

BPKIHS, Dharan is planning to procure & install DG Set having 2000 KVA. All Interested vendors are requested to submit quotation along with catalog within 10 days.

Specification of DG Set are as follows:

SECTION - I

1.0 GENERAL

- 1.1 The Generator Set shall be completely factory assembled compact design, stationary Diesel Generator Set, mounted on the sound proof weatherproof acoustic enclosure. It consists of Heavy Duty Industrial Diesel Engine connected to an 11KV Alternator mounted on heavy duty fabricated steel base frame and inclusively necessary accessories, auxiliaries and control equipment resulting in a complete self contain unit capable of operation.
- 1.2 The specification covers the design, manufacture, assembly, testing, packing, supply, transportation to site, unloading storage at site, erection, start-up, commissioning and guarantee tests for one (1) No. of 11kV, 200kVA Diesel Generator sets along with the associated auxiliaries, pipe work, exhaust system, Electrics and instrumentation, 11KV HT Panel, 11 KV HT XLPE Copper cable, 11KV VCB as specified.
- 1.3 The tender for all items of equipment and system covered under this specification shall be complete in all respects and any item of equipment or accessory not specifically mentioned in this tender document but considered essential for efficient and satisfactory operation of individual equipment and system as a whole shall be included in the offer. Incomplete offers will not be considered.
- 1.4 The Tenderer shall study the entire specification carefully and satisfy himself thoroughly regarding the workability of the equipment and the system as a whole and shall take fully responsibility for the guaranteed operation of equipment as regards ratings, performance and smooth reliable working.
- 1.5 The Tenderer shall compulsorily visit the site and ascertain local conditions, traffic restrictions, labour conditions, the accommodation he may require for his staff and labour, site conditions, existing structures and other obstructions in the area if any, and allow for extras, likely to be incurred due to any or all the above in his quoted rates. No additional claim whatsoever will be admissible later on these grounds.
- 1.6 The Tenderer shall prepare drawings and rendering assistance to purchaser for getting approval from BPKIHS. Any modification demanded by authorities shall be carried out by the tenderer without extra cost to purchaser.
- 1.7 The Tenderer should have the experience of supply, installation and commissioning of at least one 1000KVA Diesel Generator Set successfully and the certificate of the same should be submitted to the Institute compulsorily.

2.0 STANDARDS

- 2.1 The equipment and accessories covered by this specification shall be designed, manufactured and tested in accordance with the latest relevant standards published by the Bureau of

Indian/International Standards in order that specific aspects under local conditions are taken care of. Other international standards such as BS, ANSI/ IEEE, IEC, may be adopted with prior approval of the purchaser.

- 2.2 All electrical equipment shall conform to the latest international electricity rules as regards safety, earthing and other essential provisions specified therein for installation and operation of equipment.
- 2.3 All equipment shall be manufactured with high quality materials and workmanship. Standards in design and construction of equipment and systems intended for identical tasks and duties shall be considered. All like parts on equipment supplied or on duplicate equipment are to be interchangeable.
- 2.4 The equipment and installation shall comply with the regulations of the insurance.
- 2.5 The tenderer shall ensure that the plant and equipment supplied by him shall not subject personnel to noise levels exceeding the permissible limits. The noise level shall be restricted to 75dB (A) at 1 m distance from the equipment.

3.0 OTHER REQUIREMENTS

3.1 Painting

The equipment and fabricated structure etc shall be thoroughly cleaned and painted in accordance with IS specification. The colour shade of finish paint (two coats) shall be as per shade no.631 of IS:5 for indoor equipment and shade no. 632 of IS:5 for outdoor equipment. Clean and touch up paint shall be applied at site as required.

3.2 Safety

All equipment shall be complete with approved safety devices wherever potential hazard to personnel exists and with provision for safe access personnel to and around equipment for operational and maintenance functions. The design shall include all reasonable precautions and provisions for the safety of operating and maintenance personnel.

4.0 DESIGN BASIS

One (1) No. diesel generator as per IS-3046 set covered in this specification shall be designed to achieve the following:

- a) To give an output of 2000KVA (1600 KW) at generator terminals at 11KV, Three phase, 50 Hz, 0.8 pf.
- b) To start through Automatic Mains Failure (AMF) system within the time limit of 30 seconds from cold condition and take normal load. Initial starting of DG sets shall be by electrical means from a battery bank. A stand by air start facility shall also be provided.
- c) Diesel Engine shall be designed for using High Speed Diesel (HSD) as the main fuel.
- d) The DG set shall be suitable for operation under maximum ambient temperature of 50°C with relative humidity 88% (max.) monthly.
- e) All equipment within DG Island shall be designed for maximum ambient temperature.
- f) Noise level 75dB(A) measured at 1 meter from the equipment.
- g) 10% over loading capability for 1 hour at every 8 hours of continuous operation.

- h) It is required to synchronise DG set output with the 11kV bus of existing MRS through VCB. Tenderer shall consider supply & installation of 1 no. 630 A Siemens/ABB/Areva make, VCB with necessary protection relay, CT's in their scope. They shall use existing spare trolley for this purpose.

5.0 SCOPE OF WORK

The scope of supply and installation covered under this specification shall comprise but not be limited to the following:

- diesel engine and accessories with starting system, lubricating system, engine cooling system, governing system, fuel system, intake air and exhaust system, pipes & fittings etc.
- Alternator 2000KVA (1600 KW) rating 11 KV, TP, 50 Hz Brushless, selfexcited.
- 24 v DC Battery and Battery Charger.
- Independent battery charger suitable for engine starting system.
- Instruments & Control.
- High speed diesel oil system including oil tank, pumping system, separator unit, return fuel oil system, associated pipe work, valves and instruments.
- Complete compressed air system for startup of engine shall also be provided
- One (1) No. of Corton Steel Chimney.
- Accoustic enclosure
- Pre lube oil system if required.
- Interconnecting pipe work.
- Cooling water line within DG enclosure.
- One (1) No. 11 KV 630 A Vacuum Circuit Breaker (VCB) panel.
- One (1) No. 11 KV Siemens make 630 A, type 3AH5 VCB to be mounted in existing trolley at Main Receiving Station (MRS) along with suitable protective relays.
- 11KV (UE), 3C, 400 sq.mm copper conductor, XLPE insulated and FRLS PVC sheathed, flat stiped armoured cable from the output terminal of DG to 11 KV VCB breaker Panel and also from DG set to changeover switch and from changeover switch to 11 KV VCB at MRS.
- 11 KV (UE), 1C 400 sq.mm copper conductor, XLPE insulated and FRLS PVC sheathed, flat striped armoured cable from Generator Neutral to Neutral grounding resistor panel.
- 1.1 KV grade power and control cabling within DG Island.
- GI cable trays and supports within DG Island.
- Equipment earthing and neutral earthing.
- 11/K3KV, 30 Sec rated Neutral Grounding Resistor (NGR) of suitable capacity with motorized isolator suitable for local/remote operation.
- One (1) No. DG set local control panel with meters, controls, emergency stop push buttons, display units, indicators, alarm & annunciation system, AVR system, AMF control etc.
- Miscellaneous structures such as platforms, ladders, floor plates etc., which are integral to the equipment is in tenderer's scope.

- Safety items as per IE rules for normal operation and maintenance.
- Common base frame.
- Foundation bolts and embedments including grouting.
- Technological supporting structures for equipment.
- Insulation and cladding.
- Anti vibration pads for DG set and panels/boards.
- Free commissioning spares including lube oil, fuel oil and air filters etc.
- Consumables such as lubricating oil, sulphuric acid etc. required for initial filling, start-up, commissioning and performance tests etc.
- Tools and Tackles.
- Complete painting including final coating for all structures and equipment.
- Preparation of drawing and obtaining approval from statutory authorities for design, manufacture and installation.
- Necessary civil foundation works for the DG set and associated equipment.

