SR #	DESCRIPTION	QTY REQ
1	Brand New Diesel Generator Set enclosed in Weather Proof & Sound attenuated Canopy **Engine Make:** Cummins QSK78-G9 (UK/USA or EU) with Electronic Injection Fuel System having following specs **Rating**: 2750KVA/2200eKW (**Prime Duty**), 3000KVA/2400eKW (**Standby**); 11,000 V; 1500 rpm, 50 Hz; 0.8 P.F (ISO Conditions) **Alternator:** Stamford (UK/USA or EU only) with Differential CTs (03 installed on Alternator & 03 No shipped loose for installation in MV incoming panel), Insulation Class F or H, 11kV Neutral Ground Resistor (NGR) Panel as per Alternator Requirements **Controller**: Generator sets should be equiped with Deep Sea DSE8610 (UK/EU) **Specifications:** As per attached specifications sheet **Complete with;** • Genset must be original, brand new, and supplier must provide technical certificate from OEM. • All Technical Manuals and Complete drawings. • Engine Preheating System for Lube Oil & Jacket Water. • Electric Starting Motors with Batteries & Battery Charger. • Certificate for life time provision of after sales services and spare parts for gen sets and controllers. • 01 Diesel Tank with 2000 liters capacity for each gen set. • 05 years operational and maintenance spares for each gen set. • 01 No. spare controller for each genset. • Factory Acceptance Test Report of gen sets. • Free of cost pre-shipment Test bench inspection including load / no load etc. • Testing by 02 buyer's engineers at OEM premises.	2

TECHNICAL DETAILS OF DIESEL GENERAOR SET:

Brand New Diesel Generator Set, Make: Cummins QSK78-G9 (UK/USA or EU) 2750KVA/2200eKW **Prime duty,** 3000KVA/2400eKW **(Standby)** at 1500 RPM, 50 Hz, 0.8 PF & 11KV with sound attenuated and weather proof canopy.

Generator sets should be equipped with Deep Sea DSE8610 (UK/EU). This can control following functions:

i. Start and stop of Engine set.
ii. Synchronizing and load sharing between the diesel generator sets.
iii. Detect the failure and health of grid supply and shifting of load on generator sets in case of grid failure and back on grid after restoration of grid.
iv. Details ANSI codes available with controllers.
v. Details of Engine protection.

ENGINE

i. Make: Engine: Cummins QSK78-G9 (UK/USA or EU)
ii. 04 Stroke, Water Cooled
iii. Electronic Injected
iv. Turbocharged and Aftercooled
v. Jacket Water heater, pre-heating of water and lube oil and Pre-lubrication system

1. AIR INLET SYSTEM
   i. Normal Duty Engine Air Cleaner
2. ALTERNATOR
   i. Make: Stamford (USA/UK or EU)
   ii. 50 Hz, 11,000 V, 0.8 PF,
   iii. Double bearing
   iv. Stator Winding Temperature Sensors- 2RTDs Per Phase
   v. Bearing Temperature Sensors RTDs
   vi. Voltage Regulator –PMG
   vii. 11KV Neutral Ground Resister (NGR) Panel As per alternator requirement
   viii. 240V Main Generator Heater
   ix. Insulation Class F or H
   x. Degree of Protection IP 23
   xi. The instantaneous voltage dip shall not exceed 10% of rated voltage when full load, at rated power factor, is suddenly applied. Recovery of stable operation shall occur within 5 seconds. Steady state modulation shall not exceed +0.5%.
   xii. The alternator shall be AVR (Automatic Voltage Regulator) controlled (digital type)
3. CANOPY
   i. Sound attenuated and weather proof enclosure with sound attenuation level of 85dB and enough inside space for maintenance purpose.

ii. The generator set shall be manufactured and housed completely into a weatherproof and sound attenuated enclosure, with standard forklift slots and two standard load locking /lifting fittings. The arrangement inside the enclosure shall allow for the generating set to be pulled out in either direction after unbolting sound attenuation enclosure, anti-vibration mounts etc.

iii. All sheet metal shall be primed for corrosion protection and finish painted and shall be suitable for a minimum of 30 years life.

iv. The canopy shall be supplied with lockable doors and window to view control panel.

v. The enclosure shall be outfitted with all necessary louvered openings to provide sufficient ventilation to the generator set during operation.

vi. Ceiling mounted Light bulb (220V), providing sufficient light on both sides of the generator.

vii. Suitable outlet for distribution cable, that when not in use is covered by a bolt-on cover accessible from inside only.

viii. Sound proofing materials should be highly fire protective and reliable

ix. Dimensional data shall be given for the Engine/Alternator set and for the weatherproof enclosure:

