भारत हैवी ईलैक्ट्रिकल्स लिमिटेड

BHARAT HEAVY ELECTRICALS LIMITED

पारेषण व्यापार अभियांत्रिकी प्रबंधन

TRANSMISSION BUSINESS ENGINEERING MANAGEMENT

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DIESEL GENERATOR SET (250 KVA)				दिनांक/ DATE	09.10.18	09.10.18	09.10.18
				समूह/GROUP	TBEM	W.O. No	88005
ग्राहक/ CUSTOMER	UP POWER TRANSMISSION CORPORATION LTD. (UPPTCL)						
परियोजना/ PROJECT	400/220/132 kV GIS SUBSTATION AT RASRA, BALLIA						

विषय-सूचि/ CONTENTS

Enclosure – Switchyard Plant Layout for Ballia GIS Project

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SECTION 1
INTENT, DESIGN CRITERIA, SYSTEM REQUIREMENT AND SCOPE

1.1 SCOPE

1.1.1 This specification covers the design, manufacture, inspection and testing at Contractor's and/ or his Sub-Contractor's works, transportation & delivery (FOR destination) and erection, testing & commissioning at site of **250kVA Diesel Generating Set** 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. Customer spec. provided with sec-2 shall be adhered to strictly.

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 term 'Customer' appearing in this specification shall refer to **UPPTCL**, the term 'Purchaser' shall refer to **BHEL** and the term 'Contractor' shall refer to the **Successful Bidder**.

1.2 SPECIFIC TECHNICAL REQUIREMENTS

1.2.1 SYSTEM REQUIREMENT & DESIGN CRITERIA

The following shall be considered:

1. **DG set shall have net electrical output of 250kVA at specified site conditions of 50° C ambient temperature and 100% relative humidity.**
2. Diesel engine set shall be rated for 110% of full load for 1 hour in every twelve hours of continuous running.
3. 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%.
4. **The Diesel Generator and other auxiliary motor shall be of H class with temperature rise limited to Class-F for temperature rise consideration.**
5. Enough space and termination arrangement shall be ensured by DG set supplier inside the alternator terminal box for single run of 1Cx630 sq. mm XLPE cable per phase.

6. Neutral shall be solidly grounded through CI pipe electrode. DG body shall be separately grounded through another CI pipe electrode.
7. 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.
8. **3 nos. CTs for differential protection shall be mounted in neutrals brought to the AMF panel while other 3 CTs shall be mounted on the LVAC Board. These six nos. CTs are in other's scope of supply. However, DG supplier shall ensure provision for mounting of 3 CTs in AMF Panel.**
9. 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 (Customer Standard specification).
10. DG Set will be housed placed on a foundation located in switchyard area.

1.3 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.

1.3.1 SCOPE OF SUPPLY

A. Main Item

The scope covers supply of One (1) nos. Diesel Generator Set of stationary type having a net electrical output **(after considering deration for engine and alternator separately due to temperature rise inside the enclosure and on account of power reduction due to auxiliaries)** shall be 250kVA, 1500RPM, 0.8Pf, 415V, 3 phase, 50Hz on FOR site basis. Essential components are:

i) Diesel engine set of adequate capacity to deliver 250kVA at 50^{o}C ambient temperature & 100% relative humidity.

ii) Suitable alternator **(considering suitable deration at ambient temperature of 50degC & insulation class for temperature rise as per specification)** directly coupled to the engine through coupling, complete with all accessories.

iii) Automatic Voltage Regulator.

iv) Complete starting arrangement including 2 sets of Battery (one set comprises of 2 batteries of 12 V each) & battery charger (2 sets) with leads.

v) Base frame and 1 set of AVM pads & foundation bolts.

vi) Day tank of 990 litres capacity complete with accessories viz. canopy, breather, level indicator, fuel inlet & outlet, air vent, drain plug, inlet arrangement for direct filling. The tank shall be painted with oil resistant paint. Suitably fabricated steel platform for day tank to be provided.

vii) Motor operated pump and a set of hoses to transfer fuel from barrel to day tank.

viii) Engine cooling and lubrication system. Engine air filtering system.

ix) Exhaust silencer package with adequate length of exhaust piping with insulation beyond flexible connection up to the stack height as per the CPCB norms.

