



Technical Specifications for Diesel Generators 2500 KVA (Canopy/Containerized –Type)

1. SCOPE

This specification details the minimum technical requirements for furnishing all labour, materials and services required for the supplying, installation and commissioning of three canopy generators at the substations:

1. East Honiara Substation
2. Honiara Substation
3. White River Substation

This specification covers the generator installation, cabling with existing circuits, testing and commissioning of the generators onto grid. The materials specified in the various clauses of this Specification represent the Purchaser's minimum requirements. All work, including design, supply of all materials (including generators and connection accessories), fabrication, and installation within this specification shall be carried out by the supplier unless otherwise specified or in event supplier unable to do installation, Solomon Power may make the decision to engage a suitable reputable contractor to perform the installations works on behalf of the supplier.

2. Description

The generator units will be supplied in a complete enclosure and comprises all necessary components necessary for the safe operation of the generators.

3. Inclusions

The supplier's responsibilities include:

- Perform assessment of the points of connections on the grid as determined by Solomon Power and make appropriate recommendation to ensure addition of the generators do not jeopardize network normal functions and operations
- Transporting the generators to nominated project sites
- Installation of generators onsite including all necessary wiring works both primary and secondary cabling and wirings;
- Testing and commissioning of the entire project, to ensure system is fully function as expected by client
- Provide technical support to Solomon Power for the first 24 months of delivery of the project
- Quality assurance of the above to ensure accuracy includes to Point to point checks and wiring checks. The checked connections/wiring shall be highlighted on drawings and all corrections added or deleted as agreed with Solomon Power and Contractor or supplier.



4. Standards and Specifications

4.1 General requirements

The containerized generator unit shall be in accordance with applicable codes, standards, specifications, datasheets and regulations outlined in this specification. This specification shall not relieve the Supplier of any responsibility to provide equipment and/or services that are suitable for the intended duty.

The Supplier shall:

- Ensure that all equipment within this scope is suitable for the service conditions;
- Supply fully comprehensive documentation for site assembly/installation and testing/commissioning and to ensure satisfactory operation, maintenance and troubleshooting, for all equipment provided; and
- Ensure all documentation, correspondences, drawings, etc. are in a legible language.

4.2 Codes and Standards

Particular standards and regulations relevant to the work include but are not limited as follows:

- ISO8528-2 and ISO 3046) as minimum requirements
- AS/NZS 3010:2005 Electrical installations – Generating sets
- AS/NZS 3000 Electrical Installations (known as the Australian/New Zealand Wiring Rules)
- AS/NZS 3008 Electrical Installation – Selection of Cables – for Alternating Voltages up to and including 0.6/1kV
- AS/NZS 5000.1:2005 Electric Cables – Polymeric Insulated, Part 1: For Working Voltages Up To and Including 0.6/1 (1.2) kV
- AS 1319 Safety Signs for the Occupational Environment
- AS 1939 Degrees of Protection provided by Enclosures for Electrical Equipment (IP codes)
- NFPA 850: Recommended Practice for Fire Protection for Electric Generating Plants and High Voltage Direct Current Converter Stations, 2000 Edition.
- AS/NZS ISO 9001:2008 Quality Management Systems - Requirements

5.0 Generator Specifications

The technical requirements for three (3) units of Diesel engine drives electric alternators, housed in a sound and weather proof canopy with the specifications depicted below.

Generator rating	kVA	2500	Line Voltage	415 V +/-5%	Frequency	50 hz
	kW	2000	Phase Voltage	240 V +/-5%	Pf	0.8
Duty	Continuous		Synch Speed	1500 RPM	Phase	3
System type	4 wire					
Voltage Regulation						
Voltage level adjustment: +/-				5 %		
Voltage regulation steady state: +/-				0.5%		
Voltage regulation with 3% speed change: +/-				0.5%		



Waveform deviation line-line no load: Less than	3%
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5.1 Applications

All units are intended to supply the substation feeders operating at the voltage level of 11 kV system. The supplier shall provide evidence that similar equipment has been supplied and given satisfactory service. A list indicating the places where such equipment is being in operation shall be provided.

