

# GENSET SPECIFICATIONS

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## TECHNICAL SPECIFICATIONS FOR DIESEL GENERATORS 2×10 kVA (PORTABLE – CANOPY) TYPE

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### ***1) General :***

These specifications cover the technical requirements for two units of Diesel engine drives electric alternators, 400/230V +10% – 15% , 3phase, 4 wires, 50HZ, prime output rating 10kVA, and 0.8 PF at an altitude of 2200m ASL and 30 °C , sound and weather proof portable and canopy outdoor unit.

#### ***1.1 Applications :***

The generators will be used in emergency situations at telecommunication services of Yemen Mobile Company. The two units are expected to supply rectifiers, single phase air conditioners, single phase lights, and fans etc. In addition, the generators shall be installed in the site which is under maintenance.

The tenderer shall provide customer list where similar Gen-sets and their facilities have been supplied and giving satisfactory services. The list should indicate the places where such equipment is currently in service.

The most important specifications and main points are summarized in the attached tables to be filled by the tender just as a secondary part from the whole Gen-set specification and it is significant to be fulfilled clearly and perfectly based on detailed required specifications. The basic detailed required specifications are stated as following:

#### ***1.2 Sites conditions :***

- a) At 2200m above sea level and 30 °C.
- b) At sea level, 45 and Humidity up to 90%.

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

#### ***1.3 Documentations supplied with offer:***

Proposals for approval shall include with the tenderer offer:

- Generator set photographs (suitable size) of all sides.
- Gen-set Technical Data , design and performance, specifications (tabulated data that identifies make , model and country of origin as attachment) for the following:

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- 1) Engine (Including its relevant components).
- 2) Alternator (Including its relevant components).
- 3) Control panel (Including its relevant components).
- 4) Auxiliary components:
  - a) Starter components.
  - b) Fuel Solenoid.
  - c) Dynamo charger.
  - d) Injection pump.
  - e) Exhaust system.
  - f) Gen-set circuit breaker etc.

- **Drawings:-** General dimensions drawings showing overall generator set measurements, mounting location, and interconnecting points for load leads, fuel, exhaust, cooling and drain lines.

All Wiring and schematic drawing showing detailed circuits.

- **Standards Compliance:** The quoted product should meet out International Industry standards, and should meet European Codes and standard or American Codes and standard for diesel generator sets.

All pages of the original Tender Document are to be signed and enclosed with the Technical Bid without cutting .

### ***1.4 Warranty Statements:***

- The two generators shall be under (18 months) on-site comprehensive warranty support from the date of installation and operation at the site or 30 months from date of final acceptance for the tender equipment as a whole including spare parts which is certainly after the technical test in warehouse of Yemen Mobile Company. The two generators components shall be covered by the warranty. All components of the generator are to be warranted against any damage or malfunctions may occur during the warranty period. And an approved quality assurance certificate should be provided.
- Service - Location and description of local spare parts suppliers and services center including parts inventory and number of qualified generator set service personnel.
- The manufacturer shall have a local authorized dealer who can provide factory trained servicemen.

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- The bidder may quote for all or selected items among items placed in tender notice.

### 2) Diesel Engine Specifications:

S.No	Component Name	Required Specifications
2-1	<i>Cooling System</i>	Water cooled with fan and radiator
2-2	<i>Water Level Maintenance</i>	The Water cooled system of the engine shall be equipped with built in expansion tank. Engine should have high quality and finish to make it a zero leakage system. Similarly the water system should have seals to ensure no water leakage from the water pump.
2-3	<i>Radiator</i>	The radiator shall be Heavy duty with fan and corrosion resistance (provide technical details).
2-4	<i>Output</i>	The engine prime power duty shall be de-rated capable of developing sufficient output HP not less than required by the alternator (10kVA prime power) at the following site conditions: <ul style="list-style-type: none"><li>- Altitude: up to 2200 meter Above Sea Level (A.S.L)</li><li>- Ambient Temperature: 30 °C</li></ul>
2-5	<i>Maximum Output</i>	The Maximum engine prime power duty rated shall be not more than the power required by the alternator (15 kVA prime power) at sea level and 45 °C
2-6	<i>Speed</i>	1500 RPM

