

Technical Specification for generator set supply and installation

1. POWER GENERATION SET

This specification describes and specifies the requirements for the supply, delivery, installation, setting into effective operation and maintenance of the main power generator.

1.1. GENERAL REQUIREMENTS

The generators shall each be rated at Prime Power rating suitable to run for an unlimited number of hours per year in a variable load application. Variable load should not exceed 80% average of the Prime Power rating during any operating period.

A 10% overload capability should be available for a period of one hour within a 12 hours period of operation.

1.2. SCOPE

The works include the supply of all labour, materials, plant and equipment necessary for the supply, delivery, and installation and commissioning of the generators as described in the Specification.

The works shall be complete with all minor and incidental items necessary for the proper functioning of the generators, even though not specifically detailed or mentioned. Duty exchange, sales tax and all similar charges shall be included in the Tender Price.

The works include :

- a. Supplying and delivering to site, unpacking and fixing the standby generating sets on boat with anti - vibration mounts
- b. Supplying and installing fuel piping and associated accessories to an adjacent day fuel tank, the exhaust system including ducting, and batteries suitable for generator set starting.
- c. Supplying and installing the generator control panels and associated cabling.

- d. Supplying, installing and sizing of the generator pumps, pipe connections, valves for the generator cooling system, silencer, neutral grounding, body grounding, other accessories to support proper genset system.
- e. Supplying and installing the generator earthing system, body grounding and other still material should be grounded, earthing accessories.
- f. Supplying and installing the ventilating system to full fill genset requirement complete with fans, ducting, intake and other grill damper, control panel and other accessories if required.
- g. Supplying and installing anti vibration equipment for all genset, silencer pipes ducting and all material.
- h. Checking, starting, running and commissioning of generator sets installed.
- i. Maintaining the generator sets during the defect liability period.
- j. Twelve months warranty from starting completion of work.

Note :

Specification of genset see equipment schedule.

1.3. OPERATION

Each generating set shall comprise a multi - cylinder diesel engine directly coupled to a 3-phase alternator together with all the necessary ancillary equipment as further described herein, and shall be capable of maintaining a continuous electrical output as 380 V, 50Hz under specified operating conditions and range of frequency and voltage fluctuation.

1.4. GENERATOR CONTROL PANEL

Generator control panel shall incorporate the following :

- a. Moulded case circuit breaker has specification as follows :
 - Electronic trip type
 - 100 percent rated
 - Complying with and UL 489
 - Tripping Characteristics
Adjustable long-time and short-time delay and instantaneous.

- Trip Settings

Matched to generator thermal damage curve as closely as possible

- Shunt Trip
Connected to trip breaker when generator set is shut down by other protective devices.
- Mounting
Adjacent to or integrated with control and monitoring panel.

The appropriate rating as indicated in the drawing complete with over-current protective relays, over-voltage/ under voltage relays, current transformer etc.

- Rotary, lockable duty selectors switch for “off”, “test”, “manual” and “auto”. This switch shall be arranged to permit testing of the generator and engine control systems and safety devices without the operation of the automatic transfer switches
- Push buttons for engine “start and “stop” and for changeover contactors of transfer switches “open and “close”.
- Reset switches for overload, alarm muting etc.
- Indicating lamps for “Mains Available” , “Standby Available”, “Standby On Load”, “Alarm On”.
- Main powered battery charger and auxiliaries
- Voltmeter, ammeter, frequency meter, power factor meter, kWh meter, hour run meter.
- Other items as specified elsewhere in the Specifications and Drawings.

1.5. ENGINE & FUEL SYTEM

- Engine Type
 - The standard comply with NFPA 37.
 - Rated engine speed 1500 rpm.
 - Maximum Piston Speed for Four-Cycle Engines:

The engine shall be multi-cylinder (in-line or vee), medium duty, turbo charged, fuel injection, water (sea water) cooled with instant starting, oil pressure protection should be a switch normally closed and temperature

protection as a switch normally closed that be provided. Diesel engine designed to supply continuously the motive power required by the alternator at the correct speed for generation of the specified output power under the specified conditions in accordance with BS 5514 Part 1.

