

**Technical Specification**

**for**

**Supply, Installation and Commissioning of Diesel Generators for**

**UNDP**

**November 2016**

## **PART I - GENERAL TECHNICAL REQUIREMENTS**

### **1.0 Composition**

The Diesel Generator Units (DG Unit) shall consist of the following;

- Diesel Generator Set
- Fuel Tank
- Exhaust System
- Outdoor Weather Protective and Sound Attenuating Enclosure
- Automatic Transfer Switch (ATS)
- External Fuel Tank

The DG Unit shall be supplied as a complete pre-integrated and pre-assembled unit.

### **2.0 Manufacture**

The DG Unit shall be internationally reputed make. DG units shall be supplied from original suppliers and locally assembled units are not acceptable.

### **3.0 Service Conditions**

The DG unit shall be designed to be operated at following worse case conditions;

<b>Altitude</b>	Up to 1000 meters above sea-level
<b>Ambient temperatures – Outdoor:</b>	
Maximum outdoor	+55 <sup>0</sup> C
Maximum outdoor daily average	+40 <sup>0</sup> C
Maximum outdoor yearly average	+30 <sup>0</sup> C
Minimum outdoor	-10 <sup>0</sup> C
Highest one day variation	+25 <sup>0</sup> C
<b>Relative Humidity:</b>	
Maximum	92 %
Minimum	12 %
Yearly average	44%

### **4.0 System Conditions**

The DG sets shall be designed to be operated under following system parameters;

Nominal System Voltage	400 V / 230 V
Highest System Voltage	440 V / 253 V
Number of Phases	3 ph, 4 wire
Frequency	50Hz
Neutral Point	Solidly Earthed

## **PART II - PARTICULAR TECHNICAL REQUIREMENTS**

### **5.0 Standards**

The DG Units shall be designed, manufactured and tested in compliance with the latest versions of the following standards;

- IEC 60034 Rotating Electrical Machines
- IEC 60085 Thermal Evaluation and Classification of Electrical Insulation
- IEC 60529 Degrees of Protection provided by Enclosures (IP Code)
- ISO 10816 Specification for Mechanical Performance: Vibration
- ISO 3046 Specification for Reciprocating Internal Combustion Engines
- SI 426 European Commission (dangerous substances)  
(Classification, packing, labelling, and Notification of Regulations 1992.
- CIMAC Congress International des Machines a Combustion  
Recommendations for Diesel Engine Acceptance Tests
- ISO 9000 Quality assurance

### **6.0 Ratings:**

The DG Units shall be rated for: 416 V AC, 3 phase, 50 Hz.

Required rated Prime Power Capacities (kVA) at an outdoor operating temperature of 55 deg is as follows.

500 KVA

**Bidder should propose generator capacity (KVA) to obtain required prime KVA ratings of 500 KVA, at the maximum outdoor operating temperature. Bidder should also provide calculations and reference graphs, etc, to confirm that the proposed generator is capable of providing the required prime KVA rating.**

### **7.0 Performance**

The DG sets shall be capable of delivering rated kVA indicated under item 6 at Prime Power under the service conditions specified in section 3.0.

Voltage regulation:  $\pm 0.5$  %

Frequency regulation: Random frequency variation with any steady load from no load to full load shall not exceed  $\pm 0.25$ %.

### **8.0 Diesel Engine**

The diesel engine shall comply with the specified International IEC Standards or an equivalent international standard and shall be of the four-stroke, multi-cylinder, water-cooled, cold start, direct fuel injection, compression ignition, and preferably turbo-charged type. The crankshaft speed shall not exceed 1500 r.p.m.

**Speed Governor:**

The diesel engine shall be fitted with a speed governor capable of accuracy to Class A2 of ISO 3046/IV. The governor is to be fitted with speed control facilities to enable the engine speed to be adjusted from the local control panel.

**Shutdown System:**

The engine shall be fitted with a mechanically operated device which will shut off the fuel supply to engine when any of the specified alarm conditions occur.

**Cooling System:**

The cooling system shall be filled with chemically treated water mixture by the equipment supplier. Rotating parts shall be guarded against accidental contact in accordance with standard requirements.

A vertical fan cooled sectional radiator, rated for the tropical site conditions shall be mounted at the end of the combined under base and driven from the diesel engine. The radiator shall be arranged to cool the engine jacket water and lubricating oil. The radiator must be generously sized to permit operation at full load and overload in the specified ambient conditions. The radiator shall be integral with the generating set. The radiator shall be provided complete with fan claw and guards.

**Pumps :**

Cooling water, lubricating and fuel oil pressurizing pumps shall be provided and mounted on the engine and shall be gear driven from the crankshaft.

**Lubrication :**

Lubrication shall be by means of an engine-driven gear pump and the system shall include full flow oil filters with replaceable elements.

**Safety Guards :**

All moving parts shall be adequately guarded, in order to prevent danger to personnel.

**Fuel :**

The engine shall be designed for operation on diesel fuel.