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2-7	<i>Governor</i>	<p>Mechanical Governor under steady state conditions, whatever the load might be, the rotational speed shall remain between N and 1.04 N, where N is the normal speed in the event of a sudden load variation of 0.25L nominal, but with the load remaining between 0.5 L and L nominal, Where L nominal is the rated load, the instantaneous change in speed should not exceed 4% of N.</p> <p>The rotational speed then should be returned within offset limits is less than 3 seconds and stabilize in less than 8 seconds. The tender shall enclose graphic diagrams showing the de-rating of his units depending on altitudes, temperature and humidity varying.</p>
2-8	<i>No. Of Cylinders</i>	The engine shall be multi cylinder, in line configuration, and four strokes.
2-9	<i>Flywheel</i>	Of suitable diameter and weight (indicate the diameter and the weight).
2-10	<i>Overload Capacity</i>	The engine should be capable of providing 10% overload for 1 hour for every 12 hour continuous running at full load
2-11	<i>Engine Aspiration</i>	Naturally Aspirated
2-12	<i>Standard That The Engine Should Meet</i>	The engine shall be complying with an international standard.
2-13	<i>Silencer &amp; Exhaust System</i>	<p>Residential type with exhaust piping with vibration isolators , thermal insulation for exhaust line with glass wool , aluminum sheet .</p> <p><b><u>(Provide technical details).</u></b></p>
2-14	<i>Starting System</i>	<ul style="list-style-type: none"> <li>▪ <b>Electromagnetic solenoid switch:</b> it shall supply the required current to the starter motor and pull in and pull out pinion drive.</li> <li>▪ <b>Starter motor:</b> 12 VDC, it shall have clutch for normal and abnormal operation.</li> <li>▪ <b>Battery:</b> <ul style="list-style-type: none"> <li>➤ The battery shall be maintenance free, of known manufacture, sufficient to supply starting and control circuit.</li> <li>➤ The battery shall be adequately charged either from mains supply and / or from the Gen-set supply through the unit control panel.</li> </ul> </li> </ul>

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2-15	<i>Fuel System</i>	<p><b><u>Fuel injection:</u></b> Fuel injection pump with fuel lift hand pump , fuel flow replaceable filter and separate preliminary fuel filter (water separator) and electric fuel solenoid (preferred energized to run type) should be provided.</p> <p><b><u>The tenderer shall furnish details of fuel injection pump, fuel consumption at full load and at varying loads.</u></b></p>
2-16	<i>Air Filter</i>	<ul style="list-style-type: none"> <li>• Dry type air filter, heavy duty type with replaceable elements shall be provided.</li> <li>• Efficiency of the system at various stages shall be furnished.</li> </ul>
2-17	<i>Lubrication System</i>	<ul style="list-style-type: none"> <li>• Full pressure lubricating oil system including an oil cooler is to be fitted.</li> <li>• Oil pre-heating is required only before starting.</li> <li>• The Oil shall be drained through external hose-pipe – plug type is preferred.</li> </ul> <p><b><u>The tender shall indicate the frequent of changing oil.</u></b></p>
2-18	<i>Flexible Coupling</i>	<p>A heavy duty flexible block coupling shall be fitted between the engine and the alternator to absorb the transmission of shock loads.</p> <p><b><u>Details should be offered by the tender.</u></b></p>
2-19	<i>Engine Protective Devices</i>	<p>The engine shall be equipped with protective devices to provide warning and automatic shut-down under the following conditions:-</p> <ol style="list-style-type: none"> <li>1) Low Lubricating Oil Pressure      -(W+SD)</li> <li>2) High Water Temperature            -(W+SD)</li> <li>3) Low Radiator Water Level           -(W)</li> <li>4) Fail To Start                              -(W+SD)</li> <li>5) Over Speed/Under Speed           -(W+SD)</li> <li>6) Low and high Battery Voltage      -(W)</li> <li>7) Dynamo Charger Fail                  -(W)</li> <li>8) The engine shall be equipped with an oil pressure and temperature detectors.</li> <li>9) The engine shall be fitted with an oil pressure and Temperature sensors that shall be extended to the controller.</li> </ol>