x) 15 mtrs of fuel piping with valves and fittings between day tank & engine. The day tank will be placed near the DG set and would be within 5 mtrs from the periphery of the DG set.

xi) AMF control panel complete with all standard protection, alarm/ annunciations and meters necessary for 250 KVA DG set

xii) Sound proof & weather proof enclosure in line with CPCB norms for silent type DG Set.

xiii) Adequate Illumination & ventilation arrangement for DG set enclosure.

xiv) Lube oil and other consumable, touch up paints etc. for first testing & commissioning at site. Fuel (HSD) for testing and commissioning at site shall be arranged by purchaser (BHEL).

Notes:

Bidder may please see Annexure-DG attached to section-4 for major technical parameters to be ensured while quoting.

Bidder should furnish deration calculation of engine and alternator as per format given in section-5.

B. Mandatory Spares

The following mandatory spares shall be provided along with DG set:

Sl. No.	Item Description	Unit	Qty.
1	Set of filters (Lube oil/ fuel/ air)	Set	1
2	Solenoid Coil assembly	No.	1
3	Self-starter assembly with clutch engaging and disengaging arrangements complete with motors	No.	1
4	Lube oil pressure safety control	No.	1
5	High water temp. safety control	No.	1
6	Diode	Nos.	2

C. Standard Tools & Tackles

Bidder shall include one set of standard tools and tackles required for erection, operation & maintenance of equipment. The list of tools required shall be furnished in the bid.

1.3.2 SCOPE OF SERVICES

The contractor shall provide following, services:

A. Design, manufacture, shop testing including assembly test.

B. Dispatch transportation to Site.

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

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

i) Following drawings and data sheet shall be submitted for approval:
   (a) Data sheet for Engine, Alternator, Battery, AMF panel and Enclosure.
   (b) GA drawing of DG set.
   (c) Layout of DG set in the enclosure along with sections.
   (d) GA and schematic of AMF panel.
   (e) Arrangement of inclined roof and pedestal.
   (f) Details of rating plate
   (g) Storage instruction before dispatch, Packing details
   (h) All drawings and documents will be submitted by the bidder within 2 weeks after placement of order for customer approval.

ii) The DG Set shall be supplied with
   (a) DG Set test certificate.
   (b) Engine Operation & maintenance Manual
   (c) Alternator Operation, maintenance & Spare parts Manual, Alternator test certificate.

G. The draft O&M manual shall be submitted within 4 weeks after award of contract.

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

1.4 EXCLUSIONS

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

1.4.1 **Unloading, Storage of DG set and shifting from storage space to its foundation at site.**

1.4.2 Supply and laying of power & control cables.

1.4.3 Supply of GI flat and 2 nos. CI pipe electrodes for equipment earthing.

1.4.4 CTs for differential protection

1.4.5 Fuel (HSD) for testing and commissioning at site shall be arranged by purchaser (BHEL).

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

1.4.7 Construction of foundation for DG set, day tank. However, the supplier shall submit the foundation details of these equipment

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

INSPECTION AND TESTING

Inspection and testing of DG set shall be done at manufacturer works as per Customer's approved GTP/drawing/QAP. *Also refer section-2, customer spec for type test and routine test requirement, if any.*

INDICATED BOQ

Bidder shall provide items inline with indicated BOQ listed below however the same shall not be limited to scope of supply. Items not listed below shall be supplied and installed by contractor as per the technical specification.

Sl. No.	Description	Qty.
1.0	**250kVA DG Set comprising of but not limited to**: - Diesel engine complete with all accessories - Alternator directly coupled to engine through coupling, complete with all accessories - Automatic voltage regulator - Complete starting arrangement with starter motor, 2 sets of batteries (4 nos. of 12V each) and 2 Nos. battery chargers - Day tank of 990 litres capacity with canopy - Motor driven oil pump to transfer fuel to day tank - Engine cooling and lubrication system - Engine air-filtration system - Exhaust silencer package - Acoustic and weather proof enclosure as per CPCB norms - AMF panel for control, metering and alarm - Base Frame - Inspection & testing of complete DG set at works	1 Set
2.0	**Complete erection material for each site but not limited to:** - 1 set of AVM Pads. - Exhaust silencer package with 1 lot of MS class 'B' exhaust piping complete with hardware and fittings. - 1 lot of fuel piping from day tank to engine complete with hardware & fittings. - 1 lot of thermal insulation of exhaust piping and silencer beyond flexible connections. - Set of valves, strainers and unloading hose pipes as required. - 1 no. fabricated steel platform for day tank. - First fill of lube oil and consumables for commissioning at site	1 Lot
3.0	**Standard tools and tackles for erection, operation and maintenance**	1 Set
4.0	**Mandatory Spares (applicable spares as per clause 1.3.1 B)**	1 Lot
5.0	**Erection Testing & Commissioning of DG set**	1 Lot