6.0 SPARES

The Tenderer shall submit with his offer itemized prices for various spares. The offer for the spares shall include the following:

- 6.1 Commissioning spares: Commissioning spares shall include all spares required for commissioning of the equipment and subsequent operation, until demonstration of satisfactory performance in accordance with the guarantees and provisional acceptance. Commissioning spares are to be included in the main offer in sufficient quantities and must be at site along with the main equipment. The Tenderer shall furnish a list of commissioning spares included in the offer.
- 6.2 Spares for Two (2) Years' Normal Operation: The Tenderer shall submit with his offer quotation and delivery schedule for spares for two (2) years' normal operation of the plant after provisional acceptance and demonstration of satisfactory performance.
- 6.3 Annual maintenance: The tenderer shall also quote separately for annual maintenance and operation of supplied DG set to be operative from second year onwards (i.e. after completion of contract as an optional price) for a period of 2 years renewable as per requirement subsequently. They shall submit their quote with two versions namely with inclusive of spare parts price/without spare parts price.
- 6.4 Tenderer shall confirm spares support for a period of ten (10) years.

7.0 TOOLS AND TACKLES

The Tenderer shall include in his offer all special tools and tackles required for normal operation and maintenance of the equipment.

8.0 TESTING AND INSPECTION

All plant and equipment included in the contract including spares shall be inspected. All necessary tests shall be carried out by the successful tenderer to demonstrate whether the material and equipment offered conform to the contract, drawings, relevant standards and

specifications. Test certificates for bought out/items including electrics, instruments and pneumatic equipment etc. shall be submitted along with inspection call or during inspection of the equipment. Valid calibration certificate for all inspection, measuring and test equipment, issued by government laboratories/ private laboratories recognized by registered agencies, used during inspection of equipment shall be submitted by the successful Tenderer along with inspection call or during inspection of the equipment. Spares supplied as components shall be put up along with necessary test certificates/ internal inspection reports. The Tenderer shall furnish in his offer a complete list of tests he proposes to conduct at site during commissioning.

9.0 DRAWINGS AND DOCUMENTS

All drawings, test certificates, instructions etc. shall be in English language.

9.1 Tender Drawings

Tenderer shall enclose with his offer all necessary drawings and documents required for proper understanding of the design, arrangement and functioning of the equipment offered. The drawings/documents shall include but not limited to the following:

- i) Single line diagram showing metering and protection offered.
- ii) Write-up on AMF start and AVR & excitation offered.
- iii) All information asked for in the Questionnaire, Annexure - D.
- iv) List of alarm annunciation (solid state).
- v) Descriptive literature and catalogue for the major items.
- vi) DG control panel, generator protection panel, 11KV Vacuum Circuit Breaker panel, indicating position of components/ devices, cable termination etc.
- v) Descriptive literature and catalogue for the major items.
- vi) DG control panel, generator protection panel, 11KV Vacuum Circuit Breaker panel, indicating position of components/ devices, cable termination etc.
- vii) Independent battery charger for engine starting system.
- ix) P & I diagram for lube oil system and cooling system.
- x) DG layout plan & section and detailed equipment arrangement indicating locations of mechanical and electrical equipment supplied by the tenderer.
- xi) Reference list of similar installations executed by the tenderer.
- xii) Total heat load (in kW) generated by mechanical and electrical equipment within DG Island.

Tenderer shall also furnish in detail any information regarding the equipment quoted by him if asked for by the purchaser during tender evaluation.

9.2 Drawings and Documents during engineering and Execution

The Tenderer shall submit following drawing/ documents in four (4) sets for approval/ comments prior to commencement of manufacture.

- i) Equipment data sheet
- ii) GA drawings for DG set & auxiliaries, Dg control panel and generator protection panel, 11KV Vacuum circuit breaker (VCB) panel, indicating position of components/ devices, cable termination etc.

- iii) 24 V/110V Battery system and associated equipment required with DG set.
- iv) Independent battery charger for engine starting system.
- v) Layout plan and section of DG showing equipment & fitting and clearances for erection and maintenance.
- vi) Document quantifying total heat load (in KW) generated by various mechanical and electrical equipment associated to DG, including DG.
- vii) Cable routing layout within DG Island.
- viii) Earthing layout for DG Island.
- ix) Cable schedule within Dg Island.
- x) Handling equipment required for erection and maintenance.
- xi) Foundation data, embedments, cable trench, cable cutout, equipment/panel mounting arrangement details (Feedback data).
- xii) P & I diagram and write-up for fuel forwarding system, lube oil system and cooling water system.
- xiii) Control schemes, wiring diagram, inter connection diagram and ratings of devices & Bill of materials.
- xiv) Relevant catalogues & instructions for control & protection devices used.
- xv) Write-up on control of DG set, AMF starting, AVR & excitation system.
- xvi) Pre-dispatch Inspection procedure (QAP)

After obtaining approval/ comments of the above drawings/ documents, the tenderer shall supply all certified drawings.

9.3 Drawings, Instructions and Test Certificates with Equipment

The Tenderer will supply the following with the delivery of the equipment.

- four (4): Sets of all certified drawings mentioned under item 8.2 above + two (2) reproducible tracings.
- Four (4) : Sets of instruction for proper erection and assembly of all equipment.
- Four (4): Sets of instructions for operation and maintenance of the equipment and controls.
- Four (4): Sets of test certificates for each item of equipment.
- Four (4): Sets of manufacturer's catalogue of bought out items.
- Four (4): Sets of list of spare part with manufacturer's catalogue, wherever available.

9.4 Drawings on Completion of work

On completion of the work, the Tenderer will supply Six (6) sets of prints of all drawings and soft copies in CD mentioned under Item 8.0 above after incorporating all the changes that might have been effected during the course of execution of the contract.

10.0 DELIVERY

Total completion period for supply, installation, testing and commissioning of the total equipment covered under this specification shall be Six(6) months from the date of Work Order.

SECTION-II

1.0 EQUIPMENT SPECIFICATION

1.1 DIESEL ENGINE

- 1.1.1 The diesel engine shall be of standard design with radiator cooled, turbo charged developing rated power under reference conditions as per IS-3046 to deliver the load of 2000 KVA, 0.8 pf, 11KV, at generator terminals. The engine shall be capable of taking 10 percent overload for 1 hour in every 8 hours of continuous operation.
- 1.1.2 The accessories of the engine shall be complete with fuel oil system, lubricating oil system, cooling water system, combustion air system, exhaust gas system, speed regulating system and instruments.
- 1.1.3 The engine and governing system shall be capable for sudden loading and load throw off conditions of the generator. The voltage transients shall be within limits.
- 1.1.4 AC driven pre-lube oil pumps (2 Nos.) shall be provided (if required) with one working and one standby. The engine will also be provided with safety control instruments to stop the engine under abnormal conditions indicated below:
 - a) Low lube oil pressure
 - b) Cooling water temperature very high.
 - c) Engine over speed.
 - d) Lube oil temperature very high.
 - e) Cooling water pressure very low.
 - f) Lube oil level low.
- 1.1.5 The air intake system shall be equipped with a turbo charger unit. The exhaust gas system shall comprise of exhaust manifold to collect the exhaust gas from each cylinder and connected with suitable expansion bellows. The exhaust gas manifold shall be suitably insulated. Necessary exhaust gas piping with silencer shall be provided from turbo charger outlet and routed outside the building up to the exhaust point. The DG set shall be provided with a complete self contained lubricating oil system including engine driven oil pump, oil coolers, filters, inter connecting pipe work etc. A self contained, close circuit cooling water system shall be provided comprising of heat exchangers and interconnecting piping.
- 1.1.6 The engine shall have control panel housing all control switches, instruments for lube oil pressure, lube oil temperature, water temperature, and hour meter with RPM indicator, indication lamps and alarm for abnormal conditions of the DG set.
- 1.1.7 The automatic starting of DG set shall be by means of AMF system and on battery mode, however manual starting feature shall also be provided from DG set Remote control panel.
- 1.1.8 The engine and generator shall be mounted on single base frame. The base frame shall be welded steel bar construction type.
- 1.1.9 Anti-vibration: Suitable anti-vibration pad shall be provided for the DG set.
- 1.1.10 Battery & Charger: A set of 24-volts, lead acid sealed & maintenance free type batteries and battery charger with leads and terminals. A non-corrosive battery stand shall be