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<b>2-20</b>	<b><i>Accessories</i></b>	<ul style="list-style-type: none"> <li>• All fuel-lines before the cut off valve shall be fireproof.</li> <li>• The engine color shall remain the original color as supplied by the manufacturer.</li> <li>• Rubber hose pipes used on the water, lubricating oil or fuel systems and rubber belts shall not be painted.</li> <li>• All cables that connect the engine auxiliary components such as sensors, dynamo charger, starter motor, and fuel solenoid shall be extended through high quality conduit to be protected from engine heating.</li> </ul>
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### **3) Alternator Specifications :**

S. No	Component Name	Required Specifications
<b>3-1</b>	<b><i>Alternator</i></b>	<p><b><u>General</u></b></p> <ol style="list-style-type: none"> <li>1) The alternator shall be three phases, 0.8 PF (lagging), four wires, 400/230V +10% -15% with a frequency of 50 Hz, star connected.</li> <li>2) The alternator shall be screen protected, drip-proof, self-regulating, self-exciting, Brushless, and directly coupled to the engine.</li> </ol>
<b>3-2</b>	<b><i>Rating</i></b>	Rating of alternator shall be determined in accordance to the engine output rating at sea level.

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3-3	<b>Construction</b>	<ol style="list-style-type: none"> <li>1) <b><u>Design:</u></b> the alternator shall be design of welded steel construction.</li> <li>2) <b><u>Degree of protection:</u></b> The alternator shall have an International Protection Code (IP) not less than “IP 23”.</li> <li>3) <b><u>Insulation Level:</u></b>The alternator shall be to class ‘H’ insulation.</li> <li>4) <b><u>Bearing:</u></b>Only single bearing for alternator shall be supplied.</li> <li>5) <b><u>Centrifugal fan:</u></b>High velocity cooling air circuit shall maintain internal winding and rotor free of dust particles.</li> </ol>
3-4	<b>Excitation System</b>	<ul style="list-style-type: none"> <li>• 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).</li> <li>• Self-excitation is acceptable, <u>if it gives</u> 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.</li> </ul> <p><b><u>The auxiliary exciter technique shall be described in full details by the tenderer.</u></b></p>

S. No	Component Name	Required Specifications
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3-5	<b><i>Automatic Voltage Regulation (AVR)</i></b>	<ol style="list-style-type: none"> <li>1) The alternator shall be AVR controlled.</li> <li>2) The AVR shall be mounted in the connection box of alternator and all components must be accessible and replaceable.</li> <li>3) The automatic voltage regulator (AVR) shall be of three phase sensing electronic type with accuracy regulation not more than <math>\pm 1\%</math>.</li> <li>4) The voltage shall be maintained within <math>\pm 5\%</math> of nominal range from no-load to full-load, at unity and 0.8 P.F lag whatever the alternator temperature is.</li> <li>5) The AVR shall be protected against failure due to low speed operation, over excitation, overvoltage and any abnormal conditions.</li> </ol> <p><b><u>The full technical data with schematic diagram for A.V.R shall be provided.</u></b></p>
3-6	<b><i>Wave Shape</i></b>	The output waveform should be pure sine. The residual harmonic percentage between full load and no load should not exceed +5%.
3-7	<b><i>Overload And Short Circuits</i></b>	<ol style="list-style-type: none"> <li>1. The overload characteristic should be able to handle 110% of rated power continuously for at least one hour every 12 hours.</li> <li>2. The design of the alternator and regulator system shall be able to maintain machine excitation for a period of 10 seconds at a rating of 300% before fault clearing.</li> <li>3. Alternator shall be provided with full protection against abnormal conditions in order to withstand all types of short circuits without any damage.</li> <li>4. The alternator and voltage regulator components shall be protected against voltage transients induced by switching or lightning surges.</li> </ol> <p><b><u>All protections shall be stated in details by the tender.</u></b></p>

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<b>3-8</b>	<b><i>Frame</i></b>	Engine and alternator shall be coupled and mounted on sturdy, fabricated, welded construction base frame.
<b>3-9</b>	<b><i>Sensing Abnormal Conditions</i></b>	<ul style="list-style-type: none"> <li>• Sensing electrical conditions which might cause damages to the generator e.g. high and low output voltages and frequency and sudden severe phase unbalance.</li> <li>• 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.</li> </ul>