SECTION-2

Refer CUSTOMER Specification enclosed herewith as part of section-2.

DIESEL GENERATOR SET

DIESEL GENERATOR SET

CONTENTS

TECHNICAL SPECIFICATION
FOR
DIESEL GENERATOR SET

1.1 SCOPE OF SUPPLY

The scope covers supply of Diesel Generator set of stationary type having a net electrical output of 250kVA 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.

(ii) An alternator directly coupled to the engine through coupling, complete with all accessories.

(ii) Automatic voltage regulator.

(iv) Complete starting arrangement, including two nos. batteries & chargers.

(v) Base frame, foundation bolts etc.

(vi) Day tank of 990 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) MF panel for control, metering and alarm.

(xiii) Enclosure for silent type D.G. Set

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 250kVA, 1500RPM, 0.8Pf, 415V, 3 phase, 50Hz. The above ratings are the minimum requirements. However for 132kV substations the net output of DG Set shall be 100kVA.

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

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

1.4.5.1 The engine shall be fitted with electronic governor suitable for class A-1 as per IS: 10000.

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

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 mm^2 XLPE cables per phase for 250kVA DG set and 3½Core 300 mm_2 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

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 990 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 AND 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 Out-put 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 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. Circuit breaker 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) Over speed 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 250kVA.
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
n) Two (2) Set Battery charger as specified in Technical Specification
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 a tray inside the 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 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 250 microns.

7. **Noise Level check as per relevant standard**

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.

Necessary provision should be made available to have following control and indication for SAS auxiliary panel from AMF panel:

A. For Remote Indication (Digital Input to SAS Auxiliary Panel)

1) Mains 1 ON
2) Mains 2 ON
3) Alternator ON
4) Charger 1 ON/OFF
5) Charger 2 ON/OFF
6) Main 1 LT Supply ON/OFF
7) Main 2 LT Supply ON/OFF
8) Engine Over Heating
9) Lack Of fuel
10) Low Oil Pressure
11) Set Failed to start 30 Sec after receiving the first start Impulse
12) High Cooling Water Temperature
13) Low Level in daily service fuel Tank
14) Over speed trip
15) Alternator Fault
16) Breaker ON/OFF

B. For control from remote (Digital Output from SAS Auxiliary Panel)

1) Circuit Breaker Open
2) Circuit Breaker Close
3) DG Voltage Lower
4) DG Voltage Raise
5) DG Speed Lower
6) DG Speed Raise

SECTION-3

PROJECT DETAILS & GENERAL SPECIFICATION

SITE INFORMATION

S. N.	Particular	Details
a)	Owner	UPPTCL
b)	Customer	UPPTCL
c)	Project Title	400/220/132 kV GIS at Rasra, Ballia
d)	Location	Uttar Pradesh
e)	Transport Facilities	Nearest rail head - Ballia
	SITE CONDITIONS	
a)	Max. Ambient air temp.	50°C
b)	Min. ambient air temp.	0°C
c)	Max. design ambient emp.	50°C
d)	Design reference temp.	50°C
e)	Average Humidity	Max. 100%
f)	Special corrosion conditions	No
g)	Solar Radiation	
h)	Atmospheric UV radiation	High
i)	Altitude above sea level	Less than 1000meter
j)	Pollution Severity	High Pollution level
k)	Seismic Zone	As per the seismic zone defined in the relevant BIS / **IEC-62271-300** but not less than 0.3g horrizontal
	WIND DATA	
	Wind load	195kg/sqm
	Average No. of thunderstorm days per annum	As per IS

1. GENERAL

This Chapter covers Technical Requirements and requirements of auxiliary items.

