



O'M Engineering

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ELECTRICAL SPECIFICATIONS

CITY OF COQUITLAM TOWN CENTRE FIRE HALL GENSET SPECS

**TOWN CENTRE FIRE HALL
1300 PINETREE Wy, COQUITLAM, BC V3B 7S4**

November 12, 2024

Project No.: 24-595

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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, 27, 28, 33, 34 and 48 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 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.
- .5 Comply with the requirements of the General Contract, and coordinate the installation with all other trades on site.

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 Emergency generator system
- .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 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.

1.5 CARE, OPERATION AND START-UP

- .1 Instruct and 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.
- .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.

1.6 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.

1.7 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 on completion of work to Consultant.



- .6 Consultant will provide drawings and specifications required by Electrical Inspection Department and Supply Authority at no cost to the Contractor.
- .7 Furnish to Consultant on completion of work Certificates of Acceptance from Electrical Inspection Department.

1.8 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with the Construction Waste Management Plan as established by the Construction Manager.
- .2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal: paper, plastic, polystyrene, corrugated cardboard and packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
- .4 Divert unused metal and wiring materials from landfill to metal recycling facility approved by Consultant.
- .5 Fold up metal banding, flatten and place in designated area for recycling.

1.9 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.

1.10 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 system including phasing, voltage, grounding and load balancing.
- .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.

1.11 SUBSTITUTIONS

- .1 Unless otherwise noted on the specifications, substitutions for the generator may be approved by the Consultant if requested by the contractor or equipment suppliers.
- .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 the proposed generator substitution shall accompany the application, and the supplier must be prepared to submit samples for approval on short notice.
- .4 Proposed generator substitutions must be at least of equal quality to that of the specified item. The manufacturer's specification of the specified generator 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 Submit list of alternates used, within one week after acceptance of tender.

1.12 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.

1.13 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.

1.14 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 Prior to manufacture of any item made specifically for this job, submit detailed drawings of the item through the Construction Manager.
- .4 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.

- .5 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.

1.15 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.

1.16 FIRESTOPPING

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

1.17 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.

1.18 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.

1.19 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.

1.20 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.

1.21 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 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.

1.22 SUBSTANTIAL PERFORMANCE

- .1 Do not issue this written request until the following have been completed and/or submitted to Consultant:
 - .1 Warranty Certificates have been provided.
 - .2 All systems have been tested and are ready for operation.



- .3 All Inspection Certificates have been furnished including Final Electrical Inspection Certificate.
- .4 The Owner's personnel have been instructed in the operation and maintenance of all systems.
- .5 All equipment identification has been completed.
- .6 The cleaning up is finished in all respects.

1.23 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.

1.24 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.

1.25 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.

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 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.

2.4 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 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.

2.5 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 *Identify equipment with Size 3 labels engraved "ASSET INVENTORY No. []"*. Number as and if directed by Consultant.
- .9 Disconnects, starters and contactors: indicate equipment being controlled and voltage.
- .10 Terminal cabinets and pull boxes: indicate system and voltage.
- .11 Transformers: indicate capacity, primary and secondary voltages.
- .12 Label all receptacles with branch circuit label indicating panel name and branch circuit number. Use brother P-Touch device or similar. Labels are to be white with black lettering.

2.6 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 [latest edition].
- .4 Use colour coded wires in communication cables, matched throughout system.

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 Maintenance manual
 - .2 Warranty letter
 - .3 System briefing to Owner
 - .4 Electrical final from AHJ

END OF SECTION



Part 1 General

1.1 SCOPE OF WORK

- .1 Remove the existing generator and install a new 100kW, 600A generator as specified.
- .2 Ensure continuity of electrical and communication systems during installation to minimize service disruption in the occupied building..
- .3 Follow dust containment requirements as outlined in architectural and general specifications to ensure the safety and cleanliness of the installation area..
- .4 Label all new equipment and control panels as per safety and operational requirements, with clear identification of power sources and circuit information..

