To

Dear Sir/Madam,

Sub: Quotation for 500KVA Diesel Generator Set With AMF Panel – Reg.

Ref: Our Enquiry No. IITH/ Maint/2012/045/ dated 11.10.2012

Last date & time for submission of offer: 25-10-2012 by 11.00 a.m

Date & Time of Tender Opening 25-10-2012 at 11.30 a.m

This Institute is interested in purchase of the following Indigenous / Imports material as per the enclosed terms and conditions.

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Description</th>
<th>Qty Nos.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Make : Kirloskar/ Cummins / Ashok Leyland/ Mahendra &amp; Mahendra / Caterpillar</td>
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<td></td>
<td>Supply Installation testing &amp; Commissioning of 500KVA Diesel Generator Set comprising of Water cooled, electrical start diesel engine couple to brush less alternator mounted on a common base frame including with control panel, fuel tank, Batteries, complete with Acoustic Enclosure</td>
<td>01</td>
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<tr>
<td>2</td>
<td>Supply Installation testing &amp; Commissioning of AMF Panel suitable for 500KVA DGSet.</td>
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<td>As per Specification Enclosed</td>
<td>01</td>
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</tbody>
</table>

For Technical Clarification: Please Contact: Mr. Srinivas Yadav, Junior Engineer, Tel : 040 2301-6120, Email : snivas_p@iith.ac.in Mob : 94910 40822

Note - Tenderer must fill up the Datasheet and submit along with tender duly signed

Kindly acknowledge receipt.

Yours faithfully,

(V. VENKAT RAO)
DEPUTY REGISTRAR (S & P)
TERMS & CONDITIONS:

1. We are interested in the material available from Ready Stock.

2. The rate quoted should be **free delivery at IITH Stores, Yeddumailaram 502205.**

3. The complete offer should be typed in the letterhead of the tenderer. The offer should be signed & stamped by Company’s authorized signatory.

4. Rates quoted in the tender should be inclusive of all taxes, and should be valid for 90 days. Breakdown details of packing, forwarding, freight and insurance charges in percentages should be shown separately. The goods should be insured in our favor against all risks from Warehouse to Warehouse.

5. The rate of VAT/CST should be clearly indicated wherever chargeable. This Institute is not eligible to issue C or D form. However the concessional rate of Central Sales Tax admissible to research institutes on purchase of scientific equipments from certain States is applicable to this Institute.

6. **EMD:** The tenderer should submit an EMD amount of Rs.60,000/- (Rupees Sixty Thousand only) along with the tender by way of Demand draft / BG/ Banker pay order drawn in favour of “Indian Institute of Technology Hyderabad” and payable at Hyderabad from any nationalized bank valid for six months. The Technical Bid without EMD would be considered as UNRESPONSIVE and will not be accepted. The EMD will be returned without any interest to the unsuccessful bidders immediately after the award of contract.

7. **Performance Security:** The successful bidder to submit performance security for an amount of 10% of the order value in the form of DD / BG from any nationalized bank and should be valid for 60 days beyond the date of completion of all contractual obligation including warranty obligation. And it will be returned after 60 days beyond warranty period.

8. The Delivery period should clearly indicated and strictly adhered to in the event of an order is placed against your offer. Late delivery will attract liquidated damages @1 % per week subject to a maximum of 10% of the total value of supply order.

9. Incase any of the items mentioned on pre-page is on the current rate/running contract please quote the DGS&D rate contract reference and also send a copy of the latest R.C.

10. **Payment** for the supply will be made by Cross Cheque on the State Bank of India, IIT Hyderabad Branch, within 30days from the date of receipt and acceptance of material and your bill in triplicate original signed over a revenue stamp affixed. In case of Equipment/Instruments the payment will be made after installation of the material.

11. Quotation erased & overwritten will be summarily rejected unless corrections are authenticated with the tenderer’s signature.

12. The Offer should be submitted strictly as per the terms and conditions failing which the offer will be liable for rejection. In the event of the tenderer remaining silent on any terms& conditions of the IIT, it will be presumed that the tenderer(s) have accepted such terms and conditions in the event of any order/contract on them.

13. **No deviation of the terms and conditions is acceptable.** Terms and conditions which are in deviation of the tender terms are liable for rejection without making back reference to the tenderer.

14. Conditional tenders will not be accepted.

15. The quotation should be sealed and addressed to The Director, Indian Institute of Technology Hyderabad, ODF Estate, Yeddumailaram 502205, A.P. India. The inner cover should be sealed with wax and super scribed as per subject and enquiry No. mentioned on pre page. Quotation delivered personally should be delivered to the Receipt &Dispatch Section of IIT Hyderabad. Late & Delayed tenders will not be considered.

16. **IITH Hyderabad does not take any responsibility for loss of tender in transit.**

17. The tender(s) should enclose the list of similar item(s) supplied to any of the IIT Laboratories for the past three years with complete address, telephone /Fax No. and the contact person to whom they have supplied and installed similar item(s) with their tenders along with the prices finally paid.

18. **INSPECTION:** Our representative will come on the convenient of IITH and inspect Transformer at their works before delivery. During inspection the following should be done: Demonstrate the Transformer that it is capable of delivering power upto full load. Winding resistance, Ratio, Polarity, Phase relationship, Impedance voltage, Load losses, No load losses, No load current, IR, RTCC operation, AVR Test, HV Test, Guarantee - 12 months. Provide a copy of Excise Duty Gate pass from manufacturer and Type test report. After satisfactory inspection and certification of the items by our representative, you will deliver the unit at our Institute premises (Door delivery).
19. **Warranty & Maintenance contract:** The supplier shall warrant equipment, system components for a minimum period of **One years** following satisfactory installation and commissioning. The defects, if any, during the guarantee/warranty period are to be rectified free of charge by arranging free replacement wherever necessary. Any expenditure including government levies on account of the replacement are to be borne by the supplier/agent.