**Lubricating and Fuel Oil Filters :**

The lubricating and fuel oil filters shall be of the fuel flow type.

**Air Filters :**

Air filters shall be suitable for use in the environmental conditions which are likely to arise locally and the service conditions described in Part 1.

**Starting System :**

The set shall be supplied with a completely self-contained starting system consisting of an engine driven dynamo, a lead acid battery and battery charger.

The starting system shall be designed such that at engine speeds in excess of the minimum firing speed it shall be impossible to complete the starting circuit. The starting system shall preclude excessive consecutive starting attempts.

**Exhaust System :**

The engine shall be efficiently silenced and be complete with primary and terminal silencer arrangements.

## **9.0 Alternator**

The alternator shall be synchronous, four pole and brushless excitation type and shall comply with the relevant requirements of Specification IEC 60034 or an equivalent international standard.

The alternator shall be designed for operation of 10% engine overload at any power factor between unity and rated power factor for a maximum period of one hour in any 12 hour period as permitted by ISO 3046/II.

The alternator shall be rated for IP-23 protection. The insulation of the winding shall be class H. All winding shall be tropicalized and suitably impregnated to withstand the site ambient conditions.

The alternator shall be complete with all necessary cooling fans, excitation and voltage regulating equipment. The alternator shall be capable of maintaining its continuous maximum rated output when operating within + 5% of rated voltage and at rated power factor.

The alternator shall be brushless rotating field, self-exciting and self-regulating type complete with permanent magnets and fully connected damper windings. The stator winding shall be star-connected and shall be brought out together with the neutral point to terminals located in a sheet steel box mounted on top of the generator to facilitate connection of a power cable of suitable capacity.

The following protection shall be provided for the alternator:

- a. Over Current Protection
- b. Earth Fault Protection.

## **10.0 Automatic Transfer Switch (ATS)**

The ATS shall comply with IEC 60947 or equivalent international standard. The separately mounted generator control cubicle and ATS panel shall be of sheet steel vermin proof with lockable hinged front doors.

A Four pole circuit breaker and auto transfer switch should be provided rated for full load of the current (+ 10% overload).

The ATS equipment shall be of 3 attempt type and capable of sensing single phase and three phase failure of main supply or any variation in main supply voltage. The main supply and generator supply contactors or Solenoid/Motor operated change over switch shall be of fool proof design with mechanical and electrical interlock.

## **11.0 Mounting**

Complete unit to be mounted on robust skid frame. Vibration mountings to be used where required.

Skid frame to be dimensioned to accommodate generator/alternator assembly, all accessories, sound proof canopy. Skid frame to be of rigid construction suitable for locating on level ground surfaces ranging from compacted earth, crushed rock or a concrete pad.

## **12.0 Fuel Tanks**

Built-in Fuel Tank: A minimum capacity of not less than 8-10 hours full running time built in fuel tank shall be provided. Design shall be capable of preventing accidental spilling of fuel and hand pump feeding on emergencies is possible.

## **13 External Fuel Tank**

### **13.1 General**

3 Nos. of external fuel tanks of 1000 liter capacity shall be provided. Provide pre-engineered aboveground atmospheric tank system complete with tank, piping, secondary containment, gauges, and other accessories specified herein as a complete assembled system. The external tank shall have a total volume of 3000 liters to provide the diesel generators with fuel.

### **13.2 Tank Construction**

The tank shall be manufactured from carbon steel with thickness as U.L. Standard 142.

The tank shall be externally coated with 2 layers of coatings. The prime layer using Red Oxide paint and the top layer using water proof plastic layer.

Tank shall comply with the normal and emergency venting requirements NFPA 30.

Tank shall carry a ten (10) years warranty including materials and workmanship.

Fuel tank to have, lowest point drain facility for water and sludge, fuel level gauge direct mounted or remote electric, filler pipe and locking cap.

### **13.3 Accessories**

The tank shall be manufactured to support the following accessory equipment and shall be provided with suitably located lifting lugs:

☐ Direct Level Indicator: A steel pipe of suitable size shall protect the level indicating, the level indicator shall be made of plastic pipe connected through suitable valves and approved by the supervising engineer.

☐ Inspection Port Adapter Cap: Tank shall be equipped with a not less than 300 mm adapter and lockable cap for inspection and manual gauging of fuel level. Gauge port shall be accessible from steps or ladder.

☐ Tank Fill Opening: The tank shall be provided with a suitable sized filling opening that will minimize the oil spilling during tank filling operation.

☐ Vent Opening: The tank shall be provided with a suitable sized venting pipe to prevent the increase of gas pressure inside the tank. The vent opening should be covered with a wire mesh to prevent anything from entering and blocking the vent.

☐ Supply Pipe Connection: The tank shall be provided with a suitable sized ASME B36.10, Schedule 40 Black steel supply pipe connection with a stainless steel two – piece body, stainless steel ball, Teflon seats and stuffing box ring, lever handle and balancing stops, threaded ends with union Ball Valve.

