BHARAT HEAVY ELECTRICALS LIMITED
TRANSMISSION BUSINESS ENGINEERING MANAGEMENT
NEW DELHI

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200 KVA DIESEL GENERATING SET				GROUP	TBEM		
				W.O. No	83012		

CUSTOMER	**MADHYA PRADESH POWER TRANSMISSION LTD.**
PROJECT	**Construction of new 400 kV sub stations, transmission lines and Augmentation work/feeder bay work on total turnkey basis (Lot no. 1) Balaghat, Badnawar, Bhopal, Chhegaon and Nagda**

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Rev.	Date	Altered	Checked	Approved	REVISION DETAILS

Distribution	CUSTOMER	TBMM	O/C	
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SECTION 1
SCOPE, SPECIFIC TECHNICAL REQUIREMENTS AND QUANTITIES

1.1 SCOPE

1.1.1 This specification covers the Design, Engineering, manufacture, inspection and testing at Contractor's and/ or his Subcontractor's works, transportation & delivery (FOR destination) , supervision of erection, testing & commissioning at site of **2 Nos. 200 KVA Diesel Generating Set [01 No. set for MPPTCL Balaghat Substation and 01 No. set for MPPTCL Badnawar Substation]** as mentioned in different sections of this specification.

1.1.2 The requirement(s) specified under 'SECTION 2, SECTION 3, SECTION 4' and 'SECTION 5' of this specification shall be considered as part of this section. In case of variance between various sections, requirements of Section-1 shall prevail.

1.1.3 It shall be the responsibility of successful bidder to obtain necessary approval(s) /clearance(s) from statutory organization(s) / authority(s) wherever applicable for the equipment / system / sub-system(s) under the scope specified herein.

1.1.4 **The Contract shall be on lump-sum basis for the package. Within the scope of the contract, no variation shall be admissible to the Contractor so far the input remains unchanged.**

1.1.5 **Deviation:** Any deviation or variation from the Scope requirement and/or intent of this specification shall be clearly defined clause wise with respect to the specification under relevant Deviation Schedule (Section 5.0) attached with Bid Document. Deviations in any other form including clarifications / assumptions / etc will not be considered and it will be construed that the bid conforms strictly to the specification.

1.1.6 The specification comprises of following sections :

Section-1 : Scope, specific technical requirements and Quantities.
Section-2 : Equipment specifications.
Section-3 : General technical requirements for all equipments under the project.
Section-4 : Guaranteed Technical Particulars.
Section-5 : Enclosures to Specification.

In case of any conflict between various sections, order of precedence shall be in the same order as listed above.

The equipment is required for the following projects:

Name of the Customer : Madhya Pradesh Power Transmission Company Ltd.

Name of the Project : Construction of new 400 kV sub stations, transmission lines and Augmentation work/feeder bay work on total turnkey basis (Lot no.- 1) - Balaghat, Badnawar, Bhopal, Chhegaon and Nagda

1.1.7 The term 'Customer' or 'Owner' appearing in this specification shall refer to **M/s. MPPTCL [M/s. Madhya Pradesh Power Transmission Company Ltd]**, the term 'Purchaser/Employer' shall refer to **BHEL** and the term 'Contractor' shall refer to the **Successful Bidder**.

2. SPECIFIC TECHNICAL REQUIREMENTS

As per Section-2.

3. BILL OF QUANTITIES

Sl. No.	Description	Unit	Quantity					Total
			Balaghat	Badnawar	Bhopal	Chhegaon	Nagda	
1.	**200 KVA DG Set complete with all accessories.**	Nos.	01	01	0	0	0	02

4. SYSTEM REQUIREMENT & DESIGN CRITERIA

The following shall be considered:

1. Enough space and termination arrangement shall be ensured inside the alternator terminal box for single run of 3.5 C X 300 sq. mm PVC Power cable.
2. Neutral shall be solidly grounded through 25 mm * 3 mm copper strip. DG body shall be separately grounded through another 25 mm * 3 mm GI strip. The Earthing arrangement should be made by Copper bottom earth plate 600*600*3 mm alongwith earthing material as per scope of the tender along with GI bottom earth plate 600*600*3 mm alongwith earthing material as per scope of the tender and supply of further earthing materials, whatever is needed to make successful Earthing arrangement. The whole Earthing Arrangement for DG Set shall be in Bidder's Scope.
3. ACB for DG has been provided in the 415V AC distribution board. Power circuit is therefore not required in AMF panel. Control scheme shall be accordingly made for auto start of DG and auto-closing and trip of DG ACB as mentioned in Clause 1.5.6 of Section - 2.
4. Relays for Short circuit protection, Under voltage & Over Voltage shall be provided by the Purchaser in LVAC board. Contractor shall provide necessary provisions in AMF panel to interlock these relays for initiating the DG shutdown sequence as mentioned in Clause 1.5.7 of Section - 2.

5. TYPE TESTING

(a.) The Diesel generator sets shall be tested for routine and acceptance tests as per the relevant IS/IEC standards.

(b.) The type test report for diesel engine and alternator are not required to be submitted for POWERGRID approved list of subvendors. For the new makes (Other than those indicated at POWERGRID approved list of subvendors) type test reports as per relevant standard shall be submitted for purchaser's approval.

In case the equipment of the type and design offered, has already been type tested, Bidder shall invariably furnish type test reports from the reputed and approved national/international laboratory/Government approved test houses to prove that specifications of equipments offered conform to the relevant standard. Test certificates shall clearly indicate the type and model number etc., so that relevant details of offered equipments could be verified. While submitting bids the model and type etc., shall be clearly indicated.

Type test reports furnished with the offer should not pertain to the period earlier than five years from the **date of opening of Bid which is 20.11.13.**

In case the type tests were carried out earlier than five years, the manufacturer will have to conduct these tests, without any commercial & delivery implication to BHEL, before commencement of supply. In both the above cases type test certificate must be submitted with the bid. The Bidders have to submit one complete set of Type Test reports for the offered equipments.
All the tests as per relevant IS/IEC shall be carried out.

6. TECHNICAL QUALIFYING REQUIREMENT

6.1 The manufacturer for supply of plant and equipment not covered in approved vendor list of customer should have a minimum experience as specified below for supply of respective item (which must have been type tested) and must be an approved vendor of Electricity Boards/ Power Grid/ Transmission utility or a regular supplier of MPPTCL. The certificate of Electricity Boards/ Power Grid/ Transmission utility towards supply of respective item will have to be submitted by the bidder for obtaining approval of such manufacturer from MPPTCL. The equipment/ material manufactured and supplied should be in operation for a period **of two years** as on the date of Bid opening, **which is 20.11.13,** for which performance report is required to be submitted. The performance report should be issued within last two years from the date of bid opening. The Performance report issued by the Power Utilities or User Agencies clearly indicating the Order No. & Date, Ordered quantity and the quantity for which the performance report has been issued, shall only be acceptable.

S. No.	Equipment/ Material	Minimum experience required
1.	Power Transformers, 400kV Reactor, 400kV & 220kV SF6 Circuit Breakers, CT, CVT, Isolator, LA, C&R Panels, PT, 36kV Capacitor Bank, Transformer oil, Carrier Cabinet, Protection coupler, Wave Trap, Copper Control and Aluminum Power Cable, Station Batteries, Station Transformer, Transformer oil and 132kV SF6 Circuit Breakers	Five Years as on the date of Bid opening
2.	Other equipments and materials for construction of the Facilities	Three Years as on the date of Bid opening
3.	Equipment/ Material covered in the Bid : Manufacturing Capacity	100% quantity of Equipment/ Material covered in the Bid should have been manufactured & supplied in any one year during the past three years by the manufacturer of that Equipment/ Material covered in the Bid, as on the date of Bid opening
4.	To substantiate above requirement indicated in S. No. 1, 2 & 3, Bidder may please note that the design, type, rating & class of equipments/ material must be	

	similar to the design, type, rating & class or higher rating & class, as specified in the Bid. For substantiating requirement at Sr. no 3, CA certificate is acceptable.

6.2 In the case of a Bidder who offers to supply and install major items of supply under the contract that the Bidder did not manufacture or otherwise produce, the Bidder shall provide the manufacturer's authorization, using the form to be provided by BHEL, showing that the Bidder has been duly authorized by the manufacturer or producer of the related plant and equipment or component to supply and install that item in India. The Bidder is responsible for ensuring that the manufacturer or producer complies with the requirements of ITB 4 and 5 and meets the minimum criteria listed above for that item.

7. INSPECTION & TESTING

All the equipments shall be inspected prior to dispatch in line with relevant IS, approved GTP/ drawing and technical specification, BHEL/ customer approved QAP.

Before being fitted on the equipment, all components shall be subjected to routine tests at the Contractors factory, as per the relevant IEC/IS standards. A detailed test report proving the successful passing of such tests shall be provided.

Prior to dispatch, the routine & acceptance tests shall be carried out on equipment in accordance with the applicable IEC /IS and the material shall be offered for final inspection to BHEL and MPPTCL in accordance with agreed quality plan with 3 weeks advance information.

8. QUALITY PLAN

The contractor shall carry out contract works in accordance with sound quality management principles which shall include such as controls which are necessary to ensure full compliance to all requirements of the specification & applicable international standards. These quality management requirement shall apply to all activities during design, procurement, manufacturing, inspection, testing, packaging, shipping, inland transportation, storage, site erection & commissioning. Contractor shall submit detailed Quality Plan for BHEL / MPPTCL approval within 1 week of P.O. placement.