1.1 Equipments furnished shall be complete in every respect with all mountings, fittings, fixtures and standard accessories specified &/or normally provided with such equipment and/ or needed for erection, completion and safe operation of the equipment as required by applicable codes though they may not have been specifically detailed in the Technical Specifications.

Materials and components not specifically stated in the specification but which are necessary for commissioning and satisfactory operation of the substation unless specifically excluded shall be deemed to be included in the scope of the specification and shall be supplied without any extra cost All similar standard components/ parts of similar standard equipment provided, shall be inter-changeable with one another.

1.2 The Bidder shall supply type tested (including special test as per technical specification) equipments and materials. The test reports/details shall be furnished by the Bidder in the bid.

In the event of any discrepancy in the test reports i.e. any test report not acceptable due to any design/manufacturing changes or due to non-compliance with the requirement stipulated in the Technical Specification and/or IEC/ IS, same, shall be carried out without any additional cost implication to the Purchaser. The Purchaser reserves the right to get any or all type tests conducted/ repeated.

The reports for all type tests and additional type tests as per technical specification furnished by the Bidder shall be of the tests conducted within last 05(five) years prior to the date of bid opening. The type tests conducted should have either been conducted in accredited laboratory (accredited based on ISO/ IEC Guide 25/ 17025 or EN 45001 by the national accreditation body of the country where laboratory is located) or witnessed by UPPTCL or representative authorized by UPPTCL or Utility or representative of accredited test lab or reputed consultant.

2. SYSTEM PARTICULARS

	Rated System voltage	420 kV, 245kV, 145kV, 36kV
	System frequency	50 Hz, This may vary by ± 5%
	Number of phases	Three
	Neutral	Effectively Earthed
	Auxiliary power supply:-	
	Auxiliary electrical equipment shall be suitable for operation on the following supply system:	
(a)	Power device (Like drive motors)	400V, 3Phase, 4Wire 50Hz Effectively earthed AC system.
(b)	Lighting fixtures, space heaters, fractional Horse Power motors and control devices.	250V, 2wire, 50Hz, AC supply with one point grounded.
(c)	DC alarm, Control and Protective Devices from sub- station batteries as under	2 wire ungrounded DC supplies (i) 400 kV S/S : 220V DC (ii) 220/132kV S/S : 110V DC (iii) Communication : 48 V DC The above supply voltage is subject to variation as follows: All devices must be suitable for a continuous operation over the entire range of voltage variations : (i) AC Voltage may vary by ± 10%. Frequency by ± 5% Combined Voltage & frequency by ±10%. (ii) DC a) 220 V may vary between 187 & 242 V b) 110 V may vary between 93 & 121 V c) 48 V may vary between 41 & 53 V

3. System parameters

Sl. No.	Description of Parameters	400 kV System	220 kV System	132 kV System	33 kV System
1	Nominal system voltage	400kV	220kV	132kV	33kV
2	Maximum operating voltage of the system(rms)	420kV	245kV	145kV	36kV
3	Rated frequency	50Hz	50Hz	50Hz	50Hz
4	No. of phase	3	3	3	3
5	Rated short time current	50 kA for 3 Sec.	40 kA for 3 SEC	40 kA for 3 SEC	25 kA for 3 SEC
6	Dry and wet one minute power frequency withstand voltage	680 kV	460 kV	275 kV	95 kV
7	Dry and wet impulse withstand voltage positive and negative	1550 kVp	1050 kVp	650 kVp	250 kVp
8	Corona extinction voltage	320 kV	156 kV	105 kV	-
9	Max. Radio interference voltage for frequency between 0.5 MHz and 2 MHz at 508 kV rms for 765kV, 320kV rms for 400kV system and 156kV rms for 220kV system & 92kV rms for 132kV system system & 92kV rms for 132kV system	1000 microvolt	1000 microvolt	500 microvolt	-
10	Minimum total creepage	25mm/kV	25mm/kV	25mm/kV	25mm/kV
		(10500 mm)	(6125 mm)	(3625 mm)	(1300 mm)
11	Min. clearances				
	i. Phase to phase	4000mm (for Conductor-conductor)	2100 mm	1300 mm	320 mm
		4200mm (for rod - Conductor)			
	ii. Phase to earth	3500 mm	2100 mm	1300 mm	320 mm
	iii) Sectional clearances	6500 mm	5000 mm	4000 mm	3000 mm
12.	System neutral earthing	Effectively Earthed			

4. SERVICES TO BE PERFORMED BY THE EQUIPMENT BEING FURNISHED

4.1 All equipments shall perform satisfactorily under various electrical, electromechanical and meteorological conditions of the installation site.