☐ Drain Pipe Connection: The tank shall be provided with a suitable sized ASME B36.10, Schedule 40 Black Steel Drain pipe connection with a Carbon Steel, Stainless ball, with Viton seals Spill Sump Drain Valve.

☐ Access Steps and Ladders: The Tank shall be equipped with access steps or ladder. Steps and ladder shall be of welded steel construction with prime and finish paint of industrial enamel, and shall be designed to conform to OSHA requirements.

### **13.4 Fuel Distribution Pipe and Pipe Fittings**

The design criteria shall conform to the following minimum requirements:

Steel Pipe: ASME B36.10, Schedule 40 Black Steel Fittings:

ASTM B16.3, 300 lb. Threaded malleable iron, or ASTM A234, forged steel welding type. Finish: Prime and finish paint with industrial enamel.

### **13.5 Drawings**

The contractor should submit design (shop) drawings for the tank and fuel pipe distribution, location of fittings and accessories with specific dimensions, for approval by UNDP prior to product fabrication.

### **13.6 Test**

The tank shall withstand an internal air pressure test of 3-5 psi.

### **13.7 Welding**

Welding shall be carried out in accordance with an approved standard or code of practice. The welding plants and processes used shall be suitable to the materials, configurations and purposes of the welded parts.

Only qualified welders, certified for the type of welding required, shall be employed. The Contractor shall exercise strict control over the welding conditions and parameters and shall continuously monitor the standard of welding achieved in accordance with the requirements of the Clause on Quality Control and Quality Assurance.

### **13.8 CONCRETE FOUNDATION / PAD DRAWINGS**

Detailed drawings of the concrete/pad foundations required for mounting/installation of all equipment shall be provided with all necessary details within three (03) weeks of award of contract.

### **14.0** Detailed drawings of the concrete/pad foundations required for mounting/installation of generators shall be provided with all necessary details within three (03) weeks of award of contract.

### **15.0 Outdoor Weather Protective Sound Attenuating Enclosure**

The generator set shall be provided with a sound attenuated housing which allows the generator set to operate at full rated load in the ambient conditions. The enclosure shall reduce the sound level of the generator set while operating at full rated load to below 95 dBA at 1 meter from the generator set. Housing configuration and materials used may be of any suitable design which meets application needs, except that acoustic materials used shall be oil and water resistant. No foam materials shall be used.

The enclosure shall include hinged doors for access to both sides of the engine and alternator, and the control equipment. A panel viewing window shall be provided. Key locking door latches shall be provided for all doors. Door hinges shall be stainless steel.

The enclosure shall be provided with an exhaust silencer, which is mounted outside of the enclosure, and allows the generator set package to meet specified sound level requirements. Silencer and exhaust shall include a rain cap and rain shield.

### **16.0 Fire detection**

Diesel generators housing shall have fire detection system suitable for use in an area containing diesel fuel. The fire detection system shall cut off the fuel supply from the tank in the event of a fire. The fire detection system shall operate an alarm system. The system shall meet the requirements of Iraqi fire regulations.

### **17.0 Programme of work**

The supplier shall submit a detailed programme covering the design, manufacture and testing of the diesel generators within two (2) weeks of receipt of the contract award. The reports shall subsequently be submitted on monthly basis, outlining progress and, if necessary explaining deviations from the programme.

### **18.0 Type tests**

Type test reports/certificates of generators need to be submitted with the bid.

Type tests shall be carried out at an independent laboratory or witnessed by a representative of such laboratory.

## **19.0 Testing at manufacture's works**

The complete diesel generator sets shall be subjected to routing tests as per the standards specified, at the manufacturer's Works to verify that its performance is in accordance with the specifications.

The supplier shall submit full details of the methods of testing including connection diagrams for approval at least one (1) month before testing.

The supplier shall give a minimum of six (6) weeks' notice that the generators are ready for testing.

All costs in connection with the testing shall be borne by the supplier who shall provide UNDP with all the facilities free of charge.

The UNDP may nominate representative to witness the factory tests. Certified copies of test reports shall be provided for each unit.

## **20.0 Other requirements**

- (a) Generator set shall have the following facility.  
Forklift Pockets within Base Frame (up to 350 kW)
- (b) The control panel shall have the following provisions for the control of DG Set:
  - Master engine control which for OFF/AUTO/MANUAL/TEST with a facility for starting and stopping of the set.
  - Selectable Multifunction meter
  - Engine control monitor.
  - Alternator voltage monitor.
  - Engine hours run counter.
  - Voltmeter and Ammeter
  - Combined frequency and tachometer
- (c) The diesel generator shall automatically shut down under following conditions.
  - Low Oil Pressure
  - High Engine Temperature
  - Low Fuel Level
  - Over/Under Speed
  - Battery Charge Fail
- (d) Earthing studs need to be provided.

## **21.0 Warranty-**

Warranty period shall be one year /1000 hours operation whichever occurs first