The supplier shall offer an annual test & maintenance agreement for three years, consisting of the following:

- Regularly and systematically examine, test and adjust all system components.
- Submit test reports that certify all components have been tested and the system is in proper working order and functions in accordance with this specification.

20. Please submit & confirm the following that will be complied with by the vendor during supply of the system.

   a) **Spares & service Support:** Please certify that the instrument supplied shall be of latest technology and model, so that you would support with onsite service and spares for next 10 years.
   
   b) Exhaustive soft and hard copy of installation operation, users, applications manuals, maintenance & service manuals shall include system interconnection diagram, general arrangement of equipment drawing, complete circuit diagram, trouble shooting tips & diagnostic methods.
   
   c) Standard toolkit shall be provided for general maintenance service.
   
   d) Recommended essential spare parts and consumables with budgetary price.
   
   e) Complete system pre-installation requirements.

21. **Installation & Testing:** The installation shall be completed with in a week from the date of intimation regarding the arrival of the equipment in the institute. A Penalty equivalent to 1% of the value of the goods will be levied for every week’s delay in installation. The installed system shall be performance tested at our premises in accordance with the manufacturer’s/supplier’s recommendation/specifications. Tests shall demonstrate the proper operation of the instrument and all components.

22. **Commissioning & Training:** The supplier shall perform on site installation, commissioning & startup of all system components in order to provide fully functional system. The supplier shall train onsite institute’s personnel on the operation and maintenance of the system framework. The supplier shall perform system check-out /start-up and /or training functions free of cost.

23. The Director, IIT Hyderabad reserves the right to reject or accept or withdraw the tender in full or part and to increase or decrease the quantity without assigning reason thereof.

24. The quotations are liable to be rejected if any of the above conditions are not complied with. The quotations should be complete in all respects duly signed wherever required. Incomplete and unsigned offers will not be considered. Quotations that are unclear leave room for interpretation will be considered non-responsive and will not be evaluate.

25. **ARBITRATION:**

   a) Unless otherwise specified, in all cases of disputes which cannot be settled by mutual negotiations, the disputes or differences shall finally be settled and binding on both parties by arbitration in conformity with the rules of Indian Arbitration Act, 1940. All disputes or differences what so ever arising between the parties out of relating to the construction, meaning and operation or effect of the general terms and conditions including the Purchase Order or the breach thereof shall be settled by Arbitration Act, 1940 and the award made in pursuance thereof shall be binding on the parties.
   
   b) Performance of the purchase order shall continue during arbitration and any subsequent proceedings.
   
   c) The Jurisdiction and Venue of arbitration shall be Hyderabad. The Arbitrator will be the Director, IIT Hyderabad, or his nominee.

26. **RISK PURCHASE:** If you fail to deliver the ordered material within the maximum delivery period stipulated in the purchase order, we may procure the same items in such a manner as it deemed appropriate for us. And , if we happen to incur any additional cost in the process of our procurement of similar materials you are liable to pay the same.

27. **FORCE MAJURE:** If the performance of the obligation of either party is rendered commercially impossible by any of the events herein-after mentioned, the same party shall notice of 15 days from the date of such an event in writing to the other party.

   i) Government regulation;  
   ii) Legislation;  
   iii) Natural disasters;  
   iv) Strikes;  
   v) Lockout;  
   vi) Act of God.
TECHNICAL SPECIFICATION FOR DGSET

1. GENERAL
This specification covers the supply, installation, testing and commissioning of 1 X 500 KVA diesel generating system covering the diesel engine, alternator, engine control panel, associated accessories, cooling system, ventilation system, fuel and exhaust system, acoustic enclosure and switchgear etc.

The installation work shall be carried out as per CPWD General Specifications for Electrical Works, Part VII (DG SET works) 2006 as amended up to date along with the following changes, CPWD General Specifications for Electrical Works Part-1 , II & IV, as amended up to date, relevant IE rules, and as per directions of Engineer-in-Charge. For electrical panels, CPWD General Specifications for Electrical Works Part-IV shall be applicable

2. SCOPE OF WORK:
The scope of work shall supply, installation, testing and commissioning of the following items. The supplier shall study the requirements stipulated in the specification and also to suit the site conditions and offer a complete system with guaranteed performance under operating conditions specified.

i) 415V, 3-phase + Neutral, 500 KVA 1500 RPM, DG set with accessories as specified.
ii) Set mounted microprocessor based engine control panel
iii) Radiator cooling system
iv) Exhaust piping including supports as per CPC norms
v) Thermal insulation for exhaust piping
vi) Exhaust stacks with steel supporting system for these sets
vii) Fuel piping
viii)Integral Acoustic enclosure
ix) Switchgear panel as specified
x) Obtaining approval of the installation from pollution control board and all other statutory authorities
xi) Preparation of related schematic and GA drawings for DG installation exhausts piping, fuel piping, ventilation system, acoustic enclosure, etc.
xii) Testing and commissioning of the installation.

Any related work covering supply of installation materials, consumables, etc. whether specified or not, to render the system fully functional and conforming to the best engineering standards. This shall include battery charging.