9. SCOPE OF SUPPLY & SERVICES

The equipment and services to be furnished under this contract are detailed here under for reference. The items, though not specifically mentioned but required for safe and satisfactory operation of system will also be treated as included and the same shall be supplied at **NO EXTRA COST** to Purchaser.

9.1 Scope of supply

A. Main Item

The scope covers supply of Two (02) Nos. Diesel Generator Set of stationary type having a net electrical output after considering deration for engine and alternator separately due to temperature rise in side the enclosure and on account of power reduction due to auxiliaries shall be 200 KVA, 1500 RPM, 415 Volts, 3 phase, 0.8 p. f., 50 Hz on FOR site basis. Essential components are :

(i) Diesel engine complete with all accessories as mentioned below
- (a) 125mm dia exhaust pipe with flanges, supports & necessary hardware.
- (b) Aluminum cladding material for 125mm exhaust pipe.
- (c) 25 mm * 3 mm GI strip with sleeves for body earthing
- (d) 25 mm * 3 mm copper strip with sleeves for neutral earthing

(e) Supply of earthing materials.
(f) Copper bottom earth plate 600*600*3 mm alongwith earthing material as per scope of the tender**.**
(g) GI bottom earth plate 600*600*3 mm alongwith earthing material as per scope of the tender.

(ii) An alternator directly coupled to the engine through coupling, complete with all accessories.
(iii) Automatic voltage regulator.
(iv) Complete starting arrangement, including two nos. batteries & chargers.
(v) Base frame, foundation bolts etc.
(vi) Day tank of 350 Litre capacity.
(vii) Engine Cooling and lubrication system.
(viii) Engine air filtering system.
(ix) Exhaust silencer package.
(x) Set of GI pipes, valves, strainers, unloading hose pipes as required for fuel transfer system from storage area to fuel tank including electrically driven fuel pump.
(xi) All lubricants, consumable, touch up paints etc. for first filing, testing & commissioning at site.
(xii) AMF panel for control, metering and alarm.
(xiii) Enclosure for silent type D.G. set

B. Mandatory Spares

The List of recommended spares shall be provided along with DG set.

- Any spares required for commissioning purpose shall be supplied along with DG Set by the contractor.

C. Standard Tools & Tackles

Bidder shall include one complete set of tools spanners and special tools necessary for assembling and dismantling the plant to be supplied along each with DG SET.

SERVICE TOOLS : A suitable tool board complete with all necessary tools required for servicing the diesel generator set shall also be supplied with relevant instruction booklets. The list of tools required shall be furnished in the bid.

9.2 SCOPE OF SERVICES

The contractor shall provide following services:

A. Design, manufacture, shop testing including assembly test.
B. Dispatch transportation to Site.
C. Expert supervision during Erection, Testing & Commissioning of DG set.
D. Certification and compliance for meeting noise level & emission parameters and other requirements in accordance with latest Notification of MOEF.
E. Against the expert supervision charges the bidder shall quote under the following heads
   i) Site visit charges, for each Site, on per day basis for one person.
   ii) Boarding and lodging, for each Site, for one person per day
   iii) Lump sum charges towards to and fro transportation for one person per visit, for each Site.

F. For evaluation purpose, the supervision charges would be considered for 5 days of site visit, for each Site, of one person. However payment shall be made as per actual visits utilized.

G. Purchaser reserves the right to utilize number of visits depending upon site conditions.

H. Submission of drawings, data, design calculations & printed erection, operation & maintenance manual.

i) Following drawings and data sheet shall be submitted for approval:

(a) General layout and assembly drawings of the equipments and the auxilieries, showing clearance and grouting details.

(b) Layout of control gear, control boards etc., with wiring drawings and cable schedule.

(c) Arrangement of Terminal equipment.

(d) Schematic diagram of control circuits and control and annunciation panel circuit (wiring diagram)

(e) Drawings showing the critical dimensions of Diesel Engine, alternator, control and annunciation panel etc., and respective individual weights, vibration pads, lifting hook positions etc.

(f) Data sheet for Engine, Alternator, Battery, AMF panel and Enclosure.

(g) All drawings and documents will be submitted by the bidder within 2 weeks after placement of order for customer approval.

ii) The D G Set shall be supplied with

(a) D G Set test certificate.

(b) Engine Operation & maintenance Manual.

(c) Engine Parts Catalogue.

(d) Alternator Operation, maintenance & Spare parts Manual.

(e) Alternator test certificate.

I. The O&M manual shall contain the following information :

- Description of the system and equipment with design particulars
- Scheme of operation and interlocks in AMF panel with the purchasers LVAC board
- Instruction for installation, operation, maintenance and repair at site.
- Recommended inspection practices and inspection schedule.
- Ordering information for all replaceable parts

10. EXCLUSIONS

The following has been excluded from the bidder's scope :

9.1 Unloading, Storage, Erection, Testing and Commissioning of DG set at site.

9.2 Supply and laying of power & control cables.

9.3 Interlocking of the DG Set with the existing system. However, provision for the same shall be made in the control panel.

9.4 Minor/ Major Civil activities associated with erection of DG set and final levelling on the foundation.

ANNEXURE

Bidder shall quote under the following heads. However sum total of all the prices quoted in the heads will be considered as lumpsum price for the package and same will be considered during evaluation.

Sl. No.	Description	Quantity
1.0	**200 KVA DG Set [EACH] complete with all accessories as mentioned below but not limited to** : (i) Diesel engine complete with all accessories as mentioned below (a) 125mm dia exhaust pipe with flanges, supports & necessary hardware (b) Aluminum cladding material for 125mm exhaust pipe. (ii) An alternator directly coupled to the engine through coupling, complete with all accessories. (iii) Automatic voltage regulator. (iv) Complete starting arrangement, including two nos. batteries & chargers. (v) Base frame, foundation bolts etc. (vi) Day tank of 350 Litre capacity. (vii) Engine Cooling and lubrication system. (viii) Engine air filtering system. (ix) Exhaust silencer package. (x) AMF panel for control, metering and alarm. (xiii) Enclosure for silent type D.G. set	02 sets
2.0	**Complete Erection Material for EACH Site but not limited to :** (i) 25 mm * 3 mm GI strip with sleeves for body earthing. (ii) 25 mm * 3 mm copper strip with sleeves for neutral earthing (iii) Supply of earthing materials (iv) Copper bottom earth plate 600*600*3 mm alongwith earthing material as per scope of the tender. (v) GI bottom earth plate 600*600*3 mm alongwith earthing material as per scope of the tender. (vi) All lubricants, consumable, touch up paints etc. for first filing, testing & commissioning at site. (vii) Set of GI pipes, valves, strainers, unloading hose pipes as required for fuel transfer system from storage area to fuel tank including electrically driven fuel pump.	02 Lots
3.0	**Standard tools and tackles for erection, operation and maintenance.**	02 Sets
4.0	**Supervision of Erection, Testing and Commissioning of DG set for 10 Days [05 Days per Site] comprising :** **<u>FOR EACH SITE AT BALAGHAT AND BADNAWAR SEPARATELY</u>** - Site visit charges on per day basis for one person . - Boarding and lodging for one person for one day. - Lump sum charges towards to and fro transportation for one person. **(OPTIONAL)**	

SECTION-II

[redacted] TECHNICAL SPECIFICATION FOR 200KVA DG SET

1.0. SCOPE OF SUPPLY

1.1. The scope covers supply of Diesel Generator set of stationary type having a net electrical output of 200kVA capacity at specified site conditions of 50° C ambient temperature and 100% relative humidity on FOR site basis. DG set shall be equipped with:

(i) Diesel engine complete with all accessories as mentioned below.

(a) 125mm dia exhaust pipe with flanges, supports & necessary hardware
(b) Aluminum cladding material for 125mm exhaust pipe.
(c) 25 mm x 3 mm GI strip with sleeves for body earthing.
(d) 25 mm x 3 mm copper strip with sleeves for neutral earthing
(e) [redacted]
(f) [redacted]
(g) Supply of earthing materials
(h) Copper bottom earth plate 600X600X3 mm alongwith earthing material as per scope of the tender
(i) GI bottom earth plate 600X600X3 mm alongwith earthing material as per scope of the tender

(ii) An alternator directly coupled to the engine through coupling, complete with all accessories.
(iii) Automatic voltage regulator.
(iv) Complete starting arrangement, including two nos. batteries & chargers.
(v) Base frame, foundation bolts etc.
(vi) Day tank of 350 Litre capacity.
(vii) Engine Cooling and lubrication system.
(viii) Engine air filtering system.
(ix) Exhaust silencer package.
(x) Set of GI pipes, valves, strainers, unloading hose pipes as required for fuel transfer system from storage area to fuel tank including electrically driven fuel pump.
(xi) All lubricants, consumable, touch up paints etc. for first filing, testing & commissioning at site. [redacted]
(xii) AMF panel for control, metering and alarm.
(xiii) Enclosure for silent type D.G. Set

[redacted]

1.1.1 **CLIMATIC CONDITIONS:**

Applicable climatic conditions shall be as per [redacted]. SECTION - 3.

