

Appendix 1B: Diesel Generator and Trailer Specification

Standby HVO/Diesel Generator

This specification covers the requirements for the supply of 165KVA silent canopied trailer mounted standby diesel generator. The generator shall carry at least 5 years full manufacturer warranty and service plan from date of commissioning. The scope of work includes the following unless otherwise indicated

165KVA Generator

Digital multi reading control panel.

1 set of sequential connector box on generator

Fast tow Trailer – twin Axle 3500kgs (See separate specification) This is the minimum required specification required.

Cables:

Mobile generator to be supplied with 5 sets of of 3 x 25metres 95mm² single core copper xlpe/pvc (75 Metre length) to be able to be coupled together if required.

Quick Busbar connectors and flexible tail connectors required to be coupled onto cables coming from generator if required.

HVO: Any proposed generators must be certified and tested by the manufacturer to run on sustainable HVO fuel, test certificates and certification will be required.

☐ Ambient Temperature	:	40 ^o max. 30 ^o average over 24 hrs.
☐ Relative Humidity	:	50% at +30 ^o C max. Below
☐ Altitude	:	1000m.
☐ Location	:	Outdoor in yard

- The Standby Generation Equipment installation shall comply with the requirements of the following standards;
 - National Rules for Electrical Installations Part 3.7.4: Supplementary Requirements for LV Asynchronous Generator Installations.
 - National Rules for Electrical Installations IS 10101
 - Code of Practice for the Design, Selection and Erection of Factory Built Assemblies of Low Voltage Switchgear (F.B.A.'s) 50 – 1000V.
 - Factories (Electricity) Regulations 1972.
 - EU directives 89/392/EU, 91/368/EU and 93/44/EU.73/23/EEC – The Low Voltage Directive.
 - 89/336/EEC – Electro Magnetic Compatibility Directive.
 - Health and Safety Legislation.
 - BS 7698/ISO8528 G2.
 - BS 4999-0.
 - BS EN IEC 60034-5.
 - BS 4999-140.
 - BS 4999-142.
 - BS EN ISO 3046-1
 - BS ISO 8528-1 to 6.
 - BS ISO 8528 – 9 & 10.

- BS EN IEC 60034-1.
 - BS EN IEC 60034-1
 - BS EN IEC 60034-22.
 - ISO 12000.
 - BS EN 953.
 - BS EN12601.
 - BS EN 61000-6-3 & -4.
 - BS EN 61000-1 & -2.
 - BS EN 60204-1.
 - BS EN 60439-1.
 - BS EN60529.
 - IEC Standards.
 - Requirements of the local Fire Services Department.
 - EU Stage 2 emissions.
- All system components shall be compliant with European Union EMC Directives and shall carry the CE Mark of conformity.

Ratings

The generator set shall comply with the following requirements.

A **minimum** size of 165KVA, at 0.8 Pf. to ISO8528 Standby Rated, and shall be capable of a one-step load of 60% of its prime power rating.

- Nominal output voltage – 400/230V.
 - Phases – 3 phase, 4 wire.
 - Frequency – 50 Hertz.
 - Connection – Star
- This contract shall include the supply, delivery to site, placing in position, assembly and installation, connection, testing commissioning and maintenance for a minimum guarantee period of three years from acceptance by the Employer, of the standby diesel generator indicated on the schematic and layout drawings and as specified herein. The scope of work includes the following unless otherwise indicated:
 - Diesel driven Standby generating set with 400V 50Hz output suitable for a TN-C-S three phase system.
 - Alternator Preferences, Leroy Somer, Kohler
 - Sound attenuated weatherproof enclosure.
 - Control panel,
 - Starting batteries and charger.
 - Exhaust and silencing system.
 - Control cable connections.
 - Anti-vibration mountings for the diesel alternator set.
 - Earthing connection.
 - All equipment required to give a complete and satisfactory standby diesel generator installation.
 - Min 334L Fuel storage in self-contained base fuel tank
 - Testing and commissioning and demonstration to the client.

2. THE DIESEL ENGINE

- The diesel engine shall comply with BS5514 and preferably use a fully electronic high-pressure common rail fuel system.
- The engine governing shall meet the accuracy requirements of class G2 to ISO8528.
- The engine shall be supplied with energised to run shutdown solenoid for fail safe operation. Oil pressure switches and water temperature switches. Oil pressure and water temperature senders shall be supplied.
- Fuel System
- The engine fuel system shall use a fully electronic high-pressure common rail fuel system where possible.
- Cooling System

The cooling medium shall be rust inhibiting coolant circulating in a closed circuit system. A heavy duty radiator, fan and a pump shall be integral to the diesel alternator unit. The fan shall be vee belt driven and a tensioning device shall be fitted. The system shall have a thermostatic by-pass valve to achieve a rapid warm-up and to give even temperature control over the load range. The generator shall be supplied complete with all necessary heat exchange equipment to provide a system to operate satisfactorily with a remote radiator.