3. ELECTRICAL SUPPLY SPECIFICATIONS:
Nominal voltage: 415V + 10%

No. of Phases: 3 + Neutral

Frequency: 50 Hz + 3%

Control supply: 24V, 2-wire DC

4. DIESEL ENGINE & ACCESSORIES
4.1 ENGINE
The diesel engines shall be of approved make, direct injection, four stroke, multi cylinder, water cooled, radiator type, turbo charged, operating at a nominal speed of 1500 R.P.M and capable of developing requisite BHP.
The engine and the governing system shall be suitable for AMF duty power generating application through PLC and shall conform to BS: 5514 / IS 3046 / BS 649 / IS 10002. The unit shall be suitable for operation on high speed diesel oil available in Indian Market.

The engine shall be electric start and shall be suitable for battery assisted manual / auto starting.

The governing system of the engine shall be electronic type and suitable to control frequency variation within ± 3% whenever a load is switched in or thrown off.

The engine fitments shall include but not be limited to the following.

i) Flexible coupling and flywheel with guard
ii) Dry type air filter
iii) Cooling radiator
iv) Fuel pump
v) Electronic governor
vi) Dual fuel filter with on line filter changing provision
vii) Lube oil pump, oil cooler and filter
viii) Turbo charger
ix) 24V DC starter & battery charging alternator

Engine mounted microprocessor based control panel to display the following engine and electrical parameters:

i) Lube oil pressure indicator and temperature gauge
ii) Tacho meter for speed indication with hour meter
iii) Battery charging Ammeter
iv) Starting switch with key
v) Over speed stop switch with contacts
vi) Low lube oil pressure switch
vii) High water temperature alarm & trip
viii) Stainless steel flexible for engine exhaust
ix) Stop solenoid
x) Control cables from Engine to AMF screened cables

The engine speed shall be regulated through an electronic governing system which shall also provide the over speed protection. The governor shall ensure that the speed of the set is regulated within 1% of the nominal speed under normal operating conditions.

The DG set shall be capable of handling step load up to 70% of the capacity without dropping other loads due to voltage dips. Further the engine shall be capable of taking full load within 10 seconds of starting. All moving parts of the engine and other associated equipment shall be provided with guards to prevent accidental contact. The guard shall be designed to facilitate easy removal and reinstallation.

The engine supplied with first filling of oil of required quantity as recommended by the manufacturers.

4.2 ACCESSORIES
The following accessories shall be supplied with the DG set.

i) Common base frame for the engine and alternator
ii) Antivibration mounts of suitable capacity
iii) Residential Silencer
iv) Protective guards for all rotating parts
v) Electric driven lube oil priming pump complete with hosepipes and couplers
vi) Diesel tank of 1000 Ltrs. Capacity fabricated out of 6mm thick sheet steel including first filling of diesel. The tank shall be further complete with overflow pipe, drain pipe, fuel level indicator, valves, and manhole with cover, low level contact & alarm.

4.2.1 BATTERIES
The batteries shall be of heavy duty, high performance lead acid type of Exide make. Each battery shall be rated 12V, 180 AH.

Battery shall be suitable for three successive starting attempts each of 10 seconds duration with a gap of 5 seconds between successive starts.

The battery shall be supplied complete with electrolyte and accessories. The accessories shall include battery stand, battery leads with terminal ends acrylic top cover and inter battery connectors.

Each battery is provided with a charger to charge the batteries when the set is not running. The charger shall get disconnected while the generator set is running.

4.2.2 CONTROL PANEL
Each set shall be supplied with an engine mounted Microprocessor based control panel. The control panel shall display all the engine, alternator & battery parameters. If possible it shall not only display faults but also keep a record of faults. An emergency stop push button will be provided to stop the DG during emergency. For Engine faults, the set will be stopped in emergency mode & for electrical faults it shall be stopped with a time delay for cooling down. An audible alarm shall be provided in the main panel to announce tripping of DG’s.

4.2.3 ALARMS
The following alarms shall be provided in the DG control Panel to indicate & protect against abnormal operations.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Status</th>
<th>Function</th>
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</thead>
<tbody>
<tr>
<td>Low Oil Pressure</td>
<td>2 stage Alarm</td>
<td>Engine Stop</td>
</tr>
<tr>
<td>High Water Temperature</td>
<td>2 stage Alarm</td>
<td>Engine Sop</td>
</tr>
<tr>
<td>Over Speed</td>
<td>Alarm</td>
<td>Engine Stop</td>
</tr>
<tr>
<td>Low Fuel Level</td>
<td>Day tank Alarm</td>
<td>Engine Stop</td>
</tr>
<tr>
<td>High Fuel Level</td>
<td>Day tank Alarm</td>
<td>Engine Stop</td>
</tr>
<tr>
<td>Earth fault on Alternator</td>
<td>Alarm</td>
<td>Engine Stop</td>
</tr>
<tr>
<td>Fail to start</td>
<td>Alarm</td>
<td></td>
</tr>
<tr>
<td>Battery charger fault</td>
<td>Alarm</td>
<td></td>
</tr>
</tbody>
</table>

4.2.4 AUTOMATIC MAINS FAILURE
On receiving signal from voltage monitor relay (shall be supplied by the DG vendor to the panel builder) provided in the EB incomer panel for low voltage, power failure or phase failure, the set shall start & on developing the voltage the respective DG breaker shall close & start feeding loads. On resumption of EB power the voltage monitor will monitor the voltage for a preset time (3-10 min) & then trip the DG breakers & subsequently close the EB breaker. Necessary control wiring between the DG Control Panel & the DG breakers in the DG panel shall be in the scope of work of the DG vendor.