1.2. SCOPE OF SERVICE

1.2.1. The Contractor shall provide following services:

a) Design, manufacture, shop testing including assembly test.
b) Despatch, transportation to site.
c) Erection, testing & commissioning with all equipments/ materials required for the purpose.
d) Drawings, data, design calculations and printed erection, operation & maintenance manual.
e) Certification and compliance for meeting noise level & emission parameters and other requirements in accordance with latest Notification of MOEF.

1.3. TECHNICAL REQUIREMENTS

1.3.1. The rating of DG sets are as follows:

1.3.1.1. DG set net out put after considering deration for engine and alternator separately due to temperature rise in side the enclosure and on account of power reduction due to auxiliaries shall be 200kVA, 1500RPM, 0.8Pf, 415V, 3 phase, 50Hz. The above ratings are the minimum requirements.

1.3.1.2. DG sets shall also be rated for 110% of full load for 1 hour in every twelve hrs of continuous running.

1.3.2. The output voltage, frequency and limits of variation from open circuit to full load shall be as follows:

a) Voltage variation +5% of the set value provision shall exist to adjust the set value between 90% to 110% of nominal Generator voltage of 415V.
b) Frequency 50Hz +2%

1.3.3. The Diesel Generator and other auxiliary motor shall be of H class with temperature rise limited to Class-F for temperature rise consideration.

1.3.4. NOISE LEVEL & EMISSION PARAMETERS: These shall be as per latest Notification of MOEF.

1.4. PLANT DESIGN

[redacted]

1.4.1. DIESEL ENGINE

1.4.1.1. The engine shall comply with the IS 10002/BS 5514/ISO 3046; latest edition.

1.4.1.2. Diesel engine shall be turbo charged multicylinder V-type in line type with mechanical fuel injection system.

1.4.1.3. The engine with all accessories shall be enclosed in a enclosure to make it work Silently (within permissible noise level) without any degradation in its performance.

1.4.1.4. The Diesel Engines shall be directly water cooled. Cooling of water through radiator and fan as envisaged.

1.4.1.5. The fuel used shall be High Speed Diesel oil (HSD) or Light Diesel Oil (LDO) as per IS:1460.

1.4.2. AIR SUCTION & FILTRATION

1.4.2.1. Suction of air shall be from indoor for ventilation and exhaust flue gasses will be let out to outside atmosphere, Condensate traps shall be provided on the exhaust pipe.

1.4.2.2. Filter shall be dry type air filter with replaceable elements.

1.4.3. FUEL AND LUBRICATING OIL SYSTEM

1.4.3.1. The engine shall have closed loop lubricating system. No moving parts shall require lubrication by hand prior to the start of engine or while it is in operation.

1.4.4. ENGINE STARTING SYSTEM

1.4.4.1. Automatic electric starting by DC starter motor shall be provided.

1.4.5. FUEL INJECTION AND REGULATOR

1.4.5.2. The engine shall be fitted with a heavy, dynamically balanced fly wheel suitable for constant speed governor duty.

1.4.5.1 The engine shall be fitted with electronic governor suitable for as per IS 10000.

1.4.6 ALTERNATOR

1.4.6.1. The alternator shall comply with BS 2613/IS 4722/IEC 34;

latest edition.

1.4.6.2. The alternator shall be of continuously rated duty, suitable for 415 V, 3 phase, 50 Hz. Power development having brush-less, synchronous, self-excited, self-regulating system.

1.4.6.3. The alternator shall be drip-proof, screen protected as per IP-23 degree of Protection.

1.4.6.4. The rotor shall be dynamically balanced to minimize vibration.

1.4.6.5. The alternator shall be fitted with shaft mounted centrifugal fan.

1.4.6.6. It shall have the winding of class H but limited to Class-F for temperature rise consideration.

1.4.6.7. The Alternator regulator shall be directly coupled to the engine and shall be complete with the excitation system, automatic voltage regulation of +/- 1%, voltage adjusting potentiometer and under/over speed protection.

1.4.6.8. TERMINAL BOX

1.4.6.8.1. Six (6) output terminals shall be provided in alternator terminal box. Terminals shall be Suitable for 1 No. of single core, 630 mm2 XLPE cables per phase for 200kVA DG set and 3½Core 300 mm2 XLPE cable for 100kVA DG set. The neutral shall be formed in AMF panel. The generator terminal box shall be suitable to house necessary cables and should be made of non-magnetic material.

1.4.6.9. The alternator with all accessories shall be enclosed in a enclosure to make it work Silently (within permissible noise level).

1.4.7. COUPLING

1.4.7.1. The engine and alternator shall be directly coupled by means of self-aligning flexible flange coupling to avoid misalignment.

1.4.7.2. The coupling shall be provided with a protecting guard to avoid accidental contract.

1.4.8 MOUNTING ARRANGEMENT

[redacted]

1.4.8.1. The engine and alternator shall be mounted on a common heavy duty, rigid fabricated steel base frame constructed from ISMC of suitable sections.

1.4.8.2. Adequate number of anti-vibration mounting pads shall be fixed on the common base frame on which the engine and the alternator shall be mounted to isolate the vibration from passing on to the common base frame or the foundation of the D.G. Set.

1.4.9. PERIPHERALS

1.4.9.1. FUEL TANK

1.4.9.1.1. The Fuel tank of 350 Litre capacity shall be provided on a suitably fabricated steel platform. The tank shall be complete with level indicator marked in litres, filling inlet with removable screen, an outlet, a drain plug, an air vent, an air breather and necessary piping. The tank shall be painted with oil resistant paint and shall be erected in accordance with Indian explosive act of 1932. Fuel tank shall be kept outside of enclosure. The fuel piping shall be carried out to connect the D.G set kept inside.

1.4.9.1.2. For transferring fuel to Fuel tank transfer pump is envisaged. The capacity of transfer pump shall be adequate to fill the day tank in about 30 minutes. Fuel pump shall be electrically driven.

1.4.9.2. BATTERY & BATTERY CHARGER

1.4.9.2.1. Two nos. 24V batteries complete with all leads, terminals and stand shall be provided. Each battery shall have sufficient capacity to give 10 nos. successive starting impulse to the diesel engine.

1.4.9.2.2. The battery charger shall be complete with transformer, suitable rating (415 V, 3 Ph., 50 Hz./230V, 1Ph., 50 Hz) rectifier circuit, charge rate selector switch for "trickle"/'boost' charge, D.C. ammeter & voltmeter, annunciation panel for battery charge indication / loading / failures.

1.4.9.2.3. The charger shall float and Boost Charge the battery as per recommendation of manufacturer of battery. The charger shall be able to charge a fully discharged battery to a state of full charge in 8 Hrs. with 25% spare capacity.

1.4.9.2.4. Manual control for coarse and fine voltage variation shall be provided. Float charger shall have built-in load limiting features.

1.4.9.2.5. Ripple shall not be more than 1%(r.m.s) to get smooth DC voltage shall be provided.

1.4.9.2.6. Charger shall be provided with Output Voltmeter & Ammeter.

1.4.9.2.7. Changeover scheme for selecting battery and battery charger by changeover switch should be provided.

1.5. CONTROL AND INSTRUMENTATION

1.5.1. Each D.G. Set shall be provided with suitable instruments, interlock and protection arrangement, suitable annunciation and indications etc. for proper start up, control, monitoring and safe operation of the unit. One local AMF control panel alongwith each D.G. set shall be provided by the Supplier to accommodate these instruments, protective relays, indication lamps etc. The AMF Panel shall have IP-52 degree of Protection as per IS:12063.

1.5.2. The D.G. sets shall be provided with automatic start facility to make it possible to take full load within 30 seconds of Power Supply failure.

1.5.3. Testing facility for automatic operation of D.G.Set shall be provided in AMF panel.

1.5.4. A three attempt starting facility using two impulse timers and summation timer for engine shall be proved and if the voltage fails to develop within 40 sec. from receiving the first impulse, the set shall block and alarm to this effect shall be provided in the AMF panel.

1.5.5.Following instruments shall be provided with Diesel Engine

a) Lub oil pressure gauge
b) Water temperature thermometers
c) Engine tachometer/HR
d) Any other instruments necessary for DG Set operation shall be provided.

1.5.6. DG set shall be capable of being started/ stopped manually from remote as well as local. (Remote START/STOP push button shall be provided in 415V ACDB). However, interlock shall be provided to prevent shutting down operation as long as D.G. set is closed.

1.5.7. The diesel generator shall commence a shutdown sequence

whenever any of the following conditions appear in the system:

a) Overspeed
b) Overload
c) High temperature of engine and cooling water.
d) High temperature inside enclosure
e) Low lube oil pressure
f) Generator differential protection
g) Short circuit protection
h) Under voltage
i) Over voltage
j) Further interlocking of breaker shall be provided to prevent parallel operation of DG set with normal station supply.

1.5.8. Following indication lamps for purposes mentioned as under shall be provided in AMF panel:

1.5.8.1. Pilot indicating lamp for the following:

a) Mains ON
b) Alternator ON
c) Charger ON/OFF
d) Breaker ON/OFF
e) Main LT Supply ON/OFF

1.5.8.2. Visual annunciation shall be provided for set shut down due to:

a) engine overheating
b) low oil pressure
c) lack of fuel
d) Set failed to start in 30 secs after receiving the first start impulse
e) high cooling water temperature
f) Low level in daily service fuel tank
g) Overspeed trip
h) Audio & visual Annunciation for alternator fault.