### ***4) Generator Control Panel :***

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<b>4-1</b>	<b>General</b>	<p>The control panel shall be fitted on the generator set and shall be able to function as follows:-</p> <ol style="list-style-type: none"> <li>a) Automatically starts up the generator set when receiving the remote start signal from (A.T.S) and stop after cooling the generator when removing the signal.</li> <li>b) Supervise and monitor all Gen-set devices and parameters and react for any abnormal conditions.</li> <li>c) All operation modes, monitoring, measurements, and protection processes should be functioned by using its control and display unit (electronic card).</li> </ol>
<b>4-2</b>	<b>Control and Display Unit (Electronic card)</b>	<p>The control module shall stand the dip in voltage during starting processes, and it shall be isolated by external switch.</p> <p><u>The control module shall perform the following:</u></p> <p>• <b><u>Operation mode selection :</u></b></p> <p>The panel shall contain the following operation modes:</p> <ol style="list-style-type: none"> <li>1) Auto operation mode</li> <li>2) Manual operation mode</li> <li>3) Test operation mode</li> <li>4) Off Mode</li> </ol> <p><b><u>All the above modes shall be selected via soft pressing keys.</u></b></p>

S. No	Component Name	Required Specifications
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4-3	<b>Control And Display Unit (Electronic Card)</b>	<p>• <b><u>Digital Instruments (Measuring, Monitoring and Display):</u></b></p> <ol style="list-style-type: none"> <li>1) AC (line – line / line – neutral) Voltage values.</li> <li>2) AC Current per phase values.</li> <li>3) kVA, kVAR, kW/phase and total, kWh and Power factor.</li> <li>4) Frequency and speed values.</li> <li>5) Running hours for the generator set.</li> <li>6) Battery DC voltage.</li> <li>7) Battery charging DC ampere.</li> <li>8) Oil pressure value (bar, Pascal).</li> <li>9) Engine Temp value (°C).</li> </ol> <p>• <b><u>Indicators, Alarms Lights and Protection for :</u></b></p> <ol style="list-style-type: none"> <li>1) Fail to Start (LED)</li> <li>2) Gen-set normal running (LED)</li> <li>3) High engine temp. (W +SD)</li> <li>4) Low oil pressure. (W +SD)</li> <li>5) Battery charger fail. (W)</li> <li>6) Over/Under speed. (W +SD)</li> <li>7) Over/Under Frequency (W +SD)</li> <li>8) Low water level. (W)</li> <li>9) Over/Under voltage. (W +SD)</li> <li>10) Over load and S.C. (Trip+SD)</li> <li>11) Dynamo charge fail (W)</li> <li>12) Emergency Stop (SD)</li> <li>13) Phase sequence and missing protections.</li> </ol> <p><i>Any alarms (warning and shutdown) occur shall be interpreted as an alphabetic comprehensive text message in display.</i></p> <p>• <b><u>Alarm Retransmission</u></b></p> <ul style="list-style-type: none"> <li>- Gen-set running (shall be free contact)</li> <li>- Gen-set failure (shall be free contact)</li> </ul>
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S. No	Component Name	Required Specifications
4-4	<b><i>Protections Devices</i></b>	<ol style="list-style-type: none"> <li>1) Gen-set output circuit breaker 4 poles (MCB), level protection at least IP 22, breaking capacity current at least 10kA.</li> <li>2) Rated of MCB shall be suitable of Gen-set working at sea level.</li> <li>3) 4-pole Gen-set output surge protection device (SPD) level-1 or level-2.</li> <li>4) Suitable MCBs protection for all input and output (AC /DC) circuits.</li> </ol>
4-5	<b><i>Terminals</i></b>	<ol style="list-style-type: none"> <li>1) Power terminal contacts 4 terminals for output, each terminal shall suit a cross section area 16mm<sup>2</sup>.</li> <li>2) Control and alarm terminals cross section area 4mm<sup>2</sup>, blade screwdriver.</li> <li>3) Suitable terminals for Gen-set's battery (Positive / Negative) and an automatic battery charger(L-N) so that the Gen-set's battery can be easily connected to the automatic battery charger installed in the ATS.</li> </ol>