The supplier will need to include supply and install step-up transformers 0.415kV/11kV, cables, and related accessories with sufficient protection of the unit as part of the submission.

5.2 Sites conditions

The generators will be work at operation conditions as follows:

- a) High humid temperature sites more than 40°C
- b) High salinity level sites
- c) Vicinity close to residential

De-rating tables and curves for electric power generator sets shall be supplied by the supplier.

5.3 Documentations supplied with offer:

The following information shall be provided by supplier:

- Generator set photographs (suitable size) of all sides.
- Genset Technical Data, design and performance, specifications (tabulated data that identifies make, model and country of origin as attachment) for the following:
 - 1) Engine (Including its relevant components).
 - 2) Alternator (Including its relevant components).
 - 3) Control panel (Including its relevant components).
 - 4) Auxiliary components:
 - a) Electrical charger.
 - b) genset circuit breaker etc.
 - c) Starter components.
 - d) Solenoid.
 - e) Exhaust system.
 - f) DC system all components



- Drawings - General dimensions' drawings showing overall generator set measurements, mounting location, and interconnect points for load leads, fuel, exhaust, cooling and drain lines etc.
- All Wiring and schematic drawing showing detailed circuits.

5.4 Warranty Statements

All Gensets shall be under two years on-site comprehensive warranty support from the date of installation or 24 months from date of delivery whichever is earlier at the site. All Genset parts shall be covered during warranty period for replace and repair any part in genset from any damage or any fault may occur during warranty period. And quality assurance certificate (ISO) should be provided.

Service - Location and description of supplier parts and services are to be provided for continuing maintenance of the units to remain operational.

5.5 Training

- The supplier shall provide training for client operational team on site covering theory and practical aspect of the generators

6. Diesel Engine Specifications.

No	Component Name	Required Specifications
6-1	Cooling System	Water cooled with fan and radiator
6-2	Radiator	The radiator shall be Heavy duty with fan. Corrosion resistance <i>(provide technical details)</i> .
6-3	Maximum Output	The Maximum engine prime power duty rated shall be not more than the power required by the alternator (2500 KVA prime power)
6-4	Speed	1500 RPM
6-5	Overload Capacity	The engine should be capable of providing 10% overload for 1 hour for every 12 hour continuous running at full load
6-6	Silencer	Residential type with exhaust piping with vibration isolators, thermal insulation for exhaust line with glass wool, aluminum sheet. <i>(Provide technical details)</i> .



<p>6-7</p>	<p>Starting System</p>	<ul style="list-style-type: none"> ▪ <u>Electromagnetic solenoid switch:</u> it shall supply the required current to the starter motor and pull in and pull out pinion drive. ▪ <u>Starter motor:</u> 24 VDC, it shall have clutch for normal and abnormal operation. ▪ <u>Battery:</u> the battery shall be free maintenance, of known manufacture, sufficient to supply starting and control circuit.
<p>6-8</p>	<p>Air Filter</p>	<p>Dry type air filter, heavy duty type with replaceable elements shall be provided Efficiency of the system as also at various stages shall be furnished.</p>
<p>6-9</p>	<p>Lubrication System</p>	<p>Full pressure lubricating oil system, including an oil cooler, is to be fitted. Oil pre-heating is required. The Oil shall be drained through external hose-pipe – preferred plug type. <i>The supplier shall indicate the frequent of changing oil.</i></p>
<p>6-10</p>	<p>Flexible Coupling</p>	<p>A heavy duty flexible block coupling shall be fitted between the engine and the alternator to absorb the transmission of shock loads. <u>Details should be offered by the supplier</u></p>
<p>6-11</p>	<p>Engine Protective Devices</p>	<p>The engine shall be equipped with protective devices to provide warning and automatic shut-down under the following conditions:</p> <ul style="list-style-type: none"> a) Low Lubricating Oil Pressure - (W+SD) b) High Engine Temperature -(W+SD) c) High Oil Temperature -(W) d) Low Radiator Water Level (Preferred) -(W) e) Fail to Start -(W+SD) f) Over Speed/Under Speed -(W+SD) g) Low Battery Voltage -(W) <p>1) The engine shall be equipped with an oil pressure and temperature detectors. Analogue is preferred or equivalent.</p> <p>2) The engine shall be fitted with an oil pressure and Temperature sensors that shall be extended to the controller.</p>