1.5.9. Thermostatically controlled space heaters and cubicle illumination operated by Door Switch shall be provided in AMF panel. Necessary isolating switches and fuses shall also be provided.

1.5.10. AMF panel shall have facility for adjustment of speed and voltage including fine adjustments in remote as well as in local mode. Following shall also be provided in AMF panel:

a) Frequency meter
b) 3 Nos. single phase CT's for metering
c) 3 Nos. (Provided by LT swgr manufacturer) single phase CT's with KPV 300V & RCT 0.25 ohm for differential

protection of DG Set on neutral side only for 200kVA.

d) One (1) DC Ammeter (0-40A)
e) One (1) DC Voltmeter (0-30V)
f) One (1) Voltmeter Selector switch
g) One (1) AC Ammeter
h) One (1) AC Voltmeter
i) Three (3) Timers (24V DC)
j) Two (2) Auto/Manual Selector Switch
k) Two (2) Auto/test/Manual Selector Switch
l) Eleven (11) Aux. Contactors suitable for 24V DC
m) One (1) Motorised potentiometer for voltage adjustment
o) One (1) Set Phase & Neutral busbars.
p) Any other item required for completion of Control scheme shall be deemed to be included.

1.6. D.G. SET Enclosure

1.6.1. General requirements

1.6.1.1. Diesel engine, alternator, AMF panel, Batteries and Chargers shall be installed outdoor in a suitable weather-proof enclosure which shall be provided for protection from rain, sun, dust etc. Further, in addition to the weather proofing, acoustic enclosures shall also be provided such that the noise level of acoustic enclosure DG set shall meet the requirement of MOEF The diesel generator sets should also conform to Environment (Protection) Rules, 1986 as amended. An exhaust fan with louvers shall be installed in the enclosure for temperature control inside the enclosure. The enclosure shall allow sufficient ventilation to the enclosed D.G. Set so that the body temperature is limit to 50°C. The air flow of the exhaust fan shall be from inside to the outside the shelter. The exhaust fan shall be powered from the DG set supply output so that it starts with the starting of the DG set and stops with the stopping of the DG set. The enclosure shall have suitable viewing glass to view the local parameters on the engine.

1.6.1.2. Fresh air intake for the Engine shall be available abundantly; without making the Engine to gasp for air intake. A chicken mess shall be provided for air inlet at suitable location in enclosure which shall be finalised during detailed engineering.

1.6.1.3. The Enclosure shall be designed and the layout of the equipment inside it shall be such that there is easy access to all the serviceable parts.

1.6.1.4. Engine and Alternator used inside the Enclosure shall carry their manufacturer's Warranty for their respective Models and this

shall not degrade their performance.

1.6.1.5. Exhaust from the Engine shall be let off through Silencer arrangement to keep the noise level within desired limits. Interconnection between silencer and engine should be through stainless steel flexible hose/ pipe.

1.6.2. All the Controls for Operation of the D.G. Set shall be easily assessable. There should be provision for emergency shut down from outside the enclosure.

1.6.3. Arrangement shall be made for housing the Battery set in at Enclosure.

1.6.4. Construction Features:

1.6.4.1. The enclosure shall be fabricated from at least 14 Gauge CRCA sheet steel and of Modular construction for easy assembling and dismantling. The sheet metal components shall be pre-treated by Seven Tank Process and Powder coated (PURO Polyester based) both-in side and out side – for long life. The hard-ware and accessories shall be high tensile grade. Enclosure shall be given a lasting anti-rust treatment and finished with pleasant environment friendly paint. All the hardware and fixtures shall be rust proof and able to withstand the weather conditions.

1.6.4.2. Doors shall be large sized for easy access and provided with long lasting gasket to make the enclosure sound proof. All the door handles shall be lockable type.

1.6.4.3. The Enclosure shall be provided with anti-vibration pads (suitable for the loads and vibration they are required to carry) with minimum vibration transmitted to the surface the set is resting on.

1.6.4.4. High quality rock wool of required density and thickness shall be used with fire retardant thermo – setting resin to make the Enclosure sound proof.

1.6.5. Provision for Neutral/Body Earthing

1.6.5.1. Points shall be available at two side of the enclosure with the help of flexible copper wires from alternator neutral, and electrical panel body respectively. The earthing point shall be isolated through insulator mounted on enclosure.

1.7. INSTALLATION ARRANGEMENT

1.7.1. DG set enclosed in enclosure shall be installed on Concrete Pedestal 300mm above FGL

1.8 DOCUMENTS

1.8.1. Following drawings and data sheet shall be submitted for approval:

(i) Data sheet for Engine, Alternator, Battery, AMF panel and Enclosure
(ii) GA drawing of DG set
(iii) Layout of DGset in the enclosure along with sections
(iv) GA and schematic of AMF panel
(v) Arrangement of inclined roof and pedestal.

1.8.2. The D G Set shall be supplied with

(i) D G Set test certificate
(ii) Engine Operation & maintenance Manual.
(iii) Engine Parts Catalogue.
(iv) Alternator Operation, maintenance & Spare parts Manual.
(v) Alternator test certificate.

1.9. TESTS

a) The Diesel generator sets shall be tested for routine and acceptance tests as per the relevant IS/IEC standards.
b) The type test report for diesel engine and alternator are not required to be submitted or the makes indicated at ~~Annexure-E of Section-GTR~~/POWERGRID approved list of subvendors. For the new makes (Other than those indicated at ~~Annexure-E~~/POWERGRID approved list of subvendors) type test reports as per relevant standard shall be submitted for purchaser's approval.

1.10. Commissioning Checks

In addition to the checks and test recommended by the manufacturer, the Contractor shall carryout the following commissioning tests to be carried out at site.

1. Load Test

The engine shall be given test run for a period of atleast 6 hours. The set shall be subjected to the maximum achievable load as decided by Purchaser without exceeding the specified DG Set rating:

During the load test, half hourly records of the following shall be taken:

a) Ambient temperature.
b) Exhaust temperature if exhaust thermometer is fitted.

c) Cooling water temperature at a convenient point adjacent to the water output from the engine jacket.
d) Lubricating oil temperature where oil cooler fitted.
e) Lubricating oil pressure.
f) Colour of exhaust gas
g) Speed
h) Voltage, wattage and current output.
i) Oil tank level

The necessary load to carryout the test shall be provided by the purchaser.

2. Insulation Resistance Test for Alternator

Insulation resistance in mega-ohms between the coils and the frame of the alternator when tested with a 500V megger shall not be less than IR=2x(rated voltage in KV)+1

3. Check of Fuel Consumption

A check of the fuel consumption shall be made during the load run test. This test shall be conducted for the purpose of proper tuning of the engine.

4. Insulation Resistance of Wiring

Insulation resistance of control panel wiring shall be checked by 500V Megger. The IR shall not be less than one mega ohm.

5. Functional Tests

a) Functional tests on control panel.
b) Functional test on starting provision on the engine.
c) Functional tests on all Field devices.
d) Functional tests on AVR and speed governor.

6. Measurement of Vibration

The vibration shall be measured at load as close to maximum achievable load and shall not exceed 250microns.

7. Noise Level check as per relevant standard

8. The tests shall be carried out with the DG set operating at rated speed and at maximum achievable load. Necessary correction for Test environment condition & background noise will be applied as per IS:12065.

1.11 DISCREPANCIES IN TECHNICAL PARTICULARS:

It has been noticed that some of the information furnished in the schedule of technical particulars, technical questionnaire and price schedule do not match with each other. In order to avoid any discrepancy, it may be noted that for the purpose of price evaluation the details brought out by the Tenderers in "Schedule-III" Technical Questionnaire" - SECTION 5 will be treated as final and evaluation will be done based on the information which will be given in this Schedule III. In case of discrepancy in regard to information given in any other table,

responsibility will rest solely on the Tenderer. It may please be noted that while this condition shall be applicable for the purpose of price evaluation, at the time of acceptance of Tender, the Purchaser will have the right to take such of the values which are advantageous to the Purchaser.

1.12 Services for Supervision of Erection & Commissioning OF DG Set:

1.12.1 Services for Supervision of Erection & Commissioning:

It is obligatory on the part of the Bidder to provide "free services" of their erection & commissioning team to supervise erection & commissioning of each DG set. Bidder may please note that services of their engineer shall be required for the following activities at substation sites.

S. No.	Description
1	Installation including positioning of 200KVA DG set, AMF panel, accessories, CPCB approve acoustic enclosure etc.
2	Supervision charges for installation & commissioning of DG set
3	Carrying out earthing with Copper bottom earth plate & GI bottom earth plate both 600 x 600 x 3 mm as per BIS including digging, chamber construction etc.
4	Laying of Control cable 4 core X 4 sqmm copper armoured
5	Laying of 3.5C X 195 Sqmm aluminium armoured cable with required supports and fasteners for clamping the cable

Normally MPPTCL has trained staff for erection of DG set based on guidelines, which are to be furnished by the manufacturer. While undertaking erection work the purchaser will require services of supervision engineer for suitable period depending upon design of equipment and these services for required period will have to be made available on free of cost basis. In case any manufacturer feels that their experienced engineer for final supervision of erection and testing will need assistance of any junior grade supervisor also, services of the same should also be provided on free of cost basis. In any case free services by way of deputation of required number of personnel for sufficient period will have to be ensured by the bidder on free of cost basis. The intention is that the services are made available until supervision of erection & commissioning is completed. These services shall be provided for each unit. It will be obligatory on the part of bidders to depute their erection supervisor and commissioning engineer positively within one week of telephonic intimation from MPPTCL.