provided for the batteries with 6 mm thick rubber sheet at the bottom of the stand. The battery cell tester and battery hydrometers shall also be supplied along with the set.

1.1.11 MS fabricated coupling guard shall be provided.

2.0 GENERATOR

The alternator shall be of 2000 KVA (1600 KW), 11 KV, 50Hz, brushless, self-excitation confirming to IEC-60034. The generator shall be directly coupled to diesel engine mounted on a common base frame. Degree of protection of enclosure shall be IP: 54.

2.1 The Technical Parameters:

- a) Continuous rating: 2000 kVA (1600 kW)
- b) Rated terminal voltage: 11 kV
- c) Power factor: 0.8 lag
- d) Frequency: 50 Hz
- e) Synchronous speed: 1500 rpm
- f) Momentary peak over load : 50% for 3 sec.
- g) Max. Percentage of unbalance permissible in generator: 20%
- h) Max. Permissible transient voltage dip during starting: 10%
- i) Excitation system: Brushless
- j) Class of insulation: F (temperature rise limited to 70 C over ambient)
- k) typing of cooling: IC 01 (alternatively IC 0141).
- l) Type of enclosure: IP 54
- m) Additional provisions:
 - i) Anti condensation heaters
 - ii) 6 Nos. ETD for winding 2 Nos. per phase.
 - iii) 2 Nos. ETD for alternator bearing.

2.2 The self-excitation and the automatic voltage regulating system shall give fast and accurate response so as to maintain the terminal voltage within +2% of the rated value at all loads and any power factor between 1.0 and 0.8 lag.

2.3 The alternator shall be of 2000 kVA (1600 kW), 3 phase, 11 kV, 50 Hz, brushless, self excitation confirming to IEC-60034. The degree of protection of enclosure shall be IP: 54. The generator shall be directly coupled to the diesel engine mounted on the common base frame.

3.0 INSTRUMENTATION AND CONTROL SYSTEM

3.1 the diesel generator set will be provided with dedicated controller unit which will be interfaced with the plant DCS to provide remote manual start/stop and monitoring features from the plant DCS.

3.2 The instruments and control, equipment for the DG set and auxiliaries shall include but not be limited to the following.

3.3 Engine mounted instrument & controls

The flexibly mounted instrument panel on the engine shall be complete with the following:

- Starting switch & key
- Lubricating oil pressure gauge.
- Cooling water pressure gauge.

- Lube oil temperature gauge
- Cooling water temperature gauge.
- Exhaust temperature at outlet
- Battery charging ammeter.
- Hour meter with RPM indicator
- Safety control - trip
- Level gauges for fuel oil storage tank.
- Level switches for lube oil sump and jacket cooling water tank.
- Necessary local thermometers for lube oil, cooling water, intake air and exhaust gas temperature reading.

3.4 Transmitters and switches for alarm and control equipment

- Lubricating oil pressure at engine inlet with automatic shutdown in case of pressure failure.
- Lubricating oil temperature at engine inlet.
- Cooling water flow at engine inlet. (With automatic shutdown in case of very high lube oil temp).
- Cooling water temperature at engine outlet.

4.0 DG SET AUXILIARIES

4.1 Fuel oil day tank

One (1) No. of day tank made out of carbon steel material shall be provided. The tank shall be provided with necessary nozzles for fuel oil filling, recirculation, outlet, drain, over flow, manhole, level gauges, high and low level switch and temperature sockets, etc. Interconnecting pipes from fuel tank to diesel engine shall be provided with necessary strainers and filters. The tenderer shall provide reusable mesh filter to remove dust particles in addition to main fuel oil filter mounted on the DG set. (It may be optional if existing old one can be used).

4.2 Fuel piping

Complete fuel supply and return piping shall be provided with necessary valves, instruments and accessories.

4.3 Charge air system

Charge air filter to protect the engine against impurities in the inlet air and charge air silencer to reduce the air intake noise from the engine shall be provided. Vertical weather louver shall be provided to protect the air inlet to the filter against rain.

4.4 Starting air system

The engine shall be started by means of compressed air. Adequate capacity of compressor shall be provided. Engine shall be provided with air bottle(s) to store the air required for minimum six(6) start-ups. (It may be optional).

4.5 Cooling system

Radiator type cooling system shall be provided for cooling the cylinder heads, cylinder liner and lubricating oil.

4.6 Exhaust piping & chimney

Exhaust gas from the engine shall be discharged at the required height through exhaust gas silencer and carbon steel chimney of standard height. Expansion bellows shall be provided to isolate exhaust ducting from vibration and allow for thermal expansion. The total exhaust pipeline system shall be insulated by wool/chicken mesh and provided with aluminium cladding to entire length.

4.7 Lube oil system

Tenderer shall provide required lubrication for all moving part on the engine. Engine related lubricating oil system, filtration of the lubrication oil and other plant related lubricated oil system shall be provided.

4.8 Supports/Platform

Ladder for checking fuel oil tank level, exhaust supports, miscellaneous item, instruments etc. shall be provided.

5.0 11KV DG-VCB PANEL

5.1 General

- i) One (1) No. of floor mounted, indoor totally enclosed, metal clad, dead front cubicle, fully interlocked fabricated out of 2 mm thick CRCA sheet steel conforming to degree of protection of enclosure to IP 54, housing draw out type vacuum circuit breakers, controls, metering, protection etc. shrt time withstand capacity of breaker panel shall be of 26.2 kA for 3 sec.
- ii) The maximum operating height of devices on the panel shall not exceed 1900 mm. All relays, instruments, meters, push-buttons, switches and other devices shall be located on the respective panel only.
- iii) Suitable rated lead acid sealed & maintenance free type batteries and battery charger with leads and terminals shall be considered for the control power supply of 110 v DC and auxiliary power supply of 240 v AC shall be tapped from existing source at MRS.

5.2 11 kV circuit-Breakers

5.2.1 Circuit-breakers shall be of tested and proven design and of robust construction. No part of the circuit breaker or any other part of the equipment carrying the fault current or any supporting structures shall be unduly strained or damaged when making or breaking the specified fault current.

5.2.2 All current carrying parts of the circuit breaker shall be of adequate size. The circuit breaker will satisfactorily interrupt low value, low power factor, inductive and capacitive current.

5.2.3 The transient voltage surges produced by the circuit breaker due to wave chopping during rapid interruption of inductive circuit shall be within the allowable limit. Suitable surge absorbers shall be provided to limit/ restrict the transient over voltage.