4.2 All equipment shall be able to withstand all external and internal mechanical thermal and electromechanical forces due to various factors like wind load temperature variation, ice & snow (wherever applicable) short circuit etc for the equipment.

4.3 The Bidder shall design the various forces which the terminal connectors of the equipment are required to withstand.

4.4 All outdoor EHV equipments except marshalling kiosks shall be suitable for hot line washing.

4.5 To facilitate erection of equipment, all items to be assembled at site shall be "matchmarked".

5. SUPPORT STRUCTURES (If in the scope of Bidder)

The base design of all the equipments, to be installed on auxiliary structures, shall conform to the standard auxiliary structure designs presently being used in UPPTCL at 400/220/132/33kV Substations.

All equipment support structures shall be supplied along with brackets, angles, stools etc. for attaching the operating mechanism, control cabinets and marshalling box (wherever applicable) etc. The support structures should be hot dip galvanised with minimum 610 gram/sq.m net of zinc.

6. STANDARDS

6.1 **Except** as modified by this Bid specification, all material and equipment shall conform to the requirement of the latest editions of relevant ISS/ IEC and other applicable standards. The equipments/ works shall be designed, engineered, manufactured, built, tested and commissioned shall be carried out in accordance with the Acts, Rules, Laws and Regulations in force in India.

6.2 In addition to meeting the specific requirements called for in the respective sections of the Technical Specification, the equipment shall also conform to the general requirement of the relevant standards which shall form an integral part of the specification. When the specific requirements stipulated in the specifications exceed or differ than those required by the applicable standards, the stipulation of the specification shall take precedence.

6.3 In the event of the Bidder offering equipment conforming to standards other than ISS/IES standards, which ensure equivalent or better performance than that specified in the standards, the salient point of comparison between the standards adopted and relevant ISS/ IEC standards shall be indicated clearly in the proposal, along with English language version of such standard or relevant extract of the same. The equipment conforming to standards other than IS/IEC shall be subject to Purchaser's approval.

6.4 The standards mentioned in the respective equipment specifications are not mutually exclusive or complete in themselves. The equipment &/or work shall also conform to any other applicable standard, even if not specifically mentioned in these specifications.

6.5 Should the Bidder wish to depart from the provisions of the specifications, either on accounts of manufacturing practices or for any other reason, he shall clearly mention the departure and submit complete justification supported by information, drawings etc. as will enable to assess the suitability of equipment(s) offered. In the event of the Bidder's specifications, drawings, forms and tables etc. being found to disagree with the requirement of the Bid specifications at any stage, Bid specifications shall be binding, unless the departures have been duly approved in writing by the purchaser.

6.6 REFERENCE OF STANDARDS

Reference	Abbreviation	Name and Address
BS	British Standards,	British Standards Institution, 101, Pentonnvilla Road, N-19-ND UK
ISO	International Organization	Danish Board of Standardization Danish Standardising Sraat, Aurehoegvej-12, DK-2900, Heelprup, DENMARK
NEMA	For Standardization, National Electric Manufacture Associate	115, East 44th Street, New York NY 10017 U.S.A
BS	British Standards,	British Standards Institution, 101, Pentonnvilla Road, N-19-ND UK
ISO	International Organization	Danish Board of Standardization Danish Standardising Sraat, Aurehoegvej-12, DK-2900, Heelprup, DENMARK
NEMA	For Standardization, National Electric Manufacture Associate	115, East 44th Street, New York NY 10017 U.S.A

7. ENGINEERING DATA AND DRAWINGS

7.1 SUBMISSION AND APPROVAL OF DRAWINGS/ DOCUMENTS

7.1.1 The Bidder shall follow a well-defined coding system for proper and quick identification of all systems/ sub-systems/ equipments/ assemblies/ sub-assemblies/ accessories/ other plant material/ spare parts/ special tools and plants and drawings for the execution of the plant and later for its operation and maintenance.