7. Alternator Specifications

S. No	Component Name	Required Specifications
7-1	Alternator	<p><u>General</u></p> <ol style="list-style-type: none"> 1) The alternator shall be three phases, 0.8 PF (lagging), four wires, 415/240V +/- 5% with a frequency of 50 Hz, star connected. 2) The alternator shall be screen protected, drip-proof, self-regulating, self-exciting, Brushless, salient pole type and directly coupled to the engine.
7-2	Excitation System	<p>Permanent magnet (PMG) in exciter field is preferred (for fast voltage build up both after a short circuit and also after a long time of inactivity). Self-excitation is acceptable, <i>if it gives</i> fast voltage build up both after a short circuit and also after a long time of inactivity. The main exciter Shall be protected against surge voltage.</p> <p><u>The auxiliary exciter technique shall be described in full details by the supplier</u></p>
7-2	Automatic Voltage Regulation (AVR)	<ol style="list-style-type: none"> 1) The alternator shall be AVR controlled. 2) The AVR shall be mounted in the connection box of alternator and all components must be accessible and replaceable. 3) The automatic voltage regulator (AVR) shall be of three phase sensing electronic type with accuracy regulation not more than $\pm 1\%$. 4) The voltage shall be maintained to within $\pm 5\%$ of nominal over the range from no-load to full-load, at unity and 0.8 P.F lag whatever be the alternator temperature. 5) The AVR shall be protected against failure due to low speed operation, over excitation, overvoltage and any abnormal conditions. 6) <u>The full technical data with schematic diagram for A.V.R shall be provided.</u>



<p>7-3</p>	<p><i>Overload and Short Circuits</i></p>	<ol style="list-style-type: none"> 1. The overload characteristic should be able to handle 110% of rated power continuously for at least one hour every 12 hours. 2. Alternator shall withstand all type of short circuits without any damage with full protection against abnormal conditions. 3. The alternator and voltage regulator components shall be protected against voltage transients induced by switching or lightning surges. 4. <u>All protections shall be in details by the supplier</u>
<p>7-4</p>	<p><i>Recommended Makes Of Alternator</i></p>	<p>LEROY SOMER / STAMFORD or equivalent.</p>
<p>7-5</p>	<p><i>Sensing Dangerous Condition</i></p>	<p>Sensing electrical conditions which might cause damages to the generator e.g. high and low output voltages and frequency and sudden severe phase unbalance.</p> <p>In such circumstances and any fault electric problem the control equipment shall immediately isolate the generator from the load, stop the diesel engine and raise an alarm.</p>

8. Generator Control Panel

No	Component Name	Required Specifications
<p>8-1</p>	<p><i>Control and display unit - Controller</i></p>	<p>The control module shall stand the dip in voltage during starting processes, and shall be isolated by external switch. The control module shall program and perform the following operations:</p> <ol style="list-style-type: none"> 1) Auto operation mode 2) Manual operation mode 3) Test operation mode 4) Off Mode <p><i>All the above modes shall be selected via soft pressing keys.</i></p> <ol style="list-style-type: none"> 5) Synch check capabilities for: <ol style="list-style-type: none"> a. Close on LIVE bus b. Close on DEAD bus <p><i>The control system should be capable/ready to interconnect to existing SCADA systems</i></p>