5.2.4 Circuit breaker shall operate as one complete three phase unit with minimum vibration. The arrangement shall allow for easy access to all contacts for inspection, repair and replacement. Insulating barriers and arc control devices shall be of approved material

not affected by tropical climate. To reduce pressure build-up inside the enclosure, pressure relief devices shall be provided.

- 5.2.5 Circuit breaker shall be provided with necessary auxiliary switches for indication, control, interlocking, protection and other purposes. Four spare sets of auxiliary contacts, two normally closed and two normally open shall be left free in each unit wired up to the control cable terminal board. The auxiliary contacts shall be mounted in an accessible position. If contact multiplication is required, CB Normally open (N.O) auxiliary contacts shall only be used along with auxiliary relays.
- 5.2.6 Vacuum circuit-breaker shall consist of three separate identical phase units coupled to one another and to the operating mechanism by self-aligning rotary operating shaft.
- 2.5.7 Each circuit-breaker shall have shunt trip device and shall be provided with 'ON' and 'OFF' position indicators and operation counter.
- 5.3 Circuit-breaker operating mechanism
 - 5.3.1 The circuit-breaker shall be electrically operated. Only well tried out and robust operating mechanism which is proven and tested for frequent operations shall be provided. When required to mechanically interlock the operation of the circuit breaker with other apparatus the interlock provided shall be in the form of properly numbered keys.
 - 5.3.2 Electrical operation of circuit-breakers shall comprise electrical motor wound spring actuated mechanism complete with motor, opening spring, closing spring and all necessary accessories. Mechanism shall be so designed as to enable a continuous sequence of circuit-breaker opening and closing operations to be obtained by the control switch as long as power is available to the motor and at least one circuit breaker opening and closing after failure of power supply to the motor. The operation of the circuit-breaker shall be independent of the motor which shall be used solely for the purpose of compressing the closing spring. The closing action of the circuit-breaker shall compress the opening spring to be ready for tripping. The control system shall be designed for operation with 110 v DC.
 - 5.3.3 The circuit-breaker shall be provided with manual button for emergency tripping and testing purposes.
 - 5.3.4 The operating mechanism of the circuit-breaker shall be of anti-upmping type. It shall be trip-free under every method of closing. The circuit-breaker shall have shunt trip device and the trip coil shall be designed to operate satisfactorily when the voltage at the terminals of the coil is between 70 and 110 per cent of the rated control power supply voltage.
 - 5.3.5 The circuit-breaker mechanism shall make one complete closing operation, including automatic cut-off of closing power, after a closing command has been initiated and the first device in the control scheme has responded even though the contacts of the initiating device are opened before the circuit breaker closing operation is completed.
 - 5.3.6 The cable termination for VCB Panel shall be fully contained within the cubicle forming an integral part thereof mounted in the rear and shall be freely accessible for cable connection. Where more than one cable to be terminated, the arrangement shall permit

connection and disconnection of individual cables separately without disturbing the other cables. The cable termination chamber shall have adequate space for termination of the required number, type and size of cables and shall be provided with suitable bracings so that the weight of the cables do not unduly stress the terminals.

6.0 CURRENT TRANSFORMERS

- 6.1 Rated current of all secondary windings of CTs shall be 1A. For differential protection class PS CTs shall be provided with adequate knee point voltage.
- 6.2 The terminals of primary and secondary windings shall be marked clearly and indelibly either on their surface or in their immediate vicinity and terminal markings shall be in accordance with the applicable standard.
- 6.3 The CTs will have insulation level and thermal and dynamic ratings corresponding to that of the circuit breaker or isolator with which these are associated. Short time rating of 26.2 kA for 3 sec. shall be considered for CTs.
- 6.4 The CT cores shall have adequate volt-ampere output to suit the secondary burden imposed by the connected instruments, relays and leads. The volt-ampere output shall be selected from the standard values of 10 VA, 15 VA and 30 VA, depending on the specific requirement with provision for connection of 25% additional burden in future.
- 6.5 The accuracy limit factor for all CT cores for protective relaying shall be 10. The CT cores for general protective relaying will have accuracy class 5 P and those for differential and pilot-wire relaying will have accuracy class PS having knee point voltage suitable for the specific application.
- 6.6 The CT cores for measuring and indication will have accuracy class of 0.2 and shall saturate at a moderate over current so as to relieve the measuring and indicating instruments of any undue strain caused by heavy over currents in the primary circuit.
- 6.7 Separate CT cores shall be used for protection and measurement.

7.0 POTENTIAL TRANSFORMERS

- 7.1 All PTs shall be single-phase type and will have secondary rating of 110v.
- 7.2 The PTs shall have insulation level corresponding to the switchgear with which these are associated.
- 7.3 The PTs for indoor switchboard shall be draw-out and protected by suitable HRC fuses both on the primary and secondary sides.
- 7.4 The PTs shall have 25 per cent additional VA capacity over and above that required for meters relays and instruments connected initially. The accuracy class of PTs shall be 1.0.
- 7.5 The VA rating of the PTs shall be selected from following standard values of 50 VA, 100 VA, 200 VA and 500 VA.

8.0 CONTROL, INDICATION AND ALARMANNUNCIATION SYSTEM

- 8.1 For 11 kV switchboard, a separate metering chamber shall be provided in the front of the switchboard just above the circuit-breaker compartment. Meters, relays, control switches, indication lamps and annunciation facia shall be mounted on the hinged door

of the metering chamber. Each circuit-breaker shall be provided with ON (red) OFF (Green) AUTO TRIP, Trip-circuit healthy and spring charged (Amber) indication lamps. All indication lamps shall be of LED type. All PTs shall be provided with three (3) red indication lamps for the three phases for each core. All circuit-breaker shall be provided with trip-neutral close spring return control switches. All breaker to be remote controlled shall be provided with local/remote selector switches.

8.2 Breaker Safety Interlocks:

The breaker compartments shall be provided with all necessary interlocks designed to prevent incorrect operation so as to ensure safety of operating personnel and also the equipment including the following:

- i) It shall not be possible to move the truck from the 'isolated' to the 'service' position unless low voltage plug and socket connections have been made.
- ii) It shall not be possible to disconnect the low voltage plug and socket as long as the circuit breaker truck is in 'Service' position.
- iii) It shall not be possible to withdraw the truck past the 'isolated' position without disconnecting the low voltage plug and socket. However additional flexible jumper with plug and socket will also be provided to permit testing of the breaker outside the panel.
- iv) It shall not be possible to move the truck from the 'Service' to the 'Isolated' position or vice-versa with the circuit-breaker in the 'ON' position.
- v) It shall not be possible to switch on the circuit breaker when the truck is in between the 'Isolated' and the 'Service' position.
- vi) It shall not be possible to move the truck from the 'isolated' to 'service' position with the earthing switch in the 'ON' position.
- vii) It shall be possible to switch-on the earthing switch only when the truck is in the 'isolated' position in case in-built earthing switch is provided.
- viii) It shall not be possible to open the panel front door when the breaker is 'ON' or have access to any part of the draw-out assembly which is live when the circuit-breaker is in the 'service' position.

9.0 PROTECTION

9.1 General

- 9.1.1 Generators shall be provided with microprocessor based comprehensive generator protection relay taking care of all protections and safety requirements.
- 9.1.2 All high voltage power distribution systems shall be complete with necessary protection equipment to ensure effective and reliable protection.
- 9.1.3 All protective and auxiliary relays and associated accessories shall be furnished complete in all respects to suit the requirement of protection, interlock, control, indication and annunciation for individual applications. Trip circuit supervision relay shall be Electro-mechanical type. The Tenderer shall co-ordinate the characteristics of all relays and select their ranges to suit the system and equipment to be protected.