- Output Connections : Three phase, four wire.
- Nameplates : Each major system component is equipped with a conspicuous nameplate of component manufacturer. Nameplate identifies manufacturer of origin and address, and model and serial number of item.
- Skid : Adequate strength and rigidity to maintain alignment of mounted components without depending on a concrete foundation. Skid is free from sharp edges and corners. Lifting attachments are arranged to facilitate lifting with slings without damaging any components.
- Rigging Diagram : Inscribed on a metal plate permanently attached to skid. Diagram indicates location and lifting capacity of each lifting attachment and location of center of gravity.

b. Fuel

Engine fuel system comply with NFPA 37.

The engine shall be capable of meeting all the specified requirements while operating on diesel oil

c. Engine Exhaust

The piping and fittings shall be suitably protected from corrosion A flexible connection shall be installed close to the engine.

e. Engine Cooling System

The engine shall be cooled by a circuit water-cooling system

f. Engine Filters

The engine shall be fitted with the following filters, each of the type and capacity most suitable for its application and of the best quality :

- Air intake filters
- Duplex fuel filters
- Duplex full - flow strainers and filters for lubricating oil (detergent type)

g. Auxiliary Alternator

Each engine shall be fitted with an auxiliary alternator capable of boost charging the starting batteries at a rate equal to 10% of the rated ampere-hour capacity of the batteries

1.6. FUEL PIPEWORK

Piping connections to the tanks shall be as shown in drawings.

All piping and fittings shall be Flexible pipes used for connection between the rigid fuel pipeline and the engine fuel pump's inlet and outlet are to be of heavy-duty metal braid reinforced and thermal resistant type.

The pipe work should be pressure tested at $1.5 \times P_{nominal}$ for 4 hours. All parts of the fuel oil piping system shall be thoroughly dry before use.

Isolating valves shall be fitted in supply, outlet and drain pipelines connection.

Lamp holders shall be of flush mounted type with a projecting bezel so arranged that lamps may be readily replaced from the front. Labels shall indicate the function of each lamp. Lamps shall be minimum 32 mm diameter, press-to-test type

1.7. AUTOMATIC CURRENT TRANSFER SWITCH

Automatic current transfer switch shall be provided at the Customer Intake Switchboard. It shall be of rating as shown in the drawings and complete with mains failure sensor relay.

Automatic current transfer switch shall be of linear actuator transfer motor type or motorized MCCB's / ACB's type. All transfer switches shall be equipped with manual operator handles. The transfer switch shall also be equipped with electrical and mechanical interlock so that it shall not be possible to operate the transfer switch to close on both genset and normal power sources, under normal circumstances.

The switch contacts shall be replaceable type and complete with arc chutes.

Auxiliary contacts of the normally open and normally closed type shall be provided for interlock and control indication.

1.8. ENGINE INSTRUMENTS & GAUGES

The engine shall be completed with all instruments and gauges necessary or desirable for its proper operation, service and maintenance.

Instruments shall be panel mounted flush type.

The instruments provided shall include the following :

- a. Lubricating oil pressure gauge.
- b. Tachometer
- c. Cooling water thermometer on outlet from engine
- d. Cooling water thermometer on inlet to engine
- e. Lubricating oil thermometer on outlet from engine
- f. Lubricating oil thermometer on inlet to engine
- g. Cooling water thermometer on inlet to lubricating cooler (if water cooled)
- h. Exhaust gas thermometer.

1.9. PROTECTIVE DEVICES

The equipment has power input circuits to load banks are fused, and fuses are selected to coordinate with generator circuit breaker. Fuse blocks are located in contactor enclosure.

Cooling airflow and over temperature sensors automatically shut down and lock out load bank until manually reset. Safety interlocks on access panels and doors disconnect load power, control, and heater circuits. Fan motor is separately protected by overload and short-circuit devices. Short-circuit devices are non-interchangeable fuses with 200,000A interrupting capacity.

Equipment shall be supplied to provide warning and automatic shut down under the following conditions :

- a. Low oil pressure
- b. High jacket water temperature
- c. Failure to reach operating speed in a reasonable time after starting
- d. Over-speed
- e. Overload
- f. System earth fault
- g. Restricted earth fault
- h. Pressing of emergency stop button on control panels

The low oil pressure warning and high temperature shut down devices shall be set as

recommended by the manufacturer. The “failure to reach operating speed” shall operate after an adjustable pre-set time of between 5 to 3 seconds.