5. ALTERNATOR
1500 RPM, 415V, 3-Phase, 500 KVA, star connected, 50 Hz, 0.8 P.F, horizontal foot mounted, double bearing, self excited, self-regulated, brushless, screen protected drip proof (SDPD), continuous duty alternator with class “H” insulation in IP-23 enclosure incorporating the following.
i) Voltage Regulation ±1.0% of rated voltage from no load to full load.
ii) Self excited and self regulated.
iii) Permissible Overload: 10% for one hour in 12 hours of duration.
iv) Separately mounted adapter box suitable for cable termination of required size armoured Aluminium FRLS XLPE cable between alternator terminals and adapter box (2 runs of 400 sq. mm cable per phase).

5.1 THE ALTERNATOR SHALL FURTHER MEET THE FOLLOWING SPECIFICATIONS
The alternator shall conform to IS 4722 / IEC 34 as amended up to date.
The alternator shall be suitable for 20% over speed for two minutes.
The alternator shall be capable of carrying 50% overload for a duration of one minute.
The alternator shall be capable of carrying 10% overloading for one hour in any period of 12 hrs running.
The alternator terminal voltage for any load variation should be maintained within + 5%.
The field coil terminals shall be wired to terminal box for external speed control.
Both ends of each phase winding shall be brought to the terminal box.
The alternator shall withstand a 3-phase short circuit at the terminals for a period of 3 seconds.
The total harmonic distortion shall not exceed 3% and the design shall permit upto 30% unbalance between phases while in operation.

6. PERFORMANCE
With the integral acoustic enclosure, the sound pressure levels when measured at a distance of 1mtr outside the DG enclosure louvers shall be not more than 70 dB (A) under free field conditions.

7. DIMENSIONS
The overall dimensions of the enclosure shall be such as to provide free movement all round the DG set inside the enclosure. Two sliding doors of adequate size shall be provided on either side of the DG set to facilitate easy inspection and carry out maintenance works.

8. PIPING & ACCESSORIES
The piping shall be of Class “B” M.S pipe

All accessories such as strainer, isolating valves, non-return valves etc. shall be supplied as required based on approved piping layout drawings.

The piping schematic shall be submitted with the bid. Which should include supply, over flow return from engine & drain pipes.

The piping shall be painted with one coat of primer and two coats of finishing paint of approved color.

One number manual gear pump for filling the day tank shall be supplied per DG.

9. SPARES
The DG set will be supplied with the following spares, which shall be handed over at the time of commissioning.
   i) 1sets of renewable parts of oil, fuel & air filters.
   ii) 1 Nos. fan belts.
   iii) 1 spare relays of each type.
   iv) 1 sets of fuel injectors.
   v) 1 No. Manual gear pump

10. INSTALLATION
The bidder shall undertake the installation work at site. The general scope of installation work as following.

10.1 DIESEL GENERATOR SET
The assembled Diesel Generator set shall be installed in the container on anti-vibration mounts. The unit shall be visually inspected for any transit damage.

The contractor shall arrange for the inspection of the set by the diesel engine manufacturer’s authorized representative and obtain his approval before rolling the set.

The fuel oil day tank shall be installed over the drip tray

The batteries shall be fully charged, installed and connected.

The battery charger shall be heavy duty.

10.2 FUEL PIPING
The fuel piping shall include supply and installation of Class “B” MS pipes of adequate size with necessary valves and accessories required for the supply & return lines from day tank to the engines. The pipes shall be painted with primer over which 2 coats approved colour paint shall be applied.

The joints in the line shall be properly sealed to avoid any leakage of fuel.

10.3 EXHAUST PIPING
The exhaust piping shall be fabricated from MS pipes.

The exhaust piping and the silencers shall be insulated using 50mm thick mineral wool inside the container & up to the exhaust stack. The insulation shall be cladded with 24G aluminium sheet.

The exhaust pipe shall be supported using spring suspension supports.

The shipping sections of the stack shall be welded at site and erected over the MS frame work. The entire length including the flanges, bolts and washers shall be aluminised inside and outside to inhibit corrosion. A weather cowl shall be provided on top.

All tools and tackles used for the erection shall have valid safety certification.

11. TESTING:

11.1 AT MANUFACTURER’S WORKS
The routine tests and full load test on Engine, Alternator shall be carried out at manufacturer’s work in accordance with applicable Indian standards.

11.2 TESTING AT ‘OEA’s WORKS
Following tests shall be conducted at the assembler’s work in the presence of client’s representatives.

Full load testing for 8 hours with load bank.

Overload testing at 10% overload for one hour immediately after the full load test.

Operation of protective devices.

11.3 SITE TESTING
Following tests shall be conducted at site in the presence of the client’s representative before energisation. The vendor shall provide all testing equipment, labour and consumables required for the testing.

Insulation resistance test on alternator, control panel and cabling.

Checking the AMF operation both on auto and manual mode through PLC and synchronization.
Checking the engine safeties for satisfactory operation.

Checking vibration levels.

Testing of individual protective devices on engine and alternator and ensuring that the wiring is carried out properly.

Full load running for 8 hours continuously. All the readings shall be logged to evaluate the fuel consumption, lube oil pressure, water & oil temperature vis-à-vis the electrical load.

One hour overload testing at 110% load shall be carried out at the end of the full load trial. Any deviation from the guaranteed parameters shall be made good and these performance parameters should be measured once again till the required results are achieved.

The DG set shall be deemed to be commissioned after satisfactory performance of all associated equipment.

12. TAKING OVER
The clients will take over the DG set for operation on completion of the following.

DG set are installed, tested and commissioned as per the specifications.

Original test certificates are furnished for engine, alternator, acoustic enclosure, centrifuge and all other bought out items.

Load trials are successfully conducted including the performance of acoustic enclosure and ventilation fans.