Copies of coding documents defining the above shall be supplied along with drawings to understand the system.

7.1.2 All drawings submitted by the Bidder shall be in sufficient details to indicate the type, size arrangement, weight of each component, details for packing and shipment, the external connections, fixing arrangements, dimensions required for installation arrangement, dimensions required for installation and interconnections with other equipment and other information specifically, as called for in the drawing schedules. All the equipments tapping points etc. shall be numbered according to pre-determined scheme/ system which shall be subject to approval of Purchaser.

7.1.3 Each drawing shall be clearly marked with the name of the Purchaser, unit designation, UPPTCL's 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 drawings shall be in English. All the dimensions should be in metric units.

7.1.4 If any dimension figures on a drawing or a plan differs from those obtained by scaling the drawing or plan, the dimensions as mentioned in figures on the drawing or plan shall be taken as correct.

7.2 Submission and distribution of drawings/ documents

All the drawings which do not require approval shall be submitted along with reproducible in required number and those requiring approval shall be initially submitted for comments/ approval before submitting along with reproducible as per "Document Distribution Schedule".

7.3 APPROVAL OF DRAWINGS

7.3.1 The Purchaser shall return to the Bidder one set of drawings, plans and technical data requiring approval after marking them with their comments/ corrections, if any, either (a) marked 'Approved' or (b) marked 'Approved subject to incorporation of comments" or (c) marked 'Not Approved' with comments requiring resubmission of drawings etc. in 14 days or (d) marked 'Approval not required', where drawing is for information only. In case of (a) no further revision of drawings will be required. In case of (b) Bidder can proceed with the work but will resubmit the drawings incorporating the corrections as per comments only within fourteen (14) days. In case of (c) Bidder can proceed with the work only after resubmitting the drawings within fourteen (14) days and getting approval under (a) or (b) categories above. In case of (d) the Bidder drawing is deemed to have been received only for information purpose.

7.3.2 The Purchaser shall have the right to ask the Bidder to make any change in the design/ drawing which may be necessary to make equipment conform to the provisions and intent of the contract, without any extra cost to the Purchaser.

The drawings submitted shall be re-viewed by the Purchaser and shall be modified by the Bidder as required. The Bidder shall incorporate such modifications and/or corrections and submit the final drawings for approval/ reference.

7.3.3 No deviation from the approved drawings shall be permitted without the written approval of the Engineer.

7.3.4 The review of drawings/ data by the Purchaser will cover only general conformance of the data of the specifications and document, interfaces with the equipment provided under the specifications, external connections and the dimensions which might effect substation layout.

This review by the Purchaser may not indicate thorough review of all dimensions, quantities and details of the equipment, wiring, materials, any devices or items indicated or the accuracy of the information submitted. This review and/ or approval by the purchaser shall not be considered by the Bidder, as limiting any of his responsibilities specified under these specifications and documents.

Approval/ comments conveyed as above shall neither relieve the Bidder of his contractual obligations and his responsibilities for correctness of dimensions, material of construction, quantities, design details, assembly fits, performance particulars, guarantees and conformity of the supplies with the specifications, schemes, systems and statutory laws, nor does it limit the Purchasers right under the contract.

7.3.5 Should any minor revision be made after 'approval', at the time of erection/ commissioning the Bidder shall redistribute prints and reproducible, clearly certifying the changes incorporated in the drawing and marking it in a block. Every revision shall be marked by a revision number, date and subject, in a revision block provided in the drawing, clearly marking the changes incorporated.

7.3.6 The Bidder shall be responsible for and shall pay for any alterations of the work due to any discrepancies, errors and omissions in the drawings or other particulars supplied by him, whether such drawings or particulars have been approved by Engineer or not.

No extension of delivery periods shall be granted on this account.

7.3.7 As- build drawings

Drawings of all equipments as detailed in technical specifications of respective equipments necessarily including schematic drawings and terminal block drawings wherever applicable whether mentioned in respective technical specifications or not.

