: to CSA C22.2No.178.

.2 Two- 3 phase contactors mounted on common frame, in double throw arrangement, mechanically and electrically interlocked, with CSA enclosure.

.3 Rated: 600V, 60Hz, 4 wire, solid neutral.

.4 Main contacts: silver surfaced, protected by arc disruption means.

.5 Switch and relay contacts, coils, spring and control elements accessible for inspection and maintenance from front of panel.

.6 Auxiliary contact: silver plated, to initiate emergency generator start-up on failure of normal power.

.7 Fault withstand rating: 25kA symmetrical for 3 cycles.

.8 Lever to operate switch manually when switch is isolated.

.9 Solid neutral bar, fully rating

2.4 CONTROLS

.1 Selector switch - four position "Test", "Auto", "Manual", "Engine start".

- .1 Test position - Normal power failure simulated. Engine starts and transfer takes place. Return switch to "Auto" to stop engine.
- .2 Auto position - Normal operation of transfer switch on failure of normal power; retransfers on return of normal voltage and shuts down engine.
- .3 Manual position - Transfer switch may be operated by manual handle but transfer switch will not operate automatically and engine will not start.
- .4 Engine start position - Engine starts but unit will not transfer unless normal power supply fails. Switch must be returned to "Auto" to stop engine.

.2 Control transformers: dry type with 120V secondary to isolate control circuits from:

- .1 Normal power supply.
- .2 Emergency power supply.

.3 Relays: continuous duty, industrial control type, with wiping action contacts rated 10 A minimum:

- .1 Voltage sensing: 3 phase for normal power and on one phase only for emergency, solid state type, adjustable drop out and pick up, close differential, 2V minimum undervoltage protection.
- .2 Time delay: normal power to standby, adjustable solid state, 0 to 60s.
- .3 Time delay on engine starting to override momentary power outages or dips, adjustable solid state, 0 to 60s delay.
- .4 Time delay on retransfer from standby to normal power, adjustable 0 to 60s.
- .5 Time delay for engine cool-off to permit standby set to run unloaded after retransfer to normal power, adjustable solid state, 20s intervals to 10 min.
- .6 Time delay during transfer to stop transfer action in neutral position to prevent fast transfer, adjustable, 5s intervals to 180s.

.7 Frequency sensing, to prevent transfer from normal power supply until frequency of standby unit reaches preset adjustable values.

.4 Solid state electronic in-phase monitor.

2.5 ACCESSORIES

.1 Pilot lights to indicate power availability normal and standby, switch position, green for normal, red for standby, mounted in panel.

.2 Plant exerciser: 168h timer to start standby unit once each week for selected interval but does not transfer load from normal supply. Timer adjustable 0-168h in 15 min intervals.

.3 Auxiliary relay to provide 2 N.O. and 2 N.C. contacts for remote alarms.

.4 Instruments:

.1 Digital true rms, indicating type 2] accuracy, flush panel mounting:

.1 Voltmeter: ac, scale 0 to 750V.

.2 Ammeter: ac, scale 0 to 1000A.

.3 Frequency meter: scale 55 to 65 Hz.

.5 Voltmeter selector switch: rotary, maintained contacts, panel mounting type, round notched handle, four position, labelled "OFF – Phase A – Phase B – Phase C".

.6 Potential transformers - dry type for indoor use:

.1 Ratio: 600 to 120.

.2 Rating: 600V, 60Hz.

.3 Accuracy rating: 5%.

.7 Ammeter selector switch: rotary, maintained contacts, panel mounting type, designed to prevent opening of current circuits, round notched handle, four position labelled "OFF - Phase A - Phase B - Phase C".

.8 Current transformers - dry type for indoor use:

.1 Ratio: 1000 to 5.

.2 Rating: 600 V, 60Hz.

.3 Accuracy rating: 5%.

.4 Positive action automatic short- circuiting device in secondary terminals.

.9 Manual bypass: YES.

2.6 EQUIPMENT IDENTIFICATION

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

.2 Control panel:

.1 For selector switch and manual switch: size4 nameplates.

.2 For meters, indicating lights, minor controls: size2 nameplates.

2.7 OPERATIONS

.1 The automatic transfer switches are to be continuous rated as per drawings for –

3 phase – 4 wire - 600V operation, and are to be compatible with new emergency generator.

.2 The automatic transfer switches shall include standard components and provide control to:

.1 Select through a switch “with load” or “without load” to test as follows:

.1 “Without load” the generator set runs unloaded.