Approvals are obtained from Pollution Control Board and Electrical Inspectorate.

2 sets of AS BUILT documentation spare parts list, maintenance chart and operation and maintenance manual are to be submitted.

The set shall be handed over with first fill of lube oil and day tanks full of diesel oil along with spares mentioned.

13. GUARANTEE
13.1 DG SET
The DG set and accessories shall be guaranteed for satisfactory operation for a period of 12 months from the date of commissioning or 5000 running hours from the date of supply whichever is earlier. Any defects noticed during this period shall be rectified free of cost.

The supplier shall indicate the type of records to be maintained so that the warranty claims if any are honored by the manufacturer.

14. MAINTENANCE
The bidder shall be required to maintain the installation at no extra cost to the owner for a period of year from the date of commissioning. During this period, the contractor shall make good any defects caused due to faulty design, bad workmanship and poor quality of materials.

15. DOCUMENTATION
As a part of the equipment supply, following documentation shall be furnished.

i) General arrangement plan of DG set.
ii) Piping schematic diagram
iii) Layout of fuel and exhaust piping.
Calculations for ventilation system design.

Engine wiring diagram.

Test certificate for engine and alternator.

Installation, operation and maintenance instructions for diesel engine, alternator.

TECHNICAL SPECIFICATION FOR AMF PANEL

1.0 GENERAL
The panels shall be metal clad, totally enclosed, rigid, floor mounting, air insulated, cubical type for use on 415volts, 3 phase, 4 Wire 50 cycles system. The equipment shall be designed for operation in high ambient temperature and high humidity tropical atmospheric conditions. Means shall be provided to facilitate ease of inspection, cleaning and repairs, for use in installations where continuity of operation is of prime importance. Panel shall be fabricated from 2 mm thick CRCA sheet steel Gland Plates shall be from 3 mm thick sheet steel. Degree of Protection shall be IP 54.

The panel shall consist of the following:
Panel shall be operated with 3 modes of operation
1) Auto
2) Manual
3) Test

In Auto mode operation, load sharing, load synchronizing shall be done through PLC.

In Manual mode, DG set selected shall start manually and load synchronizing shall be done manually.

In Test operation,

Each DG AMF Panel shall be provided with the following
i) Mains supply failure monitor (3 phase voltage sensing)
ii) Supply failure timer
iii) Restoration timer
iv) 3 impulse automatic engine start / stop & failure to start lock out
v) Generator Voltage, current & Frequency sensing – RPM indication
vi) Battery voltage sensing
vii) Selector switches & push buttons:
  viii) Manual / Auto / Test Selector switch
  ix) Generator START / STOP
  x) Generator Breaker Close / Trip; Mains Breaker Close / Trip
xi) Indications:
    DG ON, DG Breaker ON; Mains Breaker On; Mains ON
xii) Metering:
    Combined digital meter to measure Volts; Amps; Frequency
    Combined digital meter for kVA, kW, PF
    Digital display type kWH meter

SOLID STATE ANNUNCIATOR SHALL BE PROVIDED WITH THE FOLLOWING FAULTS

<table>
<thead>
<tr>
<th>FAULTS</th>
<th>ALARM</th>
<th>TRIP</th>
<th>ANN.</th>
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<tbody>
<tr>
<td>set fails to start</td>
<td>√</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>low lube oil pressure</td>
<td>√</td>
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Battery charger shall consist of:
SMPS based automatic battery charger with DC Voltmeter; DC Ammeter
Selector switch for trickle/off/boost, auto/manual switch for boost to float changeover copper bus bar

The equipment shall be designed to confirm to the requirements of:
IS 4237 - General requirements for switchgear and control gears for voltages not exceeding 1100 volts.
IS 2147 - Degree of protection provided by enclosures for low voltages switchgear and control gear.
IS 375 - Marking and arrangements of bus bars.

Individual equipment housed in the power control to the following IS specifications:

i) Moulded case circuit breakers - IS 2516 (Part I & II/Sec.1) 1977
ii) Fuse switch and switch fuse units - IS 4064: 1978.
iv) Current Transformer - IS 2705.
v) Voltage Transformer - IS 3156.
vi) Relays - IS 3231.
vii) Indicating Instruments - IS 1248.
viii) Integrating Instruments - IS 711.
ix) Control Switches and push buttons - IS 6875.
x) Auxiliary contractors - IS 2959.

1.1 CONSTRUCTIONS:
The panels shall be of the metal enclosed, outdoor, plinth mounted, free stand type.
Provide dust and dump protection, the degree of protection being IP 54.
Each vertical section shall comprise:

i) A front framed structure rolled / folded sheet steel channel section of minimum 3mm thick, rigidly bolted together. This structure shall house the components contributing to the major height of the equipment, such as circuit breaker cassettes.

ii) The structure shall be mounted on a rigid base frame of folded sheet steel of minimum 3mm thick and 100mm height. The design shall ensure that the weight of the components is adequately supported without deformation or loss of alignment during transit or during operation.

iii) A cable chamber shall house the cable end connections of power/control cable termination. The design shall be to ensure generous availability of space for easy installation and maintenance of cabling, and adequate safety for making in one vertical section without coming into accidental contact with live parts in and adjacent sections.

iv) Front and rear doors shall be fitted with nuts/bolts including neoprene gaskets with fasteners designed to ensure proper compression of the gaskets. When covers are provided in place of doors, generous overlap shall be assured between sheet surfaces with closely space fasteners to preclude the entry of dust. The height of the panel should not be more than 2400mm. The maximum height of any operating mechanism shall not be more than 2100mm. The total depth should be adequate to cater for proper cabling space.

v) Doors and covers shall be of minimum 14 gauge sheet steel. All sheet steel work forming the exteriors or switchboards shall be smoothly finished, leveled and free from flaws. The corners should be rounded. The apparatus and circuits in the
power control panels shall be so arranged as to facilitate their operation and maintenance and at the same time to ensure the necessary degree of safety.