- Weight of skid mounted unit
- Overall weight of generator set including canopy
- Overall length
- Overall width
- Overall height
- Exhaust pipe size
- CFM of air required for combustion and ventilation
- Heat rejected to jacket water and lubricating oil BTU/hr
- Heat rejected to room by engine and alternator set BTU/hr

4. DATA SHEETS

i. Engine Data:

- Manufacturer
- Date of manufacture
- Model
- Number of Cylinders
- RPM
- Bore x stroke
- BMEP at full rated load
- Piston speed, FPM
- Make, model and descriptive literature of electronic governor, turbocharger, water circulation pumps and other major components of generator set

- Fuel consumption rate curves at various loads
- Gross engine horsepower to produce generator continuous rating (including fan and all parasitic loads) HP

ii. Alternator Data

- Manufacturer
- Date of manufacture
- Model
- Rated kVA
- Rated kW
- Voltage
- Temperature rise above 50°C ambient;
  - i. Stator by thermometer
  - ii. Field by resistance
  - iii. Class of insulation
- Generator efficiency including excitation losses and at 0.8 power factor and at;
  - i. Full load
  - ii. ¾ load
  - iii. ½ load
- Actual electrical diagrams including schematic diagrams, and interconnection wiring diagrams for all equipment to be provided.
- The generator set shall be operated at an altitude of 300 meters above sea level and a temperature range between 10°C to 52°C, so it shall be able to provide required output at these conditions.

5. EXHAUST SYSTEM

i. Industrial Grade Silencer with 10dB sound attenuation
ii. Exhaust Flexible with System Fixing Kit
iii. Mechanical support for exhaust

6. COOLING SYSTEM

i. Heat Exchanger Type or Remote Radiator Type or Engine Mounted Fan Radiator.
ii. Engine Pre-Heating Circuit to aid engine starting in cold weather.
iii. Water pumps for jacket water and turbocharger intercooler cooling complete with thermostatic bypasses.
iv. Alarms and trip sensors for high/low coolant levels and temperatures.

7. CONTROL SYSTEM

Generator sets should be equipped with Deep Sea DSE8610 (UK/EU) which can control following functions:

i. Start and stop of Engine set.
ii. Synchronizing and load sharing between the diesel generator sets.

iii. Deduct the failure and health of grid supply and shifting of load on generator sets in case of grid failure and back on grid after restoration of grid.
iv. Details ANSI codes available with controllers.
i. Details of Engine protection.
ii. Comprehensive indication including but not limited to;
- Diesel generator voltage (LL&LN)/current per phase
- Battery voltage
- Power meters for diesel generator kW, kWh, kVAr
- Power factor
- Frequency
- Lube oil pressure/temperature
- Fuel system monitoring
- Engine/Alternator speed
- Coolant temperatures
- Coolant pressure
- Start fail.

iii. Panel controls for circuit breaker
iv. Panel controls and status of diesel generator test, manual and automatic operations
v. Emergency stop – lock down / twist to release mushroom style
vi. The control system shall log total number of operating hours and total kWHrs
vii. The control system shall log total fuel consumed given certain number of operating hours and or total kWhrs
viii. Control Panel Mounting
ix. Controller Display Language: English
x. Paralleling Option: 3 Phase Differential CT's (3x CT's)
xi. Shutdown –Audible Alarm
xii. Meters –AC Output Digital
xiii. Display –Control Graphical

8. **ENGINE STATUS MONITORING**

i. The following information shall be available on display status panel on the generator set control:
- Engine oil pressure (psi or kPA)
- Engine Coolant Pressure (psi,kPa)
- Engine Intake Air Pressure
- Engine coolant temperature (degrees C)
- Engine oil temperature (degrees C)
- Engine speed (rpm)
- Number of hours of operation (hours)
- Number of start attempts

- Battery voltage (DC volts).

9. SOFTWARE

i. Softwares and programs for all control modules, Governor and AVR with communication leads.

ii. All software shall be licensed and supplied with activation Key.

10. MANUALS CATALOGUES AND ELECTRICAL DRAWINGS

i. Manuals, catalogues and drawings and any other documentation supplied shall be available in English. The following manuals and catalogues shall be supplied with each generator set, as well as with the quotation;

- Operation and maintenance Manuals for engine, alternator and complete generator set.
- Control and synchronization installation and operation manual.
- Troubleshooting Manuals for engine, alternator and complete generator set.
- Spare Parts Manuals and catalogues.
- Electric diagram.

ii. The supplier shall provide complete maintenance procedures for all the equipment supplied. Schedules for maintenance to be effected on a daily, weekly, monthly, etc. and on hourly run basis should be included.

iii. Guidelines for the selection of fuel oil, lubricating oil, use of water treatment additives and anti-freeze if applicable.

iv. Troubleshooting procedures shall be available to enable the timely diagnosis of a defect considered likely to occur in service. Reference outputs and conditions shall be quoted to facilitate diagnosis.

v. Note: It is mandatory that one set of above manuals, catalogues, and electrical drawings/diagrams for generator set is supplied with the quotation. Quotations shall not be acceptable unless the offer includes these items.