Under any of the above conditions, a common alarm buzzer and the appropriate warning light (amber) on the control panel shall operate. Operation of a push button shall silence the buzzer. Reset facilities shall be provided so that after a fault or normal condition has been rectified the circuit can be restored to its normal condition.

The tenderers shall give a detailed description of the construction, function and any other special features of their instruments and devices.

1.10. ALTERNATOR & ELECTRICAL SYSTEM

a. Alternator and Exciter

The alternator shall be of the self-excited, screen protection, drip proof, revolving field, brush less salient pole type, direct coupled to the diesel engine and fitted with a directly coupled exciter.

The alternator and exciter shall comply in all respects with BS 2613

Insulation shall conform to BS 2757 Class “F” or better.

The stator shall be wound for three phase star connection with phases and neutral brought out to a terminal box mounted on the side of the alternator.

The output terminal shall be marked in accordance with BS 822. Damper windings shall be provided in the pole faces.

The alternator and exciter shall be continuously rated at not less than the engine full load rated power, and shall be capable of carrying without injury a sustained overload of 10% in current at full rated voltage for one hour after having attained its full rated load operating temperature under the site conditions specified.

b. Voltage Regulation

The voltage regulation shall be within 2.5% from no load to full load and inclusive of a speed variation of 4.5%

The voltage regulation system shall include the following:

- i. An automatic voltage regulator complete with voltage adjusting rheostat and accessories.

- ii. Manual voltage control by means of an exciter shunt field regulator or other approved means
- iii. Selector switch for automatic / manual operation
- iv. Alternator field switch and field discharge resistor
- v. All necessary current transformers, voltage transformers and control devices

c. Voltage Waveform

The voltage waveform shall approximate as close as possible to a sine wave both at no load and at full load with a lagging power factor of 0.8 and shall not exceed the limits as stated in BS 2613, section 3

d. Response

Transient voltage fluctuation due to load changes shall be minimal. The output voltage shall recover to within 3% of the steady state value in less than 0.6 sec and shall comply with BS 4999.

e. Radio interference

Interference with radio transmission shall be kept at a minimal and complies with BS 800, JIS, BS & NEMA Standards

f. Earthing

Generator sets shall be earthed to the Main Earthing system

1.11. CABLING INSTALLATION WORK

a. General

The Contractor shall include for the supply, installation, testing and commissioning of all cables and accessories as specified herein and shown on the Drawings.

All cables of the same type shall be supplied by a single manufacturer to ensure uniformity of standards and composition.

All cables delivered to site shall be new and shall be clearly marked to identify different types and sizes.

All the equipment shall be suitable for use in temperature and ambient conditions that will exist in various parts of the vessel, it is assumed air temperatures will rise to 400°C with 100% relative humidity.

b. Standard

All cables shall be manufactured to the appropriate British Standard, IEC specifications or SPLN .all installation should be complied with PUIL 2000.

Conductors shall be formed from high conductivity full annealed stranded copper.

Conductor screening shall be non-metallic and consist of either a semi-conducting tape or a layer of extruded semi-conducting compound, or a combination of the two, having a total nominal thickness of 0.8 mm.

Insulation shall consist of cross-linked polyethylene which is applied by extrusion to form a compact homogeneous body. The average thickness of the insulation shall be not less than 6.0mm.

Insulation screen shall consist of either a semi conducting tape or a layer of semiconducting compound or a combination or the two.

The over sheath shall consist of an extruded layer of black PVC compound complying with B.S. 6746 or IEO 502. The oversheath shall have reduced flame propagation properties.

c. Installation and Testing

The Contractor shall include for provision, installation, testing and commissioning of all cables, ladders, trays, trunking and accessories specified herein, shown on the Drawings and those items not expressly specified but required to meet the design intent of this Section.

The requirements of this specification shall be considered supplementary to all relevant clauses for cable installation detailed in Part 3 of the specifications.

d. Cable Bushings and Transits

In certain places, where cables pass through floors, walls or other partitions, bushing of an approved type shall be supplied and set in position by the Contractor; where necessary, split bushings may be used. for convenience in running out cables. After running the cables, the bushing must be thoroughly grouted in or otherwise securely fixed in position