Apparatus forming part of the power control panels shall have the following minimum clearances:

i) Between phases - 25 mm
ii) Between phases and neutral - 25 mm
iii) Between phases and earth - 25 mm
iv) Between neutral and earth - 25 mm

If for any reason, the above clearances are not available suitable insulation shall be provided. Clearance shall be maintained during normal services conditions.

Insulated barriers shall be provided within vertical sections and between adjacent sections to ensure prevention of accidental contact with:

i) Main bus bars and vertical risers during operation, inspection or maintenance of functional units and front mounted accessories.
ii) Cable termination of one functional units, where working of those of adjacent unit / units.

All covers providing access to live power equipments / circuits shall be provided with tool operated fasteners to prevent unauthorized access. Provision shall be made for permanently earthing the frames and other metal parts of the switch gear by two independent connections.

1.2 METAL TREATMENT AND FINISH:
All steel work used in the construction of the switchboards should have undergone a rigorous metal treatment process as follows:

a) Effective cleaning by hot alkaline degreasing solution followed by cold water rinsing to remove traces of alkaline solution.
b) Picking in dilute sulfuric acids to remove oxide scales and rust formation, if any, followed by cold water rinsing to remove traces of acidic solution.
c) A recognized phosphating process to facilitate durable coating of the paint on the metal surfaces and also to prevent the spread of rusting in the event of paint film being mechanically damaged. This again, shall be followed by hot water rinsing to remove traces of phosphate solution.
d) Passivating in de-oxalite solution to retain and augment the effects of phosphating.
e) Drying with compressed air in a dust free atmosphere.
f) Primer coating, with two coats of highly corrosion resistant primer, applied wet on stove dried under strictly controlled conditions of temperature and time.
g) A finishing coat of stoving synthetic enamel paint to the specified shade of IS. The total thickness of paint should not be less than 25 microns.

1.3 BUS BARS
The bus bars shall be air insulated and made of high conductivity, electrolytic grade tinned Aluminium conductor. High tensile bolts and spring washers shall be provided at all bus bar joints.

The main phase bus bars shall have continuous current rating throughout the length of each power control panel, and the neutral bus bars shall have a continuous rating of at least 50% of the phase bus bars.

Bus bars shall be colour coded for easy identification of individual phases and neutral and protective earth.

1.4 CURRENT TRANSFORMER
Current transformer shall comply with the requirements of IS 2705. They shall have ratios, outputs and accuracy’s as specified / required.

1.5 INDICATING / INTERGRATING METERS
All indicating instruments shall be of flush mounting industrial pattern, conforming to the requirements of IS 1248. The instrument shall have non-reflecting dial, clearly divided and legibly marked scales and shall be provided with adjusting devices in the front.
1.6 CABLE TERMINATION
Cable entries and terminals shall be provided in the switch-board to suit the number, type and size of aluminum conductor, power cable and copper conductor control cable specified in the detailed specifications.

Provision shall be made for bottom entry of cables as required. Generous size of cabling chambers shall be provided, with the position of cable glands and terminals such that cables can be easily and safely terminated.

Barriers or shrouds shall be provided to permit safe working at the terminals of one circuit currents without accidentally touching that of another live circuit. Cabling risers shall be adequately supported to withstand the effects of rates short circuit currents without damage and without causing secondary faults.

Cable sockets shall be of copper and of the crimping type as specified.

1.7 CONTROL WIRING
All control wiring shall be carried out with 1100 / 660 V grade single core PVC cable conforming to IS 694 / IS 8130 having standard copper conductor of minimum 2.5 sq. mm section for potential circuits and 2.5 mm section for current transformer circuits. Wiring shall bear neatly bunched, adequately supported and properly routed to allow for easy access and maintenance.

Wire shall be identified by numbered ferrules at each end. The ferrules shall be of the ring and of nondeteriorating materials. They shall be firmly located on each wire so as to prevent free movement. All control circuit fuses shall be mounted in front of the panel and shall be easily accessible.

1.8 TERMINAL BLOCKS:
Terminal blocks shall be of 660 volts grade of finger touch proof type. Insulating barriers shall be provided between adjacent terminals.

1.9 LABELS:
Labels shall be on anodized aluminium, with white engraving on black background. They shall be properly secured with fasteners.

1.10 TESTS:
Routine tests shall be conducted on each power control panel in accordance with CI 81, 2.2 of IS 8623 and shall comprise:
   i) Inspections of the power and control circuits including inspection of wiring and electrical operational tests where necessary.
   ii) Dielectric tests.
   iii) Checking of protective measures and electrical continuity of the protective circuits.

1.11 ERECTION:
AMF Panel shall be installed on suitable plinth. Plinth foundation shall be per the dimensions supplied by the panel manufacturer. Suitable MS base channel shall be embedded in plinth foundation on which the panel can be directly installed. The panel shall be properly aligned and bolted to the foundation by bottom plat. The individual cables shall then be led through the panel to the required feeder compartments for necessary terminations. The cables shall be clamped to the supporting arrangements. The panel board earth bus shall be connected to the local earth grid.

1.12 PRE-COMMISSION TESTS:
Panels shall be commissioned only after the successful completion of the following tests. All main and auxiliary bus bar connections shall be checked and tightened.
All wiring terminations shall be checked and tightened.
Wiring shall be checked to ensure that it is according to the drawings.
All wiring shall be tested for insulation resistance by a 1000 Volts Megger.