8. NAME PLATE, MARKING OF PARTS, LABELS

8.1 All equipment shall have metal name plates fixed in suitable position with full particulars engraved legibly thereon and not painted.

8.2 Each main and auxiliary item of plant is to have permanently attached to it in a conspicuous position, a rating plate of non corrosive material upon which is to be engraved identifying manufacturer's name, equipment type or serial number, rating together with details of the loading/ operating conditions under which the item or plant in question has been designed to operate and such diagram plates as may be required by the Engineer.

8.3 Each item of plant is to be provided with a name plate or label designating the service of the particular equipment. These inscriptions are to be approved by the Engineer or as detailed in the appropriate sections of the technical specifications.

8.4 Such name plates or labels are to be white non hygroscopic material with engraved block lettering or, alternatively, in the case of indoor equipments of transparent plastic material with suitably colored lettering engraved on the back

8.5 Each bay module in GIS room will have a clear marking showing the name of bay, identification, name and rating plate marking for each individual equipment like circuit breaker, disconnectors grounding switches, current transformer, voltage transformers and bushings etc. as per relevant IEC to facilitate identification during routine operation/ maintenance.

8.6 All such name plates, instruction plates, lubrication charts etc. shall be bilingual with Hindi inscription first followed by English. Provisions shall be made to fit in name plates,

lubrication/ connection diagram plates etc.

8.7 In order to facilitate identification, the parts of the equipment shall be suitably marked.

9. INSTRUCTION MANUALS

9.1 The Bidder shall submit to the Engineer 'Descriptive Manuals', i.e. system design concept, detailed catalogues of equipment and typical equipment instructions for this project, for all major systems and equipment, covered under this contract along with dispatch of equipment.
These initial copies of descriptive manuals shall be in sufficient details, bringing out detailed internal construction, characteristics, performance parameters, principles of operation, maintenance requirements, replacement and renewals needed, erection and overhauling procedure, testing and operation procedure etc. for various equipment.

9.2 The integrated instruction manuals, fully defining the interfaces between various systems and complete in all respects shall be submitted by the Bidder one month before scheduled date of commissioning. The instruction manuals shall contain full details of designation and drawings of all the equipment furnished, the erection procedure, testing procedure, operation and maintenance procedure of the equipment, single line diagrams, and schematics. After the commissioning and initial operation of the plant, modifications/ additions/ changes, wherever required shall be incorporated in the instruction manuals and drawings shall be submitted by the Bidder to the Purchaser.

9.3 The manuals shall be specific to the equipment supplied and not of general nature.

10. DOCUMENTS AND ERECTION DRAWINGS

The Bidder shall submit within a reasonable time but at least four (4) weeks before dispatch of equipment (as per distribution schedule) the following drawings/ documents and instruction manuals etc. to the consignee and the Engineer.

I. List of item-wise equipment as proposed to be dispatched by the Bidder.
II. Erection drawings along with reproducible prints of each drawings.
III. Instruction books for proper handling/ checking of material on receipt at site/storage, erection and assembly of all equipment and necessary instruction for checking and recording proper assembly of the plant.
IV. Instruction sheets for proper balancing, alignment, adjustment, checking and calibrations as may be necessary.
V. Descriptive literature and drawings to illustrate the working principals, methods of Assembly and dismantling of plants and equipment.
VI. Testing/commissioning format for recording data during erection/testing/ commissioning and trial run. These formats/data sheets shall clearly indicate the results obtained during shop tests and permissible deviations.

11. QUALITY CONTROL PROGRAMME

To ensure that the equipment construction work and the services covered under this job are in accordance with the specifications and conform to the high standard of

workmanship. It is obligatory on the part of the Bidder to adopt a suitable quality control program. Such a program shall include suitable hold point for check for major equipments during manufacture at supplier's work, during erection at site and during the construction stage such that material checks for attaining proper strength and dimensional checks for attaining close tolerances required for equipment installation can be obtained.