The radiator and cooling fan shall be complete with protection guards, designed to cool engine at specified output in air-on temperatures up to 40 degrees Celsius. A low coolant level alarm shall be fitted.

Rating

The engine shall be rated in accordance with BS 5514 to maintain continuously the full output without over-heating.

Type

The engine shall be multi-cylinder, four stroke, high pressure common rail fuel injection, compression ignition continuously rated industrial diesel engine to BS 5514.

Speed Control

The rated speed shall be 1500 R.P.M. The speed shall be controlled by an electronic speed sensing governor. The speed governing accuracy shall be in accordance or better than Class A1 governing as specified in BS 5514: Part4:1984. As required by the BS, the manufacturer shall state the normal period of time required after the start of the engine to establish controllability within the limits specified in Table 3 of the BS. The engine fuel system shall use a fully electronic high pressure common rail fuel system where possible.

Heaters

Each engine shall be equipped with the following thermostatically controlled immersion heaters:

- In the engine water jacket.

These features shall operate from the 230 volt a.c. mains supply and shall remain normally on.

An additional cut-out device shall switch off the immersion heater supply when the diesel engine is running.

Starting

The engine shall start from any crank-shaft position using a DC supply from a 12V - 24V DC battery system. Starting shall be by means of an axial type starter motor engaging with the fly wheel. The starter motor shall be arranged to automatically disconnect when the engine starts.

The starter motor batteries shall be supplied complete with battery leads as required and located adjacent to the starter motor.

Batteries shall be of the stationary type suitable for use in a stand-by generator installation.

The panel shall be complete with all necessary internal wiring, terminations, etc.

Noise and Sound Attenuation

The generator shall be supplied with sound attenuation equipment to reduce the noise as follows:

- Maximum noise level: 78 dBA at 1Meter.

The sound attenuation equipment for the indoor Installation shall consist of one of the following:

- Silenced acoustic Canopy with rigid base suitable for crantage.
- 334l Fuel Tank.

Electrical System

A 12 / 24 Volt system with battery charging alternator and axial type starter motor shall be supplied.

High capacity lead acid starting batteries, battery rack mounted in machine base-frame and heavy duty interconnecting cables with terminations shall be supplied.

The engine shall be supplied with energised to run shutdown solenoid for fail safe operation.

Oil pressure switches and water temperature switches. Oil pressure and water temperature senders shall be supplied.

The governor shall be of the electronic type and meet the accuracy requirements of class A1 to ISO3046.

Cooling Radiator

The radiator and cooling fan shall be complete with protection guards, designed to cool engine at specified output in air-on temperatures up to 40 degrees Celsius. A low coolant level alarm shall be fitted.

Engine Filtration System

Cartridge type dry air filters, cartridge type fuel filters and full flow lube oil filters shall be supplied.

Exhaust System

A heavy duty capacity exhaust silencer system shall be supplied to reduce the noise level to the rating specified.

Generator Control Panel

The control system shall be an multi function type digital control panel, and shall be for set mounting and shall contain the means of starting and stopping the generator, monitoring its operation and output, and automatically shutting it down in the event of a critical condition arising such as a low oil pressure or high engine coolant temperature.

Protection / Instrumentation

The control panel shall incorporate a microprocessor bases load control and engine management system which shall carry out all the functions necessary for engine control and automatic generator starting.

The following operating modes shall be available:

The following generator parameters shall be displayed digitally by means of alphanumeric LCD display:

- ?? Engine coolant temperature
- ?? Engine oil pressure
- ?? Battery voltage
- ?? Engine RPM
- ?? Genset run time
- ?? 3 x Phase / phase volts
- ?? 3 x Phase currents
- ?? Generator kW
- ?? Load status
- ?? 3 x Phase/neutral volts
- ?? Generator voltage

Engine Control

The control panel shall incorporate the following:

- ?? OFF/AUTO/TEST/RUN control Function
- ?? Emergency stop pushbutton (latching)
- ?? Multiple attempt crank timer
- ?? Crank repeat timer
- ?? Crank fail alarm/shutdown
- ?? Automatic cooldown timer.

Remote Monitoring

The control panel shall be equipped with a means of remote monitoring by means of Modbus protocol.