SECTION 3
GENERAL TECHNICAL REQUIREMENT

3.0 GENERAL

This section stipulates the General Technical Requirements under the Contract and will form an integral part of the Technical Specification.
The provisions under this section are intended to supplement general requirements for the materials, equipments and services covered under other respective sections and are not exclusive. However in case of conflict between the requirements specified in this section and requirements specified under other sections, the requirements specified under respective sections shall hold good.

3.1 PROJECT INFORMATION AND SYSTEM PARAMETERS

a)	Customer/ Purchaser/ Owner	Madhya Pradesh power Transmission company Ltd.				
b)	Project Title	Construction of new 400 kV sub stations, transmission lines and Augmentation work/feeder bay work on total turn key basis (Lot no. 1) – Balaghat , Badnawar, Bhopal, Chhegaon and Nagda substation				
c)	Location	Balaghat	Badnawar	Bhopal	Chhegaon	Nagada
		Balaghat is Located in district of Balaghat of Madhya Pradesh . Distance between Jabalpur to Balaghat is 232 km by Road and 130 km by Rails.	Badnawar is Located in district of Dhar of Madhya Pradesh. Distance between Badnawar to Ujain is 70 km by Road .	Bhopal site is located 20 kM away from Bhopal city.	Chhegaon is located in Khandwa district of Madhya Pradesh . Distance between Chhegaon to Khandwa is 15 km by Road.	Nagda is located in Ujjain district of Madhya Pradesh. The road distance between Nagda to Ujjain is 47 km
d)	Transport Facilities	Road/Rail				

e)	Postal Address	To follow
SITE CONDITIONS		
a)	Maximum ambient air temperature	50°C
b)	Minimum ambient air temperature	1°C
c)	Average daily ambient temperature	35°C
d)	Maximum Relative humidity	95 %(sometimes approach saturation)
e)	Pollution Severity	Heavily Polluted
f)	Seismic level (horizontal acceleration)	0.3g
g)	Wind zone as per IS 802 (PART 1) - 1995velocity	4
h)	maximum wind pressure	150kg/sq.mts
i)	Average annual rainfall	1250 mm
j)	Maximum altitude above mean see level	1000m
k)	Isolceraunic level	90 days per year
l)	Climate	Moderately hot & humid tropical climate , conductive ti rust & fungus growth

AUXILIARY POWER SUPPLY

3 phase A.C power supply	415V 50 Hz, 3-phase 4 wire, solidly earthed
1 phase A.C power supply	240V ,50 Hz, 1-phase , 2 wire
D.C. power supply	**220V , 2-wire ungrounded**, for all equipments and panels except PLCC of 400kV /220kV /132kV /33kV substation
D.C. power supply	48V , 2 wire system positively earthed for PLCC

The above supply voltage may vary as below and all devices shall be suitable for continuous operation over entire range of voltage.

i.	**AC supply**	**Voltage + 10 % to -25% , frequency ± 4%**
ii.	**DC supply**	**Voltage + 10 % to -20%**

SYSTEM PARAMETERS

Description parameters	**400kV System**	**220kV System**	**132kV System**	**33kV System**
System operating voltage	400 kV	220kV	132kV	33kV
Maximum operating voltage(rms)	420 kV	220kV	145kV	36 kV
Rated frequency	50Hz			
Full wave impulse withstand voltage (1.2/50 micro second)	1425kV P	1050kVP	650kVP	250kVP/ 170kVP
One minute Power frequency dry/wet withstand voltage (rms)	630kV/ 520kV	460kV	275kV	95kV/70kV
Switching Impulse withstand voltage (250/2500 micro sec.) dry and wet	1050kV P	-	-	-
Corona extinction voltage	320kV	156kV	105kV	-
Maximum radio interference voltage for frequency between 0.5MHz and 2 MHz at 320kV rms phase for 400kV system , 156kVrms for 220kV system & 92 kV rms for 132kV system	1000 Micro volt	1000 Micro volt	500 Micro volt	-
Rated short time current	40 kA for three seconds/one second as applicable			25 kA for three seconds/26.2kA for two second
Creepage distance @25mm/kV	10500mm	6125mm	3625mm	900mm
System Earthing	Effectively Earthed			

3.2 GENERAL TECHNICAL REQUIREMENT

3.2.1 TYPE TESTS

All equipment/systems to be supplied shall conform to type tests as per relevant standards and proven type. The Bidder / Contractor shall furnish the reports of all the type tests carried out in within last **five years from the date of bid opening (i.e. 20.11.13)** as listed in relevant clauses in respective electrical specification and relevant standards for all components / equipment / systems. These reports should be for the tests conducted on identical/similar components/equipment/systems to those offered/proposed to be supplied under this contract.

Type tests done in an independent government laboratory or in the presence of representative of State Electricity Board or other reputed public undertakings, the type test reports of the same shall be submitted for scrutiny /approval. If these are

found suitable and technically acceptable, conducting of type tests shall be waived off.

In case Contractor is not able to submit report of type test(s) conducted in last five years, or in case type test report(s) are not found to be meeting the specification/relevant standard requirements, then all such tests shall be conducted under this contract by the Bidder free of cost to Employer/Purchaser, and reports shall be submitted for approval. No charges shall be paid under this contract. All acceptance and routine tests as per relevant standards and specification shall be deemed to be included in the bid price.

3.2.2 CODES AND STANDARDS

All materials and equipment shall generally comply in all respect with the latest edition of relevant international electro-technical commission (IEC) or any other internationally accepted standard which ensure equal or better quality or relevant Indian standard(IS) mentioned against each equipment and this specification.

3.3 MATERIAL/WORKMANSHIP

3.3.1 General Requirement

Where the specification does not contain characteristics with reference to workmanship, equipment, materials and components of the covered Equipment it is understood that the same must be new, of highest grade of the best quality of their kind conforming to best engineering practice and suitable for the purpose for which they are intended.

The design of the Works shall be such that installation, future expansions, replacements and general maintenance may be undertaken with a minimum of time and expenses. Each component shall be designed to be consistent with its duty and suitable factors of safety, subject to mutual agreements and shall be used throughout the design. All joints and fastenings shall be devised, constructed and documented so that the component parts shall be accurately positioned and restrained to fulfill their required function. In general screw threads shall be standard metric threads. The use of other thread forms will only be permitted when prior approval has been obtained from purchaser.

Whenever possible, all similar part of the Works shall be made to gauge and shall also be made interchangeable with similar parts. All spare parts shall be interchangeable with, and shall be made of the same materials and workmanship as the corresponding parts of the Equipment supplied under the Specification. Where feasible, common component units shall be employed in different pieces of equipment in order to minimize spare parts stocking requirements. All equipment of the same type and rating shall be physically and electrically interchangeable.

All materials and equipment shall be installed in strict accordance with the manufacturer's recommendation(s). Only first-class work in accordance with the best modem practices will be accepted. Installation shall be constructed as being the erection of equipment at its permanent location. This, unless otherwise

specified, shall include unpacking, cleaning and lifting into position, grouting, leveling, aligning, coupling of or bolting down to previously installed equipment bases/foundations, performing the alignment check and final adjustment prior to initial operation, testing and commissioning in accordance with the manufacturer's tolerances and instructions and the Specification. All factory assembled rotating machinery shall be checked for alignment and adjustments made as necessary to re-establish the manufacture's limits suitable guards shall be provided for the protection of personal on all exposed rotating and / or moving machine parts and shall be designed for easy installation and removal for maintenance purpose. The spare equipment(s) shall be installed at designated locations and tested for healthiness.

The Contractor shall apply oil and grease of the proper specification to suit the machinery, as is necessary for the installation of the equipment. Lubricants used for installation purposes shall be drained out and the system flushed through where necessary for applying the lubricant required for operation. The Contractor shall apply all operational lubricants to the equipment installed by him.

All oil, grease and other consumables used in the Works/ Equipment shall be purchased in India unless the Contractor has any special requirement for the specific application of a type of oil or grease not available in India. In such is the case he shall declare in the proposal, where such oil or grease is available. He shall help purchaser in establishing equivalent Indian make and Indian Contractor. The same shall be applicable to other consumables too.

3.3.2 Provisions For Exposure to Hot and Humid climate

Outdoor equipment supplied under the specification shall be suitable for service and storage under tropical conditions of high temperature, high humidity, heavy rainfall and environment favorable to the growth of fungi and mildew. The indoor equipments located in non-air conditioned areas shall also be of same type.

3.4 COLOUR SCHEME AND CODES FOR PIPE SERVICE/PANELS

The contractor shall propose a color scheme for those equipment/Items for which the colour scheme has not been specified in the specification for the approval of purchaser. The decision of purchaser shall be final. The scheme shall include:

Finishing colour of Indoor equipment

Finishing colour of Outdoor equipment.

Finish colour of all cubicles.

Finishing colour of various auxiliary system equipment including piping

Finishing colour of various building items.