11. FACTORY ACCEPTANCE TESTS (FAT)

i. The Supplier shall provide the respective reports including test results and certifications of factory tests of generator set and control panels of the complete supply. This shall include but not limited to;

- Operation of all alarms, trips safety protection devices and confirmation of operation, and their indication on the diesel generator controllers.
- Operation of all status indications and their indication on the diesel generator controllers.
- Load tests at one quarter/one half/three quarters and full load, for a minimum of 4hours per test.
- Drop and recovery load tests to an agreed regime.
- Over speed tests

12. DRAWINGS AND DOCUMENTS

i. The Supplier shall provide Operating and Maintenance Manuals for all equipment supplied (i.e. Governors, AVRs, PLCs, Diesel Generator, Controllers, etc.) in English.
ii. The format of the Operating and Maintenance Manuals or information contained therein, shall be provided in electronic (CD/DVD) and paper format and comprise instructions, diagrams and drawings which shall be sufficiently comprehensive to facilitate the training of the staff and to enable the operation and maintenance of the equipment to be performed in a safe and efficient manner.
iii. Detailed descriptions of equipment components and systems including detailed drawings.
iv. Design and material limits for loadings such as pressure, temperatures, voltage, current, operating limits, settings, etc.
v. Details of electrical circuits, accompanied by schematic and logic diagrams, indicating the physical location of the equipment parts.
vi. A list of alarms detailing alarm initiator location and setting for alarm operation and reset.
vii. Pre-start check lists covering all the systems.
viii. Starting procedures.
ix. In service checks and limits including routine test procedures.
x. Shutting down procedures.
xi. Operating instructions are required for all items of equipment for start-up, normal operation, shutdown, standby, emergency action, and on load and off load testing procedures, and shall contain the operating procedures of the systems, in addition to the emergency and abnormal conditions procedures.
xii. Actions upon receipt of alarm/alarm condition/appropriate action.
xiii. Emergency procedures for each major fault situation.
xiv. Diagnostic procedures.
xv. Separate maintenance instructions shall be prepared for each item of the generator set and shall be set out in step-by-step instructions with each step numbered in correct logical sequence and including;
    - Maintenance programs for regular inspections, preventative maintenance and overhauls, described on the basis of frequency (viz., daily, weekly, monthly, three monthly, annual, and the like).
    - Special diagrams and illustrations.
    - Parts lists presented in a logical sequence (i.e. main assembly, sub-assembly and components) with the components listed under their respective sub-assemblies.
    - Lubrication schedule showing requirements and specifications for lubricants for the diesel generator.
    - Cleaning and conservation procedures.

- List of special tools and equipment required.
- Check list of operations prior to dismantling.
- Dismantling sequence, with particulars of methods used.
- Inspection of components and checking of permissible tolerances.
- Reconditioning, replacement and adjustment procedures.
- Reassembly sequence, with particulars of methods to be adopted.
- Recommended spares list

xvi. The following drawings and documentation shall be submitted;

- Outline drawing of each diesel generator container showing major dimensions and weights, hold down arrangements of the diesel generator container, and cable access for all 11 KV power cables, control and communications cabling.
- Internal layout drawing of each diesel generator showing major components.
- External layout drawing of each diesel generator showing major components and components removed for shipping.
- Control system overview drawing showing details of all main components and monitoring, control and communication interfaces.
- Technical data, information on the diesel generators, all main components and their operating mechanisms.
- Technical data on the alternator including capability curves and all reactance and rating information.
- Technical data on all control system components, protection relays, etc.
- Calculations for silencers and exhausts for noise levels.
- Calculations for radiator
- Detail of connection arrangements to allow removal of the engine and alternator skid from the canopy when the engine and alternator skid is removed for major servicing.
- General arrangement drawings of all equipment, including control panels
- Complete Control System schematics and drawings.
- Connection drawings, showing terminations and labeling.

13. MAXIMUM VOLTAGE AND FREQUENCY EXCURSIONS

i. The generator set shall also be capable of operating under the following situations;

- The full capacity loading of the set shall be possible within 20 seconds.
- At 30% load steps the speed shall not change by more than 1% of nominal (depression) after not more than 5 seconds from load changes.
- At 30% load steps the voltage shall not change by more than 5% of nominal (depression) after not more than 5 seconds from load changes.