- 9.1.4 All voltage relays shall have sufficient thermal capacity for continuous energisation. The short-time rating of current relays shall be consistent with the maximum fault current in the respective CT secondary circuit.
- 9.1.5 Trip-circuit supervision shall be provided by relays to indicate healthiness of trip circuits and trip supply of circuit-breakers in service position.

9.2 Main Bus Bar

- 9.2.1 The bus bars shall be Triple Pole (TP), Copper. The bus bars shall be of adequate mechanical strength and so arranged and supported that the permissible clearance is maintained under all service conditions including shortcircuits. It shall be insulated for rated voltage.
- 9.2.2 The continuous and short-time current ratings which the bus bars are able to withstand shall be as shown in single line diagrams for various boards enclosed along with this specification.
- 9.2.3 the bus bars shall be of uniform cross-section, which shall be so selected that with the passage of normal rated current at rated frequency, the temperature rise of the busbars does not exceed 350 C over an ambient of 500C.
- 9.2.4 Busbars(TP) shall be colour marked as follows:
 - Phase(R) - Red
 - Phase (Y) - Yellow
 - Phase (B) - Blue

9.3 Control Power Supply

240 v AC auxiliary supply and 110 v DC control supply shall be provided in DG breaker panel. Suitable rated lead acid sealed & maintenance free type batteries and battery charger with leads and terminals shall be considered for 110 v DC control supply.

9.4 Instruments and Meters

- 9.4.1 All instruments and meters shall be of robust design, vibration proof, housed in dust-proof casing and suitable for flush mounting on vertical panels. They shall be mounted in front of the panel at a suitable height to facilitate easy access and visibility. The instruments shall be of parallax-free design and shall have glarefree front covers. Marking of the scale of all instruments shall be such that it is suitable for direct reading. All indicating instruments shall be magnetically screened. The instruments and meters shall be capable of carrying the CT secondary current under fault condition for the specified period without any damage.
- 9.4.2 VCB incomer shall be provided with a 144mm X 144 mm, 0 to 12 kV voltmeter and a 3-position selector switch on the line side of the concerned breaker for indicating the three phase voltages, complete with voltmeter fuses.
- 9.4.3 VCB incomer shall be provided with HT 144 mm X 144 mm ammeter of suitable range and a 4-position selector switch complete with CTs for measuring the currents in all the three-phases.

9.5 11 KV and 1.1 KV Grade Power & Control Cables

- 9.5.1 The cables shall be designed, manufactured and tested in accordance with the relevant standards of the Bureau of Indian Standards in order that specify aspects under Indian conditions are taken care of.
- 9.5.2 Materials and workmanship shall be of good quality suitable for the purpose intended and in accordance with the highest standards and code of particles for cables of the class covered in the specification.
- 9.5.3 The HT/LT power cables and control cables shall be capable of operating at the required capacity in ambient air temperature of 50 deg C maximum and 45 deg C average over 24 hours and ambient ground temperature of 30 deg C.
- 9.5.4 The cables shall be designed to withstand the operating conditions in the plant and the atmospheric conditions at the site as mentioned.
- 9.5.5 The cables shall generally be laid exposed on brackets, cable trays, racks/hooks in concrete trenches etc. as well as buried on ground as the case may be.

9.5.6.1 HT XLPE cables

- 9.5.6.1 The 11 kV power cables shall be of copper conductor, cross linked polyethylene insulated, screened, FRLS PVC sheathed, armoured type. The cables shall be designed, manufactured and tested in accordance with IS: 7098 (Part-II).
- 9.5.6.2 The conductor shall consist of electrical purity stranded copper wire having requisite mechanical properties to ensure the desired tensile strength as well as flexibility etc. as laid down in IS: 8130.
- 9.5.6.3 Colour coding shall be Red Yellow and Blue.
- 9.5.6.4 The cable construction shall have in general conductor screening, XLPE insulation, insulation screening, laying up of cores, thermoplastic filters, PVC inner sheath (extruded "ST2" type), armouring and PVC outer sheath (extruded "ST2" type). The materials used and the assembling/manufacturing shall conform to IS 7098 (Part-II). The conductor screening and non-metallic part of insulation screening shall be provided by extrusion of semi conducting compound. The metallic part of insulation screen shall comprise copper tape, cross sectional area of which shall be calculated on the basis of its width, thickness and layers. The screen cross-section shall be selected considering allowable maximum screen temperature not exceeding 200 deg C during earth fault.
- 9.5.6.5 The PVC compound for sheathing shall conform to IS: 5831. The colour of outer sheath shall be black.

9.5.7 1.1 Kv grade Power and Control Cables

- 9.5.7.1 The XLPE insulated, FRLS PVC sheathed armoured heavy duty power cables shall be of 1100 v grade with copper conductor designed, manufactured and tested in accordance with IS: 7098 (Part-I) and as per the latest amendment.

- 9.5.7.2 Core identification shall be provided by different colouring of PVC insulation. Following colour scheme shall be adopted for the power cables.
- 3 core - Red, Yellow and Blue
 - 3½ core - Red, Yellow, Blue and Black
 - 4 core - Red, Yellow, Blue and Black
- 9.5.7.3 The cross-sectional area of neutral conductor of multicore power cables shall constitute about 50 percent of phase conductor for cable having cross-sectional area of 25. sq.mm and above. For cables below 25 sq.mm the neutral conductor shall be of same cross-sectional area as the phase conductor. All power cables shall be of stranded type for all the sizes covered under this specification.
- 9.5.7.4 The XLPE insulated, PVC sheathed armoured heavy duty power cables shall be of 1100 V grade with copper conductor designed, manufactured and tested in accordance with IS-7098 Part-1 and as per the latest amendment.
- 9.5.7.5 The control cables shall be multi-core, heavy duty type, PVC insulated, PVC sheathed (type ST1, extruded), 1100 V grade, armoured having number of cores of 3,5,7,10,14,19,27 and 37 with copper conductors. The control cables shall be designed, manufactured and tested in accordance with IS : 1554 (Part-I) and as per the latest amendment. The cross sectional area for the control cables shall be 2.5/1.5 sq.mm with copper conductor. All control cables shall be of stranded type. The armouring where called for shall be galvanized steel round wire type.
- 9.5.7.6 The 2 core copper power cables shall be 1.1 kV grade and shall comprise tinned, annealed, stranded and flexible copper strands as conductors conforming to Class-5 as per IS 8130. The cable shall fully conform to IS 1554 for general design and construction.
- 9.6 Cable Termination for DG Auxiliaries
- The HT cable terminal arrangement for 11kV (UE) shall be housed in separate cable compartments and shall be suitable for single-core and multi-core copper conductor XLPE insulated, screened FRLS, PVC sheathed, armoured cables. The cable termination compartment shall be provided with suitable removable cover plates at the bottom as required with holes drilled for cable entry. Wire mesh/transparent acrylic coating shall be provided for cable end termination to avoid inadvertent contact with live bus.
- 9.8 VCB Circuit-Breaker Handling Truck
- The 11 KV vacuum circuit breaker handling truck wherever required shall have platform of adequate mechanical strength for bearing the weight of the circuit breaker unit and shall be provided with necessary guide rails and stops. The height of the platform shall be adjustable to suit the levels at which the circuit breaker is mounted on the switchboard.
- 10.0 DG CONTROL PANEL
- 10.1 the DG set breaker panel shall be controlled from Local/Remote DG control panel. The DG control panel shall be of dust & vermin proof, indoor, floor mounted,

fabricated out of 2mm thick CRCA sheet steel conforming to IP-54 degree of protection for enclosure.