1.2 PRODUCTS

- .1 Certain electrical equipment related to the generator may be retained or relocated as indicated on plans. Clean and refurbish this equipment as necessary to ensure proper operation.

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.

Part 2 Execution

2.1 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.

2.2 DISRUPTION TO OPERATIONS

- .1 Contractor to coordinate a scheduled shutdown time for the generator replacement and ensure testing before final startup.

2.3 INTERRUPTION TO EXISTING SERVICES

- .1 Coordinate with the Owner to ensure minimal disruption to existing services during the generator replacement process.

2.4 ABANDONED SERVICES

- .1 Remove any abandoned conduit and wiring related to the existing generator.

END OF SECTION



Part 1 General

1.1 SECTION INCLUDES

- .1 Diesel engine-driven generator sets, specifically 100kW, 3 phase, 120/208V, meeting electrical specifications and standards required for 600A service.

1.2 REFERENCES

- .1 American National Standards Institute (ANSI)/National Electrical Manufacturers' Association (NEMA):
 - .1 ANSI/API 650-[1988(A2000)], Welded Steel Tanks for Oil Storage Tenth Edition; Addendum 1.
 - .2 Canadian General Standards Board (CGSB)ANSI/NEMA MG1-[1998], Motors and Generators.
 - .1 CAN/CGSB 3.6 [2000], Regular Sulphur Diesel Fuel.
 - .3 International Organization for Standardization (ISO)
 - .1 ISO 3046-1-[2002], Reciprocating Internal Combustion Engines - Performance
 - .4 National Electrical Manufacturers Association (NEMA)
 - .5 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.

1.3 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 Steel mounting base.
 - .9 Sub-base fuel tank
- .2 System designed to operate as an unattended emergency standby unit.

1.4 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 Automatic engine enclosure ventilation system.
- .9 Cooling air requirements in m³/s.
- .10 Flow diagrams for:
 - .1 Diesel fuel.
 - .2 Cooling air.
- .11 Dimensioned drawing showing complete generating set mounted on steel base, including vibration isolators, exhaust system, drip trays, sub-hose fuel tank and total weight.
- .12 Continuous full load output of set at 0.8PF lagging.
- .13 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.

1.5 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.

1.6 EXTRA MATERIALS

- .1 Provide maintenance materials in accordance with the manufacturer's recommendations.
- .2 Include, at a minimum:
 - .1 2 fuel filter replacement elements.
 - .2 2 lube oil filter replacement elements.
 - .3 2 air cleaner filter elements.
 - .4 2 sets of fuses for control panel.
 - .5 Special tools for unit servicing.

Part 2 Products

2.1 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: 100 m.
 - .2 Ambient temperature: 40 degrees C.
 - .3 Relative humidity: 75%.
 - .2 Engine overload capability 110% of continuous output for 1 hour within 12 hours period of continuous operation.
 - .2 Cooling System:
 - .1 Air cooled: air cooling duct enveloping cylinder walls with pressure cooling by engine driven blower.



- .2 To maintain manufacturer's recommended engine temperature range at 10% continuous overload in ambient temperature of 40 degrees C.
- .3 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 system: solid injection, mechanical fuel transfer pump with hand primer, fuel filters and air cleaner, fuel rack solenoid energized when engine running.
- .6 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%.
- .7 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.
- .8 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.
- .9 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.
- .10 Guards to protect personnel from hot and moving parts. Locate guards so that normal daily maintenance inspections can be undertaken without their removal.
- .11 Drip tray.

2.2 ALTERNATOR

- .1 Alternator: to ANSI/NEMA MG1.
- .2 Rating: 208 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 Voltage regulator: thyristor controlled rectifiers with phase controlled sensing circuit:
 - .1 Stability: 30h% maximum voltage variation at any constant load from no load to full load.
 - .2 Regulation: 1.5% maximum voltage deviation between no-load steady state and full-load steady state.
- .10 Alternator: Permanent magnet generator capable of sustaining 300% rated current for period not less than 10s permitting selective tripping of down line protective devices when short circuit occurs.