Painting process shall be of powder coating type.All surface shall be cleaned , phosphated and given two coats of rust –resistant primer followed by two coats of finish paints . The interior of all panels cabinets and enclosures shall be finished with gloss white enamel. Two final powder coats of synthetic enamel paint of light grey shade(697 of IS-5) shall be given to exterior surface of all the panels. Sufficient quantities of touch paint shall be furnished for application at site. All The

indoor cubicles shall be of same colour scheme and for other miscellaneous items, colour scheme will be approved by the purchaser.

3.5 PROTECTION

All coated surfaces shall be protected against abrasion, impact, discoloration and any other damages. All exposed threaded portions shall be suitably protected with either a metallic or a non-metallic protecting device. All ends of all valves, pipings and conduit equipment connections shall be properly sealed with suitable devices to protect them from damage.

All equipment accessories and wiring shall have fungus protection, involving special treatment of insulation and metal against fungus, insects and corrosion.The parts which are likely to get rusted, due to exposure to weather should also be properly treated and protected in a suitable manner. Screens of corrosion resistant material shall be furnished on all ventilating louvers to prevent entry of insects.

3.6 FUNGI STATIC VARNISH

Besides the space heaters, special moisture and fungus resistant varnish shall be applied on the parts, which may be subjected or predisposed to the formation of fungi due to the presence or deposit of nutrient substances. The varnish shall not be applied to any surface of part where the treatment will interface with the operation or performance of the equipment. Such surfaces or parts shall be protected against the application to the varnish.

3.7 SURFACE FINISH

All interiors and exteriors of tanks, control cubicles and other metal parts shall be throughly cleaned to remove all rust, scales, corrosion, greases or other adhering foreign matter. All steel surfaces in contact with insulating oil as far as accessible, shall be painted with not less than two coats of heat resistant, oil insoluble, insulating paints.

All metal surfaces exposed to atmosphere shall be given two primer coats of zinc chromate and two coats of epoxy paint with epoxy base thinner. All metal parts not accessible for paintaing shall be made of corrosion resisting material. All machine finished or bright surfaces shall be coated with a suitable preventive compound and suitabley wrapped or other wise protected. All paints shall be carefully selected to withstand tropical heat and extremes of weather within the limit specified. The paint shall not scale off or wrinkle or be removed by abrasion due to normal handling. All external painting shall be as per shade no. 697 of IS:5.

3.8 GALVANIZING

All ferrous parts including all sizes of nuts, bolts, Plain and spring washers, support channels, structures, shall be hot dip galvanised conforming to latest

version of IS:2629 & or 4759 or any other equivalent authoritative standard. However, hardware less than M12 size shall be electro-galvasized. Minimum weight of zinc coating shall be **610 gm/sq.m** and minimum thickness of coating shall be 85 microns for all items thicker than 6mm. For items lower than 6 mm thickness, requirement of coating shall be as per relevant ASTM.

3.9 PACKING

The following details are to be clearly indicated in the material forwarding documents:

a) Name and address of the consignee.
b) Purchase order number.
c) Name of supplier/s.
d) Description of equipment / material.
e) Net weight.
f) Gross weight.

All the equipments shall be suitably protected, coated, covered or boxed and crated to prevent damage or deterioration during transit, handling and storage at Site till the time of erection. On request of the purchaser, the Contractor shall also submit packing details/associated drawing for any equipment material under his scope of supply, to facilitate the purchaser to repack any equipment/ material at a later date, in case the need arises. Any material found short inside the packing cases shall be supplied by the supplier without any extra cost.The cases containing easily damageable material shall be very carefully packed and marked with appropriate caution symbol i.e. fragile, handle with care, use no Hooks etc.

Mandatory spares shall be packed in separate packing with clear identification.

3.10 HANDLING, STORING AND INSTALLATION

Contractor may engage manufacturer's Engineers to supervise if required for unloading, transportation to site, storing, testing and commissioning of the various equipment being procured by them separately. In case of any doubt/misunderstanding as to the correct interpretation of manufacturer's drawings or instructions, necessary clarifications shall be obtained from the purchaser. Contractor shall be held responsible for any damage to the equipment consequent to not following manufacturer's drawings/instructions correctly.

Where assemblies are supplied in more than one section, contractor shall make all necessary mechanical and electrical connections between sections including the connection between buses. Contractor shall also do necessary adjustments/alignments necessary for proper operation of circuit breakers, isolators and their operating mechanisms. All components shall be protected against damage during unloading, transportation, storage, installation, testing and commissioning.

Contractor shall be responsible for examining all the shipment immediately of any damage, shortage, discrepancy etc. for the purpose of Purchaser’s information

only. Any demurrage, pilferage and other such charges claimed by the transporters, railways etc. shall be to the account of the Contractor.The Contractor shall be fully responsible, for the equipment/material until the same is handed over to the purchaser in an operating condition after commissioning.

The minimum phase to earth, phase to phase and section clearance along-with other technical parameters for the various switchyard voltage levels to be maintained shall be strictly as per the approved drawings.

The design and workmanship shall be in accordance with the best engineering practices to ensure satisfactory performance throughout the service life. If at any stage during the execution of the Contract, it is observed that the erected equipment(s) do not meet the above minimum clearances, the Contractor shall immediately proceed to correct the discrepancy at his risks and costs.

3.11 DEGREE OF PROTECTION

The enclosures of the Control Cabinets, Junction boxes and Marshalling boxes panels etc to be installed shall be provided with degree of protection as detailed here under:

a) Installed out door: IP-55

b) Installed indoor in air conditioned area: IP-31

c) Installed in covered area IP:52

d) Installed indoor-in non air-conditioned area where possibilities of entry of water is limited:IP-41

e) For LT switchgear (AC & DC distribution Boards): IP-54

The degree of protection shall be in accordance with IS:13947, (Part-1)/IEC-947(Part-1). Type test report/or degree of protection test on each type of the box shall be submitted for approval.

3.12 RATING PLATES, NAME PLATES AND LABELS

Type or serial number together with details of the loading conditions under which the item of the substation in question has designed to operate and such diagram plates as may required by the Purchaser. The rating plate of each equipment shall be according to IEC requirements.

All such nameplate instruction plates, rating plates shall be bilingual with Hindi inscription first followed by English. Alternately two separate plates one with Hindi and other with English inscriptions may be provided. All measurements shall be in M.K.S units.

3.13 EARTHING

Circuit breakers, LA, Isolator, CVT , CT , BPI shall be provided with two grounding pads suitable for connection to galvanized steel flat. Control panels,

Relay panel, outdoor marshalling boxes, Junction boxes, Lighting panels and distribution board shall be provided with two grounding pads, for connection to galvanized steel flat. The two pads shall be provided, one each at the middle of the two opposite sides of the bottom frame of the equipment. Earthing of hinged door shall be done by using a separate earth wire.

3.14 TERMINAL BLOCKS AND WIRING

Control and instrument leads from the switchboards or from other equipment will be brought to terminal boxes or control cabinets in conduits. All Inter-phase and external connections to equipment or to control cubicles will be made through terminal blocks.

Terminal blocks shall be **1100 V grade box** –clamp type and have continuous rating to carry the maximum expected current on the terminals. Those shall be of moulded piece complete with insulated barriers stud type terminals, washers nuts and lock nuts. Screw clamp, overall insulated, insertion type, rail mounted terminals can be used in place of stud type terminals. But preferably the terminal blocks shall be **non-disconnecting stud type equivalent to Elmex type CATM4**, Phoenix cage clamp type of Wedge or equivalent. The Insulating material of terminal block shall be nylon 6.6 which shall be free of halogens, fluorocarbons etc.

Terminal block for current transformer and voltage transformer secondary leads shall be provided with test links and isolating facilities. The current transformer secondary leads shall also be provided with short circuiting and earthing facilities.

The terminal shall be that maximum contact area is achieved when a cable is terminated. The terminal shall have a locking characteristic to prevent cable from escaping from the terminal clamp unless it is done intentionally. The conducting part in contact with cable shall preferably be tinned or silver plated however Nickel plated copper or zinc plated steel shall also be acceptable. The terminal blocks shall be of extensible design. The terminal blocks shall have locking arrangement to prevent its escape from the mounting rails.

The terminal blocks shall be fully enclosed with removable covers of transparent, non deteriorating type plastic material. Insulating barriers shall be provided between the terminal blocks. These barriers shall not hinder the operator from carrying out the wiring without removing the barriers.

Unless otherwise specified terminal blocks shall be suitable for connecting the following conductors on each side.

All circuits except CT circuits :	Minimum of 2 nos. of 2.5 sq.mm, copper flexible.
All CT circuits :	Minimum of 4 nos. of 2.5 sq.mm, copper flexible..

The arrangements shall be in such a manner so that it is possible to safely connect or disconnect terminals on live circuits and replace fuse links when the cabinet is live. **At least 20 % spare** terminals shall be provided on each panel/cubicle/box and these spare terminals shall be uniformly distributed on all terminals rows.

There shall be a minimum clearance of 250mm between the first bottom row of terminal block and the associated cable gland plate. Also the clearance between two rows of terminal blocks shall be a minimum of 150 mm. The Supplier shall furnish all wire, conduits and terminals for the necessary inter-phase electrical connection (where applicable) as well as between phases and common terminal boxes or control cabinets.