**TECHNICAL SPECIFICATION FOR ACOUSTIC ENCLOSURE**

1.0 SCOPE OF SUPPLY
Supply of containerized type ACOUSTIC ENCLOSURE suitable for 1 No. 500 KVA DG set driven by radiator cooled diesel engine.

2.0 DESCRIPTION
The acoustic enclosure shall be of free standing, floor mounting type integral with the DG set. The enclosure shall be provided with rugged heavy-duty structural steel base frame with chequered plate flooring on which the DG set is to be mounted. The enclosure shall be prefabricated factory-built and modular in construction, so that it can be easily assembled at site around the DG set. The enclosure shall consist of acoustically treated panels housed in rugged steel frames, which shall be bolted together to form the body of the enclosure. Sliding doors shall be provided, on either side, which shall also be acoustically treated, thereby providing easy access to the DG set while minimizing the operating space requirements. The construction of the acoustic enclosure shall be such that with both the acoustic doors open on the either side, full access is available to the engine and alternator. For fresh air inlet into the system a parallel baffle air inlet silencer shall be provided. Additionally, to augment the fresh air inlet requirements, a forced air ventilation duct with associated silencer shall be provided above the alternator. For hot air discharge, an acoustic discharge plenum shall be provided in front of the engine radiator, for discharge of hot air into the surroundings through a parallel baffle air outlet silencer. The enclosure shall have suitable openings in the roof module for exhaust piping.

3.0 CONSTRUCTIONAL FEATURES
The construction and design of the Acoustic enclosure shall be very rugged, durable and shall be virtually maintenance free.

The acoustic panels shall be filled with a special grade high-density mineral wool retained on the inside by perforated GI sheets specially designed for optimum sound attenuation.

The outer surface of the Acoustic Panels shall be fabricated of performed 14G corrugated CRCA sheet steel.

All sheet steel frames shall be of 14G CRCA sheets.

All structural members such as angles / channels used in the construction of the enclosure frame shall of TISCO / SAIL make only.

All materials used for Acoustic Enclosure shall be fire resistant / fire retardant grade.

The sheet steel treatment shall consist of degreasing, derusting and phosphating followed by two coats of zinc chromate primer, followed by two coats of Zinpholite surface for superior corrosion resistance and two coats of finish paint.

For effective Acoustic sealing, necessary gasketing material shall be provided.
All hardware and fittings used shall be passivated with zinc.

4.0 PERFORMANCE
With the above Enclosure, the sound pressure levels when measured at a distance of 1 meter outside the Acoustic Enclosure shall be around 75 dB (A) under free field conditions.
Notes:

i. The above noise level is defined with all background ambient noise levels from any other source being less than 75 db (A) so as not to influence this noise level.

ii. The section of the exhaust piping within the acoustic enclosure from the engine exhaust manifold onwards upto and including the Residential silencer, must be adequately cladded with thermal insulation to limit surface temperature as also reduce noise level to less than 75 db (A).

5.0 DIMENSIONS

The enclosure shall be provided with suction fans to ensure that the adequate cooling and combustion air is made available to the engine and the temperature within the enclosure is limited to 5 deg. C above ambient.

The fan shall be designed with sufficient static to draw the requisite quality of air from the duct provided for this purpose. Calculations shall be furnished to prove the adequacy of the ventilation system offered. The suction fans shall start automatically when the temperature in the enclosure reaches 40°C and shall continue to run for 5 to 10 minutes after the load is disconnected. A temperature controller shall be provided for this purpose housed in sheet steel enclosure.

Two light points controlled by a switch complete with 36W fluorescent Luminaire and lamps shall be provided.

Provision shall also be made for fixing a heat detector inside the acoustic enclosure which will be connected to the central fire alarm panel.

Necessary openings shall be made for the entry of power cable and control cables, fuel piping, exhaust piping, air inlet pipe etc.