### 5) **Base Requirement**

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S. No	Component Name	Required Specifications
5-1	<i>Set Requirements</i>	<p><b><u>Guards</u></b></p> <p>a) All moving and rotating parts such as belts, couplings and fans shall be protected by suitable guards to prevent accidental injury to personnel.</p> <p>b) Guards shall be fitted to the engine with side-mounted exhaust manifolds.</p> <p><b><u>Noise and vibration</u></b></p> <p>a) The engine / alternator combination shall be arranged to run free from excessive vibration and noise under all conditions of load and speed.</p>
5-2	<i>Wiring And Conduits</i>	<p>Engine Control wiring shall be multi-strand annealed copper conductor encased by cross-linked Polyethylene insulation resistant to heat, abrasion, oil, water, antifreeze, and diesel fuel. Wiring shall be suitable for continuous use at 120 °C (250°F) with insulation not brittle at -50C° (-60°F). Cables shall be enclosed in nylon flexible conduit which is slotted to allow easy access and moisture to escape.</p>
5-3	<i>Labeling And Fixtures:</i>	<ul style="list-style-type: none"> <li>• Each part shall be labeled similar to the drawings.</li> <li>• All wires and terminals shall be labeled according to the drawings.</li> <li>• All wire terminals and lugs should be tightly fixed.</li> <li>• The labels shall include all information required by IEC standards.</li> </ul>
5-4	<i>Finish</i>	<p>(a) The engine color shall remain the original color as supplied by the manufacturer.</p> <p>(b) Rubber material, which is not fire or fuel proof, is not acceptable.</p>

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### **6) Canopy, Portable Frame And Sound Proof Specifications:**

S. No	Component Name	Required Specifications
6-1	<b><i>Acoustic Enclosure</i></b>	<p><b><u>Canopy Requirements :</u></b></p> <p>a) The enclosure shall allow easy access to the engine, alternator, radiator filler cap and control cubicle for easy maintenance purposes.</p> <p>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.</p> <p>c) The enclosure shall be designed to be Water and weather-proof.</p> <p>d) The noise level generated by the set at full load should be less than 70 dB (A) at 1meter.</p> <p>e) The enclosure base frame should be designed with supports for easy transferred using forklift.</p> <p>f) Two doors for enclosure canopy are preferred.</p> <p>g) Canopy shall be capable of anti-corrosion to withstand high humidity.</p>
6-2	<b><i>Portable Frame</i></b>	<ul style="list-style-type: none"> <li>- The frame which including the engine and alternator must be portable, with two Driving wheels.</li> <li>- Traffic Indicating Light .</li> <li>- Drag &amp; Brake Device .</li> <li>- Moving Type By Car .</li> </ul>

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### **7) Documents And Drawings :**

S. No	Component Name	Documents Required
7-1	<b><i>Engine And Alternator</i></b>	<p><b><i>The contractor shall supply the following manual and drawings:</i></b></p> <ol style="list-style-type: none"> <li>1) Original test factory certificate</li> <li>2) Service and Maintenance Manuals</li> <li>3) Workshop Manual.</li> <li>4) Spare Parts Manual</li> <li>5) Spare part list - indicating make, model, and rating etc.</li> </ol>
7-2	<b><i>Control Panel</i></b>	<ol style="list-style-type: none"> <li>1) Description (operating) manual.</li> <li>2) Control module manual.</li> <li>3) Fault-finding manual.</li> <li>4) Component lists – indicating country of origin, make, etc.</li> <li>5) One original Software program for control panel and one soft copies.</li> <li>6) One software cable link .</li> <li>7) Spare part list - indicating make, model, and rating etc.</li> </ol>
7-3	<b><i>Gen-set</i></b>	<ol style="list-style-type: none"> <li>1) Wiring and schematic drawing showing detailed circuits.</li> <li>2) Each wire, component, terminal, etc. shall be clearly annotated on the drawing for identification and maintenance purposes.</li> <li>3) Hardcopy of every handbook, manual and every drawing per unit (for each).</li> <li>4) In case of handbooks, manual and drawings are not available at the time of final inspection the bidder will not be acceptable.</li> </ol>



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