<p>8-2</p>	<p>Control and display unit - Controller</p>	<ul style="list-style-type: none"> • <u>Digital instruments (measuring and display):</u> <ol style="list-style-type: none"> 1) AC (line – line / line – neutral) Voltage values monitoring, display. 2) AC Current per phase values monitoring, display. 3) KVA, KW/phase and total, kWh and Power factor. 4) Frequency and speed values monitoring, display. 5) Running hours for the generator set. 6) Battery DC voltage, display. 7) Battery charging DC ampere. 8) Oil pressure value (bar, Pascal). 9) Engine Temp value (°C). • <u>Indictors, alarms lights and protection for:</u> <ol style="list-style-type: none"> 1) Fail to Start (LED) 2) Genset working normal (LED) 3) High engine temp. (W +SD) 4) Low oil pressure. (W +SD) 5) Battery charger fail. (W) 6) Over/Under speed. (W +SD) 7) Over/Under Frequency (W +SD) 8) Low water level. (W) 9) Over/Under voltage. (W +SD) 10) Over load and S.C. (Trip CB+SD) 11) Emergency Stop (SD) 12) Phase sequence and missing protections. <p><i>Any alarms (warning and shutdown) occurring hall be interpreted as an alphabetic comprehensive text massage in display.</i></p> <p><u>Circuit breaker operations:</u></p> <ol style="list-style-type: none"> 1) Circuit breaker shall be operating in AUTO mode 2) Circuit breaker shall be operating in MANUAL mode 3) Circuit breaker shall be equipped with racking/removal tool for easy maintenance
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<p>8-3</p>	<p><i>Protections Devices</i></p>	<ol style="list-style-type: none"> 1) Genset output circuit breaker fitted over load protection element 2) Genset output circuit breaker shall be “Rackable – IN & OUT” during service for easy removal of unit for maintenance 3) Suitable MCBs or fuses protection for all input and output (AC /DC) circuits. 4) External E-stop (non-lockable, push button type)
<p>8-4</p>	<p><i>Battery Charger:</i></p>	<ul style="list-style-type: none"> - Automatic Battery charger (shall be adjustable charge current and voltage (up to appropriate Amperage), 24 VDC. - In addition, the battery charger shall provide individual indication and common alarm at the following fault conditions: - <ol style="list-style-type: none"> a) AC failure b) Charger failure -output voltage drops abnormally

9. Canopy And Sound Proof Specifications

<p>No</p>	<p>Component Name</p>	<p>Required Specifications</p>
<p>9.1</p>	<p><i>Canopy & Acoustic Enclosure</i></p>	<ol style="list-style-type: none"> a) The enclosure shall allow easy access to the engine, alternator, radiator filler cap and control cubicle for easy maintenance purposes. b) The starter battery in sound-proof canopy sets shall be housed in an insulated compartment with forced air flow when the engine is running. It should be provided with easy access for maintenance and removal of the battery. c) The enclosure shall be designed to be Water and weather-proof. d) The noise level generated by the set at full load should be less than 73 dB (A) at 5meter. e) The enclosure base frame should be designed with supports for easy transportation to site f) Large doors allow easy access to the generator set for service and monitoring purposes is preferred. g) Canopy shall be capable of anti-corrosion to withstand high humidity, dust, rain etc.



		h) Fitted with holes at the corners and middle (depending on the length) for easy lifting and transportation
10. Documents And Drawings		
10.1	<i>Engine And Alternator</i>	<p><i>The supplier shall be supply the following manual and drawings:</i></p> <ol style="list-style-type: none"> 1) Service and Maintenance Manuals 2) Workshop Manual. 3) Spare Parts Manual 4) Spare part list - indicating make, model, and rating etc.
10.2	<i>Control Panel</i>	<ol style="list-style-type: none"> 1) Description (operating) manual. 2) Control module manual. 3) Fault-finding manual. 4) Component lists – indicating country of origin, make, etc. 5) Three original Software program for control panels 6) Three Software cable link for communication purposes to dial in for local viewing and controlling. 7) Spare part list - indicating make, model, and rating etc.
10.3	<i>Genset</i>	<ol style="list-style-type: none"> 1) Wiring and schematic drawing showing detailed circuits 2) Each wire, component, terminal, etc. shall be clearly annotated on the drawing for identification and maintenance purposes. 3) Hardcopy of every handbook, manual and every drawing per unit (for each).



Appendix - Abbreviations

LED	Light Emission Diode
W	Warning
SD	Shutdown
S.C	Short Circuit
Genset	Generator Set
MCCB	Moulded Case Circuit Breaker
MCBs	Miniature Circuit Breakers
A.T.S	Automatic Transfer Switch
AMF	Automatic Mains Failure
P.F	Power Factor
KVA	kilo Volt Ampere - Apparent power
KW	Kilo watt - Active Power
PMG	Permanent Magnet Generator
A.V.R	Automatic Voltage Regulation