The DG local control panel located near DG HV panel shall comprise but not limited to the following indications:

- Microprocessor based Alarm/ Annunciator (with 20% spare windows for each DG set with RS485 MODBUS feature).
- AVR & Excitation controls.
- AMF system
- Controls (for Engine, breakers)
- Protective relays
- Battery Charger
- Indicating and Integrated meters.

Required facia type microprocessor based annunciators will be provided on the top front side of the panel with alarm and indication for monitoring the various parameters of diesel engine, generator and their auxiliaries. The control panel shall accommodate the logic control equipment for the automatic starting system. In addition, necessary control switches/push buttons, local/remote selector switches shall be provided for the manual starting and stopping of the generator sets and auxiliaries. The AMF control system built on voltage, control and time relays shall sense loss of voltage of normal power. The under voltage relays through time relays shall initiate command for starting the engine which shall persist for a suitable time interval. In case the engine fails to start on the first impulse, successive impulses shall be applied after suitable time delay which shall be adjustable. If the engine fails to start after applying five consecutive starting pulses, no further auto starting shall be permitted. An audio visual alarm shall be initiated to annunciate the 'AMF Fall' condition. The AMF control system shall have an auto-manual selector switch and Engine Start/Stop push buttons for manual control. The generator voltage regulator control shall also have facility for manual control selectable using an Auto/Manual selector switch. Necessary potentiometer/Raise-lower pushbutton control shall be provided for manual adjustment of generator excitation. The battery charger used for keeping the starting battery always charged shall be of solid state design with facility for float charging and boost charging; selectable through a mode selector switch. The charger shall have facility for regulating the charging current automatically to prevent over charging.

10.2 Auto Mains Failure (AMF) System

In case of power failure DG shall start automatically through AMF within 30 secs.

11.0 CABLE TRAYS

GI cable trays & supports as required within DG room shall be considered in the scope of tender. Ladder type cable trays shall be used for routing power cables and perforated types trays shall

be used for routing control/instrument/data cables. The width of GI cable trays shall be, 300/450/600 mm. The cable tray supports shall consist of vertical and horizontal members 50x50x6 angles. A min of 250 mm spacing shall be considered between layers of cable trays.

12.0 COMMISSIONING TESTS

12.1 Testing of various equipment shall be carried out to ensure that they are in satisfactory condition and will successfully perform the functional operation. All tests shall be carried out by the Tenderer using his own instruments, testing equipment as well as qualified testing personnel.

12.2 The following pre-commissioning tests/checks shall be performed after installation.

- Check for proper installation, alignment etc.
- Check for foreign bodies/defects or damages and removal/rectification as required.
- Check for free movement of rotating parts.
- Check for proper tightness of electrical connections.
- Check for proper lubrication, level of cooling water, fuel and lubricating oil and topping up as required.
- Check for electrolyte level in batteries and topping up as required.
- Check for continuity of electrical interconnections and functional check of control circuits.
- Check for proper setting of relays and protective devices.
- Check for proper earthing of generator neutral and earthing of all equipment.

12.3 The tests to be carried out on equipment shall include the following:

- Insulation resistance test on alternator
- No load and lost test
- Functioning of over speed and other safety devices.
- Functioning of governing system.
- Functioning of AVR equipment and AMF starting system.
- Functioning of battery charger equipment.

13.0 PERFORMANCE GUARANTEE FOR DG SET

13.1 the performance of the DG set shall be guaranteed by the supplier. The contractor will necessarily have to achieve the parameters guaranteed. In the event the contractor is unable to demonstrate the guaranteed parameters even after 90 days of notice, the purchaser may replace/ modify the system to achieve the guaranteed parameters at contractors risk and costs.

13.2 The following shall be guaranteed in respect of the DG set:

- a) Specific fuel consumption in gm/kWh for 100% and 50% loading.
- b) Rated output.
- c) Overload capability.

- d) Performance of governor and automatic voltage regulator (AVR) during sudden and step loading and load throw off.
 - e) Exhaust gas temperature.
- 13.3 the guarantee tests and tolerances permissible shall be generally in accordance with IS-10000 for the diesel engine or any other standard agreed with the Tenderer before placement of order. The generator shall be governed by relevant IS.
- 13.4 The Tenderer shall also furnish as a part of his offer, correction curves applicable in case the specified operating conditions are different from the operating conditions during the guarantee tests.

14.0 INSTALLATION AND COMMISSIONING

The installation work shall be carried out in a neat, workman like manner and in accordance with the best engineering practices. The equipment and installation shall conform to the latest Indian/International Electricity Rules as regards, safety, earthing and other essential provisions specified therein for installation and operation of electrical plants. All equipment including individual components, fittings and accessories shall be properly stored at site so as to obviate any deterioration of electrical properties and mechanical damages. All equipment shall be thoroughly cleaned of packing materials, scales, rust, oil, grease etc. prior to commencement of the installation work. All equipment shall also be checked physically for the completeness of all components and devices before taking up installation. The supplier shall repair all minor defects in the equipment, if required, prior to installation in consultation with equipment manufacturer so that manufacturer's guarantee is not affected in any way. In case of any major damage to the equipment, the same shall be rectified or replaced only by the manufacturer's representative with the approval of the purchaser. All equipment and accessories shall be installed strictly in accordance with the manufacturer's instructions/drawings. Equipment supplied in sections or in dismantled condition shall be reassembled at site with all associated accessories as per the manufacturer's instructions. All installation work shall be planned well in advance so that all openings, sleeves, inserts, mounting channels, foundation bolts, holes etc required for the installation can be incorporated during the execution of civil engineering work. In case additional openings, chases, sleeves etc are required after completion of civil engineering work, the supplier shall make at his cost necessary arrangement for the same by drilling/cutting chases, holes etc and shall make good all damaged portions of the work.

ANNEXURE-A

LIST OF PREFERRED MAKES (Other makes may also be considered)

| | | | |
|-----|--|---|---|
| 1. | Diesel Engine | : | CUMMINS/CATERPILLAR/MAN/PERKINS/MITSHUBISHI |
| 2. | Alternator | : | STAMFORD/VATECH/MARATHON |
| 3. | AVR | : | ABB/SIEMENS |
| 4. | PTs & CTs | : | ABB/AUTOMATIC ELECTRIC/KAPPA |
| 5. | Protection & Auxiliary Relays | : | ALSTHOM/ABB/SIEMENS |
| 6. | Meters | : | IMP/RISHAB |
| 7. | DG Control Panel | : | SIEMENS/AREVA/DEEPSEA(UK) |
| 8. | Tri-Vector Meter (with modbus protocol): | : | L & T |
| 9. | Axial Fan/Exhaust Fan | : | ACCO, ABB, C.DOCTOR, DUVENT |
| 10. | HT Cables | : | RPG/UNIVERSAL/NICCO/UNIFLEX/INCAB/POLYCAB/FINOLEX |
| 11. | Recorders | : | DIGITAL/ABB |
| 12. | Annunciator unit | : | PROCON/MINILEC/IIC/ACC SYS |
| 13. | Control desk | : | ICA/RITTAL/RKC/SIMCON/PYROTECH/SYSPRO |
| 14. | Flow elements | : | MICROPRECISION/BALIGA/ASIAN/INDUSTRIAL VALVES & INSTRUMENTS. |
| 15. | Temperature gauges | : | H.GURU/GENERAL INSTRUMENTS/WIKA/WAREE |
| 16. | Pressure gauges | : | H. GURU/GENERAL INSTRUMENTS/A.N. INSTRUMENTS/PRICOL/WIKA/WAREE |
| 17. | Level gauges | : | LEVCON/T.M. TECHNOMATIC/PLACKA TECHTREL |
| 18. | Pressure transmitter | : | EMERSON/YIL/HONEYWELL/ABB |
| 19. | Flow transmitters | : | EMERSON/YIL/HONEYWELL/ABB |
| 20. | Temperature transmitters | : | EMERSON/ABB/HONEYWELL |
| 21. | Temperature elements | : | GENERAL INSTRUMENTS/PYROTECH/NAGMAN/TOSHNIWAL INDUSTRIES/ALTOP/TEMPSONS |
| 22. | Pressure switches | : | SWITZER/INDFOSS/VARMA TRAFAG |
| 23. | Level Switches | : | LEVCON/SAPCON/V.AUTOMAT & INSTRUMENTS |
| 24. | I/P converters | : | ROSEMOUNT/SHIREYAS/MOORE/MTL |
| 25. | Solenoid valves | : | ASCO/AVCON/ROTEX |
| 26. | Instrument cables | : | DELTON/PARAMOUNT/THERMOPADS/TOSHNIWAL/TCL |
| 27. | LT Power cables | : | RPG/UNIVERSAL/NICCO/UNIFLEX/INCAB/POLYCAB/FINOLEX |
| 28. | Control cables | : | RPG/UNIVERSAL/NICCO/UNIFLEX/INCAB/POLYCAB/FINOLEX |