A serial communications port shall be provided (e.g. RS-422) for remote communications and control functions.

Alternator

The alternator shall be brushless, screen protected and drip proof, separately excited by means of a permanent magnet, self-regulating with fully interconnected damper windings and sealed-for-life bearings.

The insulation system shall be Class H. All windings are impregnated in either a triple dip thermo-setting moisture, oil or acid resisting polyester varnish or vacuum pressure impregnated with a special polyester resin.

A heavy coat of anti-tracking varnish for additional protection against moisture or condensation shall be included.

The alternator shall be in accordance with BS5000 part 99, IEC34-1, VDE0530, UTE51100, NEMW MG-122 & ISO8528 G2.

The fully sealed automatic voltage regulator shall monitor all three phases and maintain the voltage within the limits of +/- 1.5% from no load to full load including cold to hot variations at any power factor between 0.8 lagging and unity and inclusive of speed variation of 4.5%.

Nominal adjustment by means of a trimmer incorporated in the AVR shall be included.

The total distortion of the voltage waveform with open circuit between phases or phase and neutral shall be in the order of 2. On a 3 phase balanced harmonic-free load the total distortion shall be in the order of 3.5%.

The alternator shall be designed to have a THF better than 2% and a TIF better than 50. The alternator shall have a 2/3 pitch factor.

Radio Interference -Suppression shall be in line with the provisions of BS800 and BDE class / G & N.

Motor Starting - An overload capacity equivalent to 300% of full load impedance at zero power factor shall be sustained for 10 seconds.

Mounting Arrangement – Safety Features / Baseframe

The complete generator shall be mounted, as a whole, on a heavy duty fabricated and welded steel base-frame constructed from folded channel sections.

The base-frame shall incorporate specially designed crane lifting devices.

The engine and alternator shall be directly coupled by means of an SAE flange so that there is no possibility of misalignment after prolonged use.

The engine flywheel shall be flexibly coupled to the alternator rotor and a full torsional analysis has been carried out to guarantee no harmful vibration will occur in the assembly.

Anti-vibration pads shall be supplied.

Control System

The Automatic Start Control Panel for the generator shall be set mounted and shall contain the means of

starting and stopping the generator, monitoring its operation and output, and automatically shutting it down in the event of a critical condition arising such as a low oil pressure or high engine coolant temperature.

Generator control panels shall contain the following:

- Instrumentation:
- LCD Display with adjustable contrast and backlight with auto power off.
- AC metering:
 1. Volts 3-phase (L-L & L-N).
 2. Amps (per phase & average).
 3. Frequency.
 4. KW (total & per phase).
 5. KVA (total & per phase).
- DC Metering:
 1. Battery volts.
 2. Engine hours run.
 3. Engine jacket water temperature (in °C or °F).
 4. Lube oil pressure (in psi, kPa or bar).
 5. Engine speed (RPM).
 6. Crank Attempt counter.
 7. Start counter.
- Protection:
 - 1 Fail to start.
 - 2 Low oil pressure.
 - 3 High engine temperature.
 - 4 Low / high battery voltage.
 - 5 Battery charger failure (if fitted).
 - 6 Under-speed, over-speed.
 - 7 Loss of engine speed detection.
 - 8 Under Volts, Over Volts.
 - 9 Under Frequency. Over Frequency.
 - 10 Overcurrent.
 - 11 4 Spare fault channels.
 - 12 20 Event fault log (name of event, engine hours at first occurrence of event, engine hours at latest occurrence of event, number of occurrences of event).
- Controls:
 - 1 Menu navigation
 - 2 Engine and AC metering
 - 3 Service Interval Counter.
 - 4 Modbus communications on RS485 connection for remote customer monitoring.
- Volt free contacts for:
 - 1 Common alarm
 - 2 Genset running.

Mode of Operation

Circuit Breaker

A 3 pole moulded case circuit breaker shall be mounted on the generator in a vibration isolated sheet steel cubicle with adequate access for incoming and outgoing cables.

2.4.3 Documentation

A full set of operation and maintenance manuals, circuit wiring diagrams, commissioning/fault finding instruction leaflets shall be supplied.

2.4.4 General Arrangement

The generator shall be designed and constructed for installation in a weather-protected building or in a weatherproof enclosure for outdoor location.

2.4.5 Factory Tests

The generator set shall be load tested before dispatch from the manufacturer's works. All faults, control functions and site load conditions shall be simulated and the generator and its systems checked and proved.

Warranty and service

All equipment shall be guaranteed for a period of 60 months from date of commissioning and 60 months service plan to be included.