With the installation of the acoustic enclosure, there shall not be any de-rating of the DG set. The maximum temperature of oil and water shall not exceed the limits prescribed by the manufacturer of the engine. The DG set shall give rated output continuously.
<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Description</th>
<th>Unit</th>
<th>Parameters (Data to be filled by Bidders)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>General</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Manufacturer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.1</td>
<td>Model no.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.2</td>
<td>Type of Engine</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.3</td>
<td>Engine rating – Prime (minimum)</td>
<td>KWe</td>
<td></td>
</tr>
<tr>
<td>1.4</td>
<td>Operating Duty</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.5</td>
<td>Operating speed</td>
<td>RPM</td>
<td></td>
</tr>
<tr>
<td>1.6</td>
<td>Over speed trip</td>
<td>RPM</td>
<td></td>
</tr>
<tr>
<td>1.7</td>
<td>Design life</td>
<td>Hours</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Engine Details</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.1</td>
<td>No. of cylinders and arrangement</td>
<td>nos</td>
<td></td>
</tr>
<tr>
<td>2.2</td>
<td>Cylinder bore x stroke</td>
<td>mm x mm</td>
<td></td>
</tr>
<tr>
<td>2.3</td>
<td>Total piston displacement volume</td>
<td>m³</td>
<td></td>
</tr>
<tr>
<td>2.4</td>
<td>No. of stroke per cycle</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.5</td>
<td>Compression ratio</td>
<td>ratio</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Starting System</td>
<td></td>
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</tr>
<tr>
<td>4</td>
<td>Fuel Consumption</td>
<td></td>
<td></td>
</tr>
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<td>4.1</td>
<td>Fuel grade</td>
<td></td>
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<tr>
<td>4.2</td>
<td>Fuel Consumption at NTP</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>100% loading (Ltrs/hr)</td>
<td>Ltrs/hr</td>
<td></td>
</tr>
<tr>
<td></td>
<td>75% loading (Ltrs/hr)</td>
<td>Ltrs/hr</td>
<td></td>
</tr>
<tr>
<td></td>
<td>50% loading (Ltrs/hr)</td>
<td>Ltrs/hr</td>
<td></td>
</tr>
<tr>
<td>4.3</td>
<td>Day oil tank capacity</td>
<td>Litre</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Bearing</td>
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<td></td>
</tr>
<tr>
<td>5.1</td>
<td>No. of bearing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.2</td>
<td>Method of lubrication</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Engine Lubrication</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.1</td>
<td>Oil grade</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.2</td>
<td>Oil consumption at rated output</td>
<td>Ltrs/hr</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Fuel oil System</td>
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<td></td>
</tr>
<tr>
<td>7.1</td>
<td>Fuel oil storage tank capacity</td>
<td>Litre</td>
<td></td>
</tr>
<tr>
<td>7.2</td>
<td>Fuel oil transfer pump</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>a. Type and number</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>b. Capacity</td>
<td>LPM</td>
<td></td>
</tr>
<tr>
<td></td>
<td>c. Head</td>
<td>MLC</td>
<td></td>
</tr>
<tr>
<td></td>
<td>d. Drive motor power</td>
<td>kW</td>
<td></td>
</tr>
<tr>
<td>7.3</td>
<td>Is the system complete with strainer, valves, fittings, unloading hoses etc.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Engine Cooling</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.1</td>
<td>Method of cooling provided</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.2</td>
<td>Details of cooling system provided</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.3</td>
<td>Heat Rejection to Cooling System</td>
<td>kW</td>
<td></td>
</tr>
<tr>
<td>-----</td>
<td>--------------------------------</td>
<td>----</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td><strong>Exhaust System</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.1</td>
<td>Silencer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.2</td>
<td>Piping construction detail</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.3</td>
<td>Exhaust piping diameter</td>
<td>mm</td>
<td></td>
</tr>
<tr>
<td>9.4</td>
<td>Back pressure</td>
<td>kPA</td>
<td></td>
</tr>
<tr>
<td>9.5</td>
<td>Exhaust gas flow rate</td>
<td>CFM</td>
<td></td>
</tr>
<tr>
<td>9.6</td>
<td>Heat rejected to exhaust system</td>
<td>kW</td>
<td></td>
</tr>
<tr>
<td>9.7</td>
<td>Exhaust temperature (Max)</td>
<td>Deg C</td>
<td></td>
</tr>
</tbody>
</table>

### II Radiators

| 1   | Make & Model No               |    |
| 2   | MOC of Tubes                  |    |
| 3   | MOC of Casing                 |    |
| 4   | Pressure rating of Tubes      | Kg/ sq.cm |

### III Alternator

| 1.1 | Manufacturer                  |    |
| 1.2 | Protection class              |    |
| 1.3 | Rated apparent Power          | KVA|
| 1.4 | Rated power factor            | Cos phi |
| 1.5 | Rated active power            | kW |
| 1.6 | Rated voltage                 | kV |
| 1.7 | Rated frequency               | Hz |
| 1.8 | Number of phases              |    |
| 1.9 | Rated speed                   | Rpm |
| 1.11| Voltage variation range       | % |
| 1.11| Frequency variation range     | % |

### 2 Generator Performances

| 2.1 | Regulation under condition of rated speed, voltage and output |
| 2.2 | Reactance |
|     | a. Direct axis transient, saturated | % |
|     | b. Direct axis transient, unsaturated | % |
|     | c. Direct axis sub-transient, saturated | % |
|     | d. Direct axis sub-transient, unsaturated | % |
|     | e. Negative sequence reactance | % |
|     | f. Zero sequence reactance | % |
|     | g. Synchronous reactance | % |
|     | Capacitance of generator stator wdg to ground |    |

| 2.3 | Insulation (Rotor winding) |
|     | a. Type of insulation |    |
|     | b. Class of insulation |    |

### 2.4 Automatic Voltage Regulator
<table>
<thead>
<tr>
<th>Make</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Voltage Regulator Range</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**2.5 AMF Panel**

<table>
<thead>
<tr>
<th>Make</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current Rating of MCCB</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dimension</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Degree of protection</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**2.6 Auto Mains Failure (AMF) Scheme provided.**

<table>
<thead>
<tr>
<th>IV DG set over all Details</th>
<th>Yes/No</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1 DG set overall dimension (L x W x H)</td>
<td>mm</td>
</tr>
<tr>
<td>1.2 DG set overall weight</td>
<td></td>
</tr>
<tr>
<td>Static weight</td>
<td>kG</td>
</tr>
<tr>
<td>Dynamic weight</td>
<td>kG</td>
</tr>
<tr>
<td>1.3 Max. noise level at a distance of 1.0 m</td>
<td>dB(A)</td>
</tr>
</tbody>
</table>

**1.4 Efficiencies at rated voltage frequency and power factor - Min**

<table>
<thead>
<tr>
<th>a. At 100 % loading</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>b. At 75% loading</td>
<td>%</td>
</tr>
<tr>
<td>c. At 50% loading</td>
<td>%</td>
</tr>
</tbody>
</table>

**1.5 Total Harmonic Distortion (THD) - Max**

<table>
<thead>
<tr>
<th>At 100 % load</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>At 50 % load</td>
<td>%</td>
</tr>
</tbody>
</table>