ANNEXURE-B

ANNEXURE-B.1

FORMAT FOR ITEMISED PRICE LIST FOR TWO (2) YEARS SPARES

Price

| S.N. | Spare Parts | Qty | Units(Rs.) | Total(Rs.) | Remarks |
|------|-------------|-----|------------|------------|---------|
| | | | | | |
| | | | | | |

ANNEXURE-B.2

FORMAT FOR ITEMISED PRICE LIST FOR TOOLS AND TACKLES

Price

| S.N. | Spare Parts | Qty | Units(Rs.) | Total(Rs.) | Remarks |
|------|-------------|-----|------------|------------|---------|
| | | | | | |
| | | | | | |

ANNEXURE- C

INDICATIVE BOQ FOR SUPPLY, INSTALLATION, TESTING & COMMISSIONING OF 2000 KVA DG SET AND ACCESSORIES.

| Sl.No. | Item Description | Unit | Qty |
|--------|--|-------|-----|
| 1.0 | Diesel engine of suitable BHP and accessories complete with fuel, intake air, engine cooling system, exhaust gas, compressor starting system, engine control panel with instruments and controls, pipes & fittings with battery limit etc. | Sets | 1 |
| 2.0 | Alternator, 2000 KVA, 0.8 pf, 11 Kv, 3 ph, 4 wire, Brushless, 50 z, self excitation, class F, IP-54 and all other accessories. | Nos. | 1 |
| 3.0 | 11 kV DG VCB Panel with 110 v DC battery, battery charger, Protection Relays (Over Current, Earth, Reserve Power etc.), Metering Unit as Voltmeter, Ammeter, Energy Meter etc & all accessories. | Set | 1 |
| 4.0 | 11kV (UE) and 1.1 kV power and control cables along with cabling accessories including equipment earthing. | Set | 1 |
| 5.0 | 11Kv, 630 A VCB along with Protection relay to be mounted in the existing board | Set | 1 |
| 6.0 | DG local control panel of dust & vermin proof, floor mounted, sheet steel cubicle, IP54, comprise <ul style="list-style-type: none"> - Engine control start/stop, speed raise/lower, test emergency stop, RPM meter, counter etc. - Breaker controls, protection relays - Meters, Indications - Alarm annunciation system solid state type - Battery charger - AMF system with base frame, anti-vibration and pad and all accessories. | Set | 1 |
| 7.0 | GI cable trays and vertical & horizontal supports as required | Lot | 1 |
| 8.0 | Earthing of DG set neutral and other accessories within DG Island along with earthing station | Lot | 1 |
| 9.0 | Civil works including foundation | Lot | 1 |
| 10. | Dismantling of Old D/G set and proper packing of the engine parts. | Lot | 1 |
| 11 | Supply and laying of 11KV 3 core 400 sq mm XLPE copper cable from the Alternator terminal to 11KV VCB terminal and termination on both side with accessories. | Meter | 55 |

ANNEXURE - D

QUESTIONNAIRE

The tenderer shall fill this questionnaire and submit with each copy of his offer. This information is required in this form to facilitate tender processing even though it may be a duplicate information presented elsewhere in his offer. This data presented herein shall form a part of the contract with the successful Tenderer. This questionnaire does not supersede instructions in the tender documents relating to the descriptive information to be submitted with the offer for a complete understanding of the equipment offered and its operation.

1.0 GENERAL

- 1.1 Total estimated shipping weight of DG set, tons:
- 1.2 Overall dimensions of the set
- 1.3 Weight of heaviest single item:
- 1.4 Hoist travel required for maintenance:
- 1.5 Previous experience, list of similar plant/equipment supplied, : Enclosed/Not enclosed year of supply, name of purchaser etc. (Tenderer shall enclose separately)
- 1.6 Special transport requirement, if any:
- 1.7 Special storage requirement, if any:
- 1.8 List of deviations from tender documents: Enclosed/ Not enclosed
- 1.9 Requirement of utilities and services for regular operation:
- 1.10 Requirement of auxiliary electric power of for regular operation, kW:
- 1.11 List of auxiliaries for which a power allowance has been made in the maker's site rating and which are necessary for running of the DG set:
- 1.12 List of other auxiliaries stating the power and voltage required for each (whether driven by DG or independently).

2.0 GUARANTEED PERFORMANCE DATA

- 2.1 Net continuous power output at generator terminals, Kw: (at reference conditions) Overload capacity in every 8 hours of continuous operation. Specific Fuel oil consumption, gm/kWhr
 - at 100% load:
 - at 75% load:
 - at 50% load:Governing parameters (as per IS-10000)
Variation in AVR voltage control under all possible load ranges.
- 2.2 Other Utility Data
 - Lubricating oil consumption at 100%, 75%, 50% load, gm/kWhr
 - Cooling water consumption (make-up) lit/hr

Heat rejection to ambient, Kcal/kW/hr:

3.0 DIESEL ENGINE AND ACCESSORIES

3.1 Diesel Engine

Make:

Type/ Model:

Design standard:

Number of cylinders:

Cylinder diameter (bore), mm:

Stroke, mm:

Swept volume, Cu m/cylinder:

Speed, rpm:

Compression ratio:

Firing order:

Direction of rotation:

Mean piston speed, m/s:

Output at normal conditions, BHP:

Derated output for site conditions:

Allowable percentage of overload and duration:

Brake mean effective pressure (BMEP), kg/sq cm:

Type and details of governing system:

Anticipated noise level of the engine at 1 M distance, db(A):

Vibration level of the engine, microns:

Details of vibration damper provided, if any:

Overall assembled dimensions of engine (L x B x H), M:

Weight of the engine, Kg:

Weight of single component to be handled during normal maintenance (indicate name of component), tons:

3.2 Air Intake System

Furnish details of air intake system:

3.3 Fuel System

3.3.1 Fuel consumption

- Hourly maximum:

- Annual :

3.4 Day tank

- Capacity:

- Material:

3.5 Fuel intake pumps

- Type:
- Number:
- Capacity:
- Pressure:
- Material:

3.6 Fuel intake Filters

- Make (Automatic/manual):
- Type and description:
- Number:
- Capacity, litres / min:
- Filtration Efficiency:
- Particle Size, microns:
- Allowable differential pressure:

3.7 Exhaust Gas System

Details of exhaust pipe (size and material):