All input and output terminals of each control cubicle shall be tested for surge withstand capability in accordance with the relevant IEC Publictions, in both longitudinal and transverse modes. The supplier shall also provide all necessary filtering, surge protection, interface relays and any other measures necessary to achieve an impulse withstand level at the cable interfaces of the equipment.

3.15 CONTROL CABINETS, JUNCTION BOXES, TERMINALS BOXES AND MARSHALLING BOXES FOR OUTDOOR EQUIPMENTS

All types of boxes, cabinets etc. shall generally conform to and be tested in accordance with IS-5039, IS-8623 or IEC-439, as applicable and the clause given below.

Control cabinet, Junction boxes, Marshalling boxes & Terminal boxes shall be made of **CRCA** sheet steel of minimum 2.5 mm thickness. The thickness of door s/covers shall not be less than 2.5 mm. The box shall be properly braced to prevent wobbling. There shall be sufficient reinforcement to provide level surfaces, resistance to vibrations and rigidity during transportation and installation. Cabinet/boxes shall be free standing floor mounting type, wall mounting type or pedestal mounting type as per requirements.

Cabinet /boxes shall be provided with double hinged doors with padlocking arrangements. The distance between two hinges shall be adequate to ensure uniform sealing pressure against atmosphere. The quality of gaskets shall be such that it does not get damaged/cracked during the operation of the equipment.

All door, removable covers and plates shall be gasketed all around with suitably profiled **Neoprene gaskets**. The gasket shall be tested in accordance with approved quality plan. The quality of gasket shall be such that it does not get damaged /cracked during the years of the equipment or its major overhaul whichever is earlier. All gasketed surfaces shall be smooth, straight and reinforced if necessary to minimize distortion and to make a tight seal. Ventilating Louvers, if provided, shall have screen and filters. The screen shall be fine wire mesh made of brass.

All boxes/cabinets shall be designed for the entry of cables from bottom by means of weather proof and dust-proof connections. Boxes and cabinets shall be

designed with generous clearances to avoid interference between the wiring entering from below and any terminal blocks or accessories mounted within the box or cabinet. Suitable cable gland plate projecting atleast 150 mm above from the base of the Marshalling Kiosk/box shall be provided for this purpose along with the proper blanking plates. Necessary number of cable glands shall be supplied and fitted on this gland. The gland shall project at least 25mm above gland plate to prevent entry of moisture in cable crutch. Gland plate shall have provision for some future glands to be provided later, if required

3.16 SPACE HEATERS

The heater shall be suitable for continuous operation at 240 V AC supply voltage and shall be provided with on – off switch and fuse shall be provided for heater.

One or more adequately rated, thermostatically connected heaters shall be supplied to prevent condensation in any compartment. The heater shall be installed in the lower portion of the compartment and electrical connections shall be made from below the heater to minimize deterioration of supply wire insulation. The heaters shall be suitable to maintain the compartment temperature to prevent condensation.

The heaters shall be suitably designed to prevent any contact between the heater wire and air and shall consist of coiled resistance wire centered in metal sheath and completely encased in a highly compacted powder of Magnesium Oxide or other material having equal heat conduction and electrical insulation properties, or they shall consist of a resistance wire wound on a ceramic and completely covered with a ceramic material to prevent any contact between the wire and air. Alternatively, they shall consist of resistance wire mounted into a tubular ceramic body built into an envelop of stainless steel or the resistance wire is wound on a tubular ceramic body and embedded in glaze the surface temperature of the heaters shall be restricted to a value which will not shorten the life of the heater sheaths or that of insulated wire or other component in the compartments.

3.17 QUALITY

BHEL quality plan to be followed subject to TBEM / customer's approval.

3.18 DOCUMENTATION

3.18.1 LIST OF DOCUMENTS

The bidder shall submit a detailed list of drawings / documents along with the bid proposal which he intends to submit to the Employer after award of the contract.

The supplier shall necessarily submit all the drawings / documents unless any thing is waived.

All engineering data submitted by the Contractor after final process including review and approval by the Employer shall form part of the Contract Document

and the entire works performed under this specification shall be performed in strict conformity, unless otherwise expressly requested by the Employer in Writing.

3.18.2 DRAWINGS

All drawings submitted by the Contractor including those submitted at the time of bid shall be in sufficient detail to indicate the type, size, arrangement, material description, Bill of Materials, weight of each component, break-up for packing and shipment, the external connections, fixing arrangement required, the dimensions required for installation and interconnections with other equipments and materials, clearances and spaces required for installation and interconnection between various portions of equipments and any other information specifically requested in the specifications.

Each drawing submitted by the Contractor shall be clearly marked with the name of the Employer, name of consultant ,the unit designation, contract no. , and the name of the Project .If standard catalogue pages are submitted, the applicable items shall be indicated therein. All titles, noting, markings and writings on the drawing shall be in English. All the dimensions should be in metric units.

Further work by the Contractor shall be in strict accordance with these drawings and no deviation shall be permitted without the written approval of the Employer if so required.

All manufacturing and fabrication work in connection with the equipment prior to the approval of the drawing shall be at the Contractor's risk. The Contractor may make any changes in the design which are necessary to make the equipment conform to the provisions and intent of the Contract and such changes will again be subject to approval by the Employer. Approval of Contractor's drawing or work by the Employer shall not relieve the contractor of any of his responsibilities and liabilities under the Contract.

3.18.3 APPROVAL PROCEDURE

The scheduled dates for the submission of these as well as for, any data/information to be furnished by the Employer would be discussed and finalised at the time of award. The supplier shall also submit required no. of copies as mentioned in this specification of all drawings/design documents/test reports for approval by the Employer. The following schedule shall be followed generally for approval.

i.	Approval/comments/by employer on Initial submission	Within 2 weeks of receipt
ii.	Resubmission	Within 2 (two) weeks (whenever from date of comments required) Including both ways postal time.
iii.	Approval or comments	Within 2 weeks of receipt of

		resubmission
iv.	Furnishing of distribution copies	2 weeks from the date of last approval.

Note: The contractor may please note that all resubmissions must incorporate, all comments given in the submission by the Employer failing which the submission of documents is likely to be returned. Every revision shall be a revision number, date and subject, in a revision block provided in the drawing, clearly marking the changes incorporated.

The title block of drawings shall contain the following information incorporated in all contract drawings. Please refer enclosed sheet for details of Title block.

3.18.4 DOCUMENTS TO BE SUBMITTED ALONGWITH OFFER

1) Drawings
2) Guaranteed Technical Particulars
3) Type Test Reports
4) Manufacturing Quality Plan

3.18.5 DOCUMENTATION SCHEDULE

S. No.	DESCRIPTION	TENDER STAGE	CONTRACT STAGE FOR APPROVAL	FINAL DOCUMENTATION	
			Prints	Prints	CDs
1.	Drawings and Data Sheets	1	6	21	7 nos of all drawings / documents
2.	Drawings “As Built “	-	-	21	
3.	Type Test Reports	1	6	21	
4.	Erection Manuals	-	6	21	
5.	Operation and Maintenance Manuals	-	6	21	
6.	Manufacturing Quality Plan	1	6	21	
7.	Field Quality Plan	1	6	21	
8.	Inspection Test Reports	-	-	21	

Soft copies of drawings at contract stage shall also be submitted in **PDF format**.

Drawings will also be submitted in mini cartridges in AUTOCAD Release -14 package or any other CAD package along with conversion files for all major items.

Final Documentation shall be submitted in bound volumes with Customer & Project etc. written on top.

FIRST ANGLE PROJECTION

ON 'ISO'

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REV.	DATE	REASONS FOR REVISION	DRN.	PREPARED BY	CHECKED BY	APPROVED BY

OWNER

MADHYA PRADESH POWER TRANSMISSION COMPANY LIMITED

PROJECT

CONSTRUCTION OF NEW 400kV SUB STATION , TRANSMISSSION LINES AND AUGMENTATION WORK/FEEDER BAY WORK ON TOTAL TURN KEY BASIS (LOT NO. -1) -BALAGHAT, BADNAWAR, BHOPAL, CHHEGAON AND NAGDA

EPC PURCHASER

BHARAT HEAVY ELECTRICALS LTD
TRANSMISSION BUSINESS GROUP

DEPT CODE		NAME	SIGN.	DATE
	DRN			
	DESN			
	CHD			
	APPD			

TITLE

CV	ME	EL	MAC			DEPT. SIGN DATE

SCALE

BHEL/SUB VENDOR DRG NO.

SHT. No

REV.