2.3 CONTROL PANEL

- .1 Weatherproof 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 2200 A.
 - .3 Frequency meter: scale 55 to 65Hz.
 - .2 Voltmeter selector switch, rotary, panel mounting, round notched handle, four position, labelled "Off-Phase A-Phase B-Phase C".
 - .3 Ammeter selector switch, rotary, maintained contacts, panel mounting, designed to prevent opening of current circuits, round notched handle, four position labelled "OFF- Phase A-Phase B-Phase C".
 - .4 Instrument Transformers
 - .1 Potential-dry type for indoor use:



- .1 Ratio: 600 to 120.
- .2 Rating: 600 V, 60Hz, BIL 25 kV.
- .2 Current-dry type for indoor use:
 - .1 Ratio: 600 to 5.
 - .2 Rating: 600 V, 60Hz, BIL 25 kV.
 - .3 Positive action automatic short-circuiting device in secondary terminals.
- .3 Controls:
 - .1 Engine start button.
 - .2 Selector switch: Off-Auto-Manual - Test full load test no load.
 - .3 Engine emergency stop button and provision for remote emergency stop button.
 - .1 Alternator output breaker:
 - .1 Circuit breaker: 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 Synchronization and load sharing.
- .8 Provision for remote monitoring.
- .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 shall include an idle mode control which allows the engine to run in the idle mode in the Manual position only. In this mode, the alternator excitation system shall be disabled.
- .12 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.
- .13 Three sets of NO/NC relays to be provided, one for common alarm one for the running condition one for low fuel condition.
- .14 The controls shall include a load shed control, to operate a set of dry contacts when the generator is overload.
- .15 Provide Modbus 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.

2.4 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 Spring type isolators with adjustable side snubbers and adjustable for levelling.
- .3 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.

- .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.

2.5 EXHAUST SYSTEM

- .1 Heavy duty mounted exhaust silencer with 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.

2.6 FUEL SYSTEM

- .1 Fuel storage tanks: to ANSI/API 650, ULC labelled.
 - .1 Day tank integral to generator and capable of supplying generator for 24 hours minimum. 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.

2.7 COOLING AIR SYSTEM

- .1 Engine ventilating system:
 - .1 Recirculating damper assembly with modulating motor.
 - .2 Cold air inlet damper assembly with modulating motor.

2.8 EQUIPMENT IDENTIFICATION

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



- .1 Size [4] [5] nameplates for controls including alternator breakers and program selector switch.
- .2 Size [2] [3] nameplates for meters, alarms, indicating lights and minor controls.

2.9 FABRICATION

- .1 Shop assemble generating unit including:
 - .1 Base.
 - .2 Engine and radiator.
 - .3 Alternator.
 - .4 Control panel.
 - .5 Battery and charger.

2.10 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.

2.11 ACCEPTABLE SUPPLIERS

- .1 Finning (CAT)
- .2 Approved alternates.

Part 3 Execution

3.1 SOURCE QUALITY CONTROL

- .1 Factory test generator set including engine, alternator, control panels and accessories in presence of Consultant.
- .2 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's signature on completed forms to indicate concurrence in results of test.



- .3 Tests:
 - .1 With 100% rated load, operate set for 24 h, 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 23 hours run increase load to 110% rated value, and take readings every 15 min for 1 hour.
 - .3 After completion of 24 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.
 - .4 Next 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.



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

3.2 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 Reconnect power for charger from an emergency power panel.
- .6 Reconnect connection and monitoring to Fire Alarm Panel and annunciator.

3.3 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 Operation of manual bypass switch.
 - .4 Operation of automatic alarms and shut down devices.
- .4 Perform 4 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 Record noise level measurements in dB at various locations around the unit and area surrounding the exhaust port.
- .6 At end of test run, check battery voltage to demonstrate battery charger has returned battery to full charged state.

END OF SECTION