Number and material for silencer and expansion bellow:

Exhaust gas temperature at maximum ambient temperature, 0 C:

Exhaust gas characteristics:

Type of Chimney:

Chimney Height:

Chimney Diameter:

3.8 Turbo Charger

Make and Model No.:

Details of bearings and bearing cooling:

Charge air cooler, Type & material:

3.9 Lubricating Oil System

3.9.1 Type of system:

3.9.2 Grade of lube oil:

3.9.3 Annual consumption, kl:

3.9.4 System hold up, litres:

3.9.5 Lube oil supply pressure, kscg:

3.10 Lubricating oil pumps (engine shaft driven)

- Type:

- Number:
- Capacity, litres/min:
- Speed, rpm:
- Pressure:

3.11 Pre-lubricating oil pump

- Type:
- Capacity, litres/min. :
- Total head, mic:
- Speed, rpm :
- Motor rating, kW:
- Type of shaft sealing:

3.12 Oil Coolers

- 3.12.1 Make:
- 3.12.2 Type and description:
- 3.12.3 Number:
- 3.12.4 Capacity, Kcal/hour:
- 3.12.5 Design code:
- 3.12.6 Cooling water:
 - Flow rate, litres/min.:
 - Temperature rise, 0 C :

3.13 Oil filters

- 3.13.1 Make:
- 3.13.2 Type and description:
- 3.13.3 Number:
- 3.13.4 Capacity, litres/min.:
- 3.13.5 Filtration efficiency, %:
- 3.13.6 Particle size, microns:
- 3.13.7 Allowable differential pressure:

3.14 Cooling Water System

- 3.14.1 Jacket cooling water system
 - Type of system:
 - Storage requirement:
 - Quantity of water in circulation:
 - Make-up water requirement:
 - Type and details of cooler:
 - Make:
 - Type and description:
 - Number:

Capacity, Kcal/hour:

Design code:

Cooling water:

- Flow rate, litres/min.:

- Temperature rise, 0 C :

Number, type and details of circulation pump(s):

Details of anti-corrosive agents recommended, if any:

4.0 STARTING SYSTEM (Compressed Air System)

Compressor:

Type:

Capacity:

Number:

Pressure:

4.1 Starting Air Bottles

Storage volume:

5.0 PIPEWORK AND INSULATION

5.1 Details of pipe work covering materials specifications, dimensional, fabrication and testing standards shall be furnished service-wise for different conditions of temperature and pressure:

5.2 Schedule for pipes, valves, fittings and supports shall be furnished service-wise for different conditions of temperature and pressure:

- Pressure, kscg :

6.0 GENERATOR

6.1 Make & Type:

6.2 Standards followed:

6.3 Rated KVA/kW and overload capacity:

6.4 Momentary peak overload capacity, kW

6.5 Rated Voltage:

6.6 Rated current:

6.7 Synchronous speed, rpm:

6.8 Synchronous reactance/ sub-transient reactance:

6.9 Rated power factor:

6.10 Regulation:

6.11 Efficiency:

6.12 Excitation current and voltage at rated output:

6.13 Type of excitation offered with technical particulars:

6.14 Insulation and temperature rise:

6.15 type of enclosure and ventilation:

- 6.16 Degree of Protection, IP-54:
 - 6.17 Method of cooling:
 - 6.18 Cable terminal arrangement:
 - 6.19 Descriptive literature for automatic voltage regulators:
 - 6.20 Make and type of protection relays offered:
 - 6.21 Maximum percentage of unbalance permissible on generator:
 - 6.22 Maximum size of motor which can be started DOL within permissible limit of voltage dip : (limitation of engine in starting the motor also to be indicated)
 - 6.23 Maximum time from starting Impulse after which power can be put on generator:
 - 6.24 Dimensions (L x B x H), M:
 - 6.25 Weight, Kg:
- 7.0 DG SET
- Type of base frame:
 - Details of coupling:
 - Overall dimensions, L x B x H:
 - Weight:
 - Space requirement:
- 8.0 DG CONTROL PANEL Local/Remote
- 8.1 Make & Type:
 - 8.2 Detailed write-up on:
 - Type and response of automatic voltage regulator:
 - Type of battery charger provided:
 - Type of excitation system:
 - Details of indications:
 - Details of protection:
 - Details of annunciation:
 - 8.3 Details of battery:
 - 8.4 Other control circuit details:
 - 8.5 Dimensions (L x B x H), M:
 - 8.6 Weight, Kg:
- 9.0 INSTRUMENTATION AND CONTROLS
- 9.1 List, make and type of all field instruments:
 - 9.2 Details of the recommended control system:
 - 9.3 Details of the recommended protection and interlocking envisaged for the generator and auxiliaries:
- 10.0 11KV DG BREAKER PANEL

10.1 General

- 10.1.1 Make:
- 10.1.2 Standards followed:
- 10.1.3 Rated voltage:
- 10.1.4 Continuous current rating of busbars at specified ambient Temp., while installed in Switchboard:
- 10.1.5 Material of busbars:
- 10.1.6 Nominal cross-section of busbars, sq mm and overall detracting factor applied:
- 10.1.7 Short-time current rating, kA and duration in secs.:
- 10.1.8 Sleeving of busbars:
- 10.1.9 Degree of protection of enclosure IP No.:
- 10.1.10 Overall dimensions (L x B x H), mm:
- 10.1.11 Weight, tons:
- 10.1.12 Total DC current (peak, average) requirement for battery sizing in Amps:

10.2 11 kV Circuit Breakers

- 10.2.1 Make:
- 10.2.2 Standards followed:
- 10.2.3 Manufacturer's type designation:
- 10.2.4 Dimensions and weight of each complete unit, mm & kg:
- 10.2.5 Normal current rating in ampere
 - a) Continuous (RMS):
 - b) Short-time (time to be stated):
- 10.2.6 Derating factor specified ambient temperature and IP54 Enclosure:
- 10.2.7 Interrupting capacity
 - a) Symmetrical, kA:
 - b) Symmetrical, MVA:
- 10.2.8 Making current, kA (peak)
- 10.2.9 Short circuit type test certificate No. (Photostat copy to be enclosed):
- 10.2.10 Insulation level of the breaker:
- 10.2.11 One-minute dry power frequency test withstand stage, kV:
- 10.2.12 Type of main and arcing contacts:
- 10.2.13 Whether contacts are silver plated:
- 10.2.14 Type of closing mechanism
- 10.2.15 Power required by closing coil and voltage supply required with tolerance:
- 10.2.16 Total closing time from closing coil energisation:
- 10.2.17 Power required by shunt trip coil and voltage of supply required with tolerance:
- 10.2.18 Enclose detailed catalogue for the circuit breaker:

10.3 Protection

10.3.1 Microprocessor based (numerical) relays: Tenderer to indicate different protection functions provided with settings and catalogues for relay model:

10.4 Current Transformer

- 10.4.1 Make and Model No.:
- 10.4.2 Standards followed:
- 10.4.3 Class of insulation:
- 10.4.4 One-sec. short-time current, kA:
- 10.4.5 Dynamic current rating, kA:
- 10.4.6 Ratio :
- 10.4.7 VA burden:
- 10.4.8 Accuracy class:

10.5 Indicating Instruments

- 10.5.1 Make and Model No.:
- 10.5.2 Type :
- 10.5.3 Size :
- 10.5.4 Accuracy :

10.6 Earthbus

- 10.6.1 Size :
- 10.6.2 Material :

10.7 Control and Aux. Power Supply

- 10.7.1 Control voltage (110V DC):
- 10.7.2 Aux. Power Voltage (240V AC):