SECTION 4

GUARANTEED TECHNICAL PARTICULARS OF 200 KVA DG SET

[redacted]

GUARANTEED TECHNICAL PARTICULARS FOR 200KVA DG SET

S.No.	Particulars	
1.0	**DIESEL ENGINE AND AUXILIARIES :** (DESIGN FEATURES)	
1.1	Name of manufacturer	
1.2	Rating standard BHP	
1.3	Engine rating at site	
1.4	Maximum engine rating at site	
1.5	Derating factors	
a)	Altitude	
b)	Inlet air temperature	
c)	Humidity	
d)	Others	
1.6	Period of maximum engine rating	
1.7	Operating speed	
1.8	No. of strokes per cycle	
1.9	No. of cylinders	
1.10	Arrangement of cylinders	
1.11	Rotation direction (Viewed from alternator end)	
1.12	Compression ratio	
1.13	Super charging air pressure at rated speed	
1.14	Firing order (Viewed from power take-off end)	
1.17	Fuel system injector pressure	
1.18	Fuel system booster pump pressure	
1.19	Lubricating oil temperature at pump in engine sump	
1.20	Lubricating oil pressure at pump discharge	
1.21	Minimum level of Lubricating oil	
1.22	Fuel oil system	
1.22.1	Type	
1.22.2	Filters :	

[redacted]

S.No.	Particulars	
a)	Type	
b)	Number	
c)	Location	
1.22.3	Day tank :	
a)	Capacity	
b)	Material	
c)	Location	
1.22.4	Grade of fuel oil to be used	
1.23	Lubricating oil system	
1.23.1	Type	
1.23.2	Filters :	
a)	Type	
b)	Number	
c)	Location	
1.23.3	Lubricating oil tank (sump) :	
a)	Capacity	
b)	Material	
c)	Location	
1.23.4	Grade of Lubricating oil to be used	
1.23.5	Lubricating oil pump :	
a)	Type	
b)	Capacity	
1.23.6	Lubricating oil cooler :	
a)	Type & heat transfer area	
b)	Oil inlet and outlet temperature	
1.24	Jacket water system :	
1.24.1	Type	
1.24.2	Quality of water to be used	
1.24.3	Quantity of water (Mtr.cu./hr.)	
a)	Engine cooling circuit	
b)	Lubricating oil cooler	
c)	Turbo charged cooler	
1.24.4	Make up tank :	

S.No.	Particulars	
a)	Capacity	
b)	Material	
c)	Location	
1.25	Air intake system :	
a)	Intake filter type	
b)	Location	
1.25.1	Total air quantity required :	
a)	For engine	
b)	For cooler	
c)	For charging	
1.26	Exhaust gas system :	
1.26.1	Manifolds :	
a)	Location	
b)	Size	
c)	Construction	
d)	Material	
1.26.2	Exhaust silencer :	
a)	Type	
b)	Location	
c)	Quality of exhaust gas	
1.27	Minimum loading of D.G. sets up to which it can be operated economically	
1.28	Period between major overhauling	
1.29	Starting time of D.G. sets	
1.30	List of all auxiliaries with ratings	
1.31	List of spare parts for 2 years maintenance period	
2.0	**GENERATOR AND ACCESSORIES :**	
2.1	Name of the manufacturer	
2.2	Design rating	
2.3	Continuous output rating at site conditions	
2.4	Maximum rating	
2.5	Power factor	
2.6	Rated voltage and time taken to reach full voltage	

S.No.	Particulars	
2.7	Rated current per phase	
2.8	Speed	
2.9	Frequency	
2.10	Insulation class :	
a)	Stator	
b)	Rotor	
c)	Exciter	
2.11	Temperature rise above ambient (by thermometer)	
a)	Stator	
b)	Rotor	
c)	Core	
2.12	Generator parameters :	
a)	Synchronous reactance	
b)	Transient reactance	
c)	Sub-transient reactance	
d)	Zero sequence reactance	
e)	Negative sequence reactance	
f)	Open circuit field time constant	
g)	Short circuit ratio	
h)	Resistance of field winding at operating temperature	
i)	Resistance of stator winding at operating temperature	
j)	Maximum circuit current	
k)	Duration for which D.G. set can withstand above	
2.12	Efficiency :	
a)	½ load	
b)	¾ load	
c)	Full load	
3.0	**Performance Guarantee :**	
3.1	Net electrical output at site after engine derating factors and auxiliary power requirements have been taken into account	
3.2	Fuel oil consumption (actual) :	
a)	½ load	

S.No.	Particulars	
b)	¾ load	
c)	Full load	
3.3	Lubricating oil consumption at rated load (actual) per engine hour operation	
3.4	Jacket water temperature `IN' to engine.	
3.5	Jacket water temperature `OUT' from engine.	
3.6	Lubricating oil temperature `IN' to engine.	
3.7	Lubricating oil temperature `OUT' from engine.	
3.8	Vibration and noise at rated output.	
3.9	Generator efficiency :	
a)	½ load	
b)	¾ load	
c)	Full load	
3.10	AMF compatibility	
3.11	Generation cost per unit	
3.12	Engine life in hours	
4.0	**WEIGHT SCHEDULE :**	
4.1	Weight of engine with fly wheel including standard accessories	
4.2	Weight of generator with exciter	
4.3	Weight of common base frame	
4.4	Heaviest single piece to be handled during erection and maintenance and its weight	
5.0	**DIMENSIONS :**	
5.1	After engine and generator are assembled	
5.2	Maximum dimensions of the single item to be transported	

(Signature of the Tenderer)
Name
Designation
Seal of the company

SECTION 5

ENCLOSURES TO SPECIFICATION

Schedule 1 **Schedule of Deviations**

Schedule 2 **Details of contact persons (technical & commercial)**

Schedule 3 **CheckList**

SCHEDULE – I

SCHEDULE OF TECHNICAL DEVIATION

The following are the deviations / variations / exceptions from the specification:

Section	Clause No./ Page No.	Statement of deviation/ Variations/Exceptions

1) Certified that the following are the only deviations from the specification (for the equipment and the systems being offered)

2) In case, this schedule is not submitted, it will be presumed that the equipment /material to be supplied under this contract is deemed to be in compliance with the specification.

3) If there is NIL deviation, even then the format to be filled as **NIL DEVIATION**

4) Continuation sheets of like size and format may be used as per the Bidder's Requirement and shall be annexed to this schedule.

Place

Date

Signature of the authorized representative of Bidder

Name ----------

Designation ----------

Company seal----------

SCHEDULE - II

DETAILS OF CONTACT PERSON BOTH TECHNICAL AND COMMERCIAL

Name

Address for correspondence

Phone No.

Fax No.

Email

Place

Date

Signature of the authorized representative of Bidder

Name----------

Designation----------

Company seal ----------

Note: Continuation sheets of like size and format may be used as per the Bidder's Requirement and shall be annexed to this schedule.

SCHEDULE -III

TECHNICAL QUESTIONNAIRE

ALL POINTS MENTIONED BELOW SHOULD BE REPLIED IN THESE SHEETS ONLY WITHOUT MAKING ANY REFERENCE TO ANY CLAUSE IN THE BID. IF REPLIES ARE INCOMPLETE OR REPLY TO ANY CLAUSE IS NOT FURNISHED, BID MAY BE TREATED AS INCOMPLETE AND NON RESPONSIVE FROM TECHNICAL ANGLE.

S No.	Particulars	Tenderer's Confirmation
1	Name of manufacturer and country of Origin	
2	Address of manufacturing works	
3	What is the type and designation of DG set offered	
4	Please confirm that for DG set offered necessary galvanized mounting structures complete with foundation bolts have been included in the offered price	
5	Please refer clause no. 1.4.1.1 & 1.4.6.1 of Section II & confirm that offered DG set shall comply with the standards specified	
6	Please refer clause 1.9 of Section II & confirm that type test certificates of all relevant test of offered DG set furnished with the Tender	
7	Please confirm that offered DG set shall work satisfactorily under climatic conditions as per clause 1.1.1	
8	Our important technical requirements have been detailed out in clause no. 1.3 of Section II of technical specification which may be noted carefully. Please confirm that various technical requirements should be met with. In case of deviation same has been clearly brought out in schedule VI of technical deviation please confirm	
9	Please refer clause 1.3.4 of Section II & confirm that noise level and emission parameters shall be as per latest notification of MOEF.	
10	Please confirm that Design of Diesel Engine shall be as per clause 1.4.1.	
11	Please confirm that the filter shall be dry type air filter as per clause 1.4.2.2.	
12	Please confirm that closed loop lubricant system is offered as per clause 1.4.3	
13	Please confirm that automatic electric starting is offered as per clause 1.4.4	
14	Please refer clause 1.4.5 of Section II & specify the type of fuel injection and regulator	

S No.	Particulars	Tenderer's Confirmation
15	Please confirm that Design of alternator shall be as per clause 1.4.6	
16	Please confirm that the Design of terminal box is in line with clause no. 1.4.6.8	
17	Please specify the type of coupling offered.	
18	Please specifically confirm that all required details as called under various clauses of specification have been furnished or not	
19	Please confirm that detailed drawing for offered DG set and also detailed write-up regarding constructional details of equipments have been furnished	
20	Please confirm that the mounting arrangement shall be as per clause no.1.4.7	
21	Please confirm that the peripherals to be provided are in line with clause 1.4.9.	
22	Please confirm that the control and instrumentation provided with the DG set shall comply clause 1.5. In case of deviation same has been clearly brought out in schedule VI of technical deviation please confirm?	
23	Please confirm that the DG set enclosures to be provided are in line with clause 1.6.	
24	Please confirm that a condensed engraved type electrical wiring diagram & schematic diagram drawing shall be fixed on the rear door of control cubicle from inside	
25	Please confirm that copy of bill of material including all accessories & fittings is submitted with the offer	
26	Please confirm that you have furnished copy of orders recently executed/under execution	
27	Please indicate Quantity of DG set of 200KVA or higher rating of DG sets manufactured and supplied during the last three year and current financial year	
	Financial Year 2009-2010	
	Financial Year 2010-2011	
	Financial Year 2011-2012	
	During Current Financial Year	

(Signature of the Tenderer)
Name
Designation
Seal of the company