.2 “With load” the automatic transfer switch transfers load to the generator set as if normal source interruption occurred.

.2 Monitor each ungrounded line with a calibrated dial adjustable voltage solid state sensors and sense a decrease of voltage below a set point or loss of voltage on any phase of the normal power supply. Voltage sensors shall be temperature compensated.

.3 Signal the engine generator set to start in the event of power interruption. A solid state time delay shall delay this signal three seconds to avoid nuisance start-ups on momentary voltage dips or power outages. The maximum 15 second reaction time permitted under CSA standard C282 shall include the three second start delay.

.4 Retransfer the load to the line after normal power restoration. A time delay shall delay this retransfer to avoid short term normal power restoration (variable one to five minutes, set at one minute).

.5 Provide an automatic retransfer of the load from generating set to normal source if the generating set output interrupts after normal source restores voltage.

.6 Signal the engine generator to stop after load retransfer to normal source. A solid state time delay on stop shall permit the engine to run unloaded to cool down before shutdown.

.7 Provide a device to electrically disconnect the control sections from the transfer switch for maintenance service during normal operation.

.3 Selected automatic transfer switch shall be included in a factory assembly with bypass-isolation switch equipment. The bypass-isolation switch shall provide a safe means for manually bypassing the transfer switch from either source (Normal or Emergency) to the load, while under load if necessary, and to isolate the transfer switch from both sources for maintenance or repair. Designs that bypass to only one source are not acceptable under this specification.

.1 Ratings:

.1 Bypass-isolation switch equipment shall be ULC Listed and CSA approved, manually operated with continuous current rating, voltage and frequency ratings, and withstand and closing ratings equal to the transfer switch ratings at the specified conditions of ambient temperature, humidity and altitude.

.2 Construction:

.1 The bypass-isolation and transfer switch shall be mechanically held in each position. Switching mechanisms shall be break before make on all poles. The switch mechanism shall be an over centre toggle device which provides stored energy contact operation during both opening and closing. The speed of

contact operation shall be independent of the force applied to the operating handles, which permits manual operation under load.

.3 Bypass Switch:

.1 Equipment shall provide manual bypass without load break to the source connected to the load by the transfer switch. Equipment requiring load break before bypass is not acceptable under this specification.

.2 Equipment shall provide for manual bypass operation to the source opposite that to which the transfer switch is connected. This shall cause the transfer switch to go automatically to a position disconnected from both sources.

.4 Interlocks:

.1 Positive mechanical interlocks shall prevent all possible source to source interconnections. Designs which depend on electrical interlocks to prevent source to source interconnections, or which intentionally interconnect the sources, are not acceptable.

.2 The interlock system shall assure a properly sequenced, mechanically guided bypass and isolation action.

.3 The equipment shall utilize automatic mechanical stops.

.4 Emergency generator supplier is to install automatic transfer switch, and make all necessary connections to facilitate a complete operational system, in conjunction with new emergency generator installation. Generator equipment supplier is to provide Consultant with written Verification Report complete with test results.

2.8 SOURCE QUALITY CONTROL

.1 Complete equipment, including transfer mechanism, controls, relays and accessories factory assembled and tested in presence of Consultant.

.2 Notify Consultant 10 days in advance of date of factory test.

.3 Tests:

.1 Operate equipment both mechanically and electrically to ensure proper performance.

.2 Check selector switch, in modes of operation Test, Auto, Manual, Engine Start and record results.

.3 Check voltage sensing and time delay relay settings.

.4 Check:

.1 Automatic starting and transfer of load on failure of normal power.

.2 Retransfer of load when normal power supply resumed.

.3 Automatic shutdown.

.4 In-phase monitor operation.

Part 3 Execution

3.1 INSTALLATION

.1 Locate, install and connect transfer equipment.

.2 Check relays, solid state monitors and adjust as required.

.3 Install and connect remote alarms.

3.2 FIELD QUALITY CONTROL

.1 Perform tests as follows:

.1 Energize transfer equipment from normal power supply.

.2 Set selector switch in "Test" position to ensure proper standby start, running, transfer, retransfer. Return selector switch to "Auto" position to ensure standby shuts down.

.3 Set selector switch in "Auto" position and open normal power supply disconnect. Standby should start, come up to rated voltage and frequency, and then load should transfer to standby. Allow to operate for 10min, then close main power supply disconnect. Load should transfer back to normal power supply and standby should shutdown.

.4 Repeat, at 1h intervals, 3 times, complete test with selector switch in each position, for each test.

END OF SECTION