In order to attain the above objectives, the Bidder shall draw out a plan listing all quality control checks in detail, including all hold points at which the quality checks shall be applied, also specifically mentioning those hold points where the Purchaser shall also participate in the quality check to assure him of the quality of the products supplied. Such a program shall be outlined by the Bidder for the acceptance by the Purchaser. The Bidder shall furnish detailed information regarding his quality control program and its strict implementation. Following information shall be included in the proposal along with others regarding quality control program:

I. The quality control organizations and the proposal of its implementation.
II. The system for controlling drawings and documents for correctness.
III. The system of quality control for raw materials, process control and maintaining tolerances during manufacturing, assembly and fabrication.
IV. Quality control during purchase of components, sub-systems and assemblies.
V. Methods for ensuring selection of proper vendors/ sub-vendors.
VI. Inspection of testing at shop after assembly.
VII. Control of accuracy during calibration of measuring and testing equipments.
VIII. Preservation and quality control during the transit.
IX. Procedure for inspection before erection and quality control during erection.
X. System for storage and delivery.

Bidder shall be wholly responsible for the quality control and quality assurance for the manufacture, supply, erection, testing and commissioning etc.

During inspection, destructive testing and non- destructive test evaluation shall be done wherever applicable, in presence of Purchaser's representative in accordance with established norms. Directions of Purchaser shall be rigorously followed.

12. INSPECTION & TESTING

12.1 The Purchaser reserves the right to inspect any machinery and material to ensure that approved Q.A.P. is being strictly implemented by the Bidder or his Sub Bidder/ Supplier under this contract and to reject any item found defective in workmanship or design or otherwise unsuitable for the use and purpose intended or which is not in accordance with the intent of this contract. The Bidder should on demand by the Purchaser, rectify or replace such defective or unsuitable equipment, or the Purchaser may at the Bidder's expense, rectify or replace such defective or unsuitable equipment whether before or after supply.

12.2 That Bidder shall, for purpose of clause 15 of the annexed conditions of contract Form-A inform to the Purchaser places of manufacture, testing and inspection of various equipment offered by him. Unless specifically provided otherwise, all tests shall be

carried out at the Bidder's work or for bought out items at sub-vendors works before dispatch.

12.3 The Bidder shall advise the Purchaser at least 4 weeks in advance as to when the equipment will be ready for stage/ final inspection at the Bidder's works or at his Sub-Bidder's works.

PENAL CHARGES

In case the equipment is not available for inspection at the time of arrival of inspection officers, the Bidder shall pay to UPPTCL towards futile journey a sum decided by Chief Engineer (765 KV DU), UPPTCL and demanded by "Engineer of Contract". This amount shall be paid within 10 days from the date of demand. Further action for inspection of the material shall be taken only after the said amount is deposited.

12.4 During inspection, the Purchaser's Inspecting Engineers at all times have access to all part of shops where the equipment is being manufactured and also shall be provided with all reasonable inspection facilities by the Bidder and/ or sub-Bidders.
Even without scheduled inspection, the Engineer and/or his duly authorized representative shall have at all reasonable times access to the Bidder's premises, works or site and shall have the power to inspect and examine the materials and workmanship of the works during it's manufacture or erection.

12.5 All plants equipment/ parts, sub-assemblies/ assemblies shall comply with the requirement of type tests and shall be subjected to the routine/ acceptance tests specified in the set of standards adopted and to such other tests as are stipulated in the respective technical specifications.

The Purchaser reserves to himself the right of having at his own expense any inspection or special test of a reasonable nature at Bidder's premises or at site, in addition to those prescribed in applicable standards and the enclosed technical specifications.

12.6 The Engineer shall either depute his representative to witness the tests as applicable and inspect the material or shall waive the inspection. In case of waiver the Bidder or his sub-Bidder shall carryout the all applicable tests in absence of Purchaser's representative. In both the cases i.e. either inspection or waiver the test certificates shall be submitted to Engineer of Contract for approval and issue of dispatch authorization. In case of inspection the test certificates must bear signatures of the Purchaser's inspecting officer.

The Engineer of Contract, within 10 days of receipt of test certificates, shall issue approval/ dispatch authorization, if test certificates are found satisfactory.

In case test certificates are not found satisfactory the Engineer of Contract, within 10 days of receipt of test certificates, shall communicate his objections and actions required to be taken in writing to the Bidder. The Bidder shall take remedial action and shall re-submit the test certificates or re-offer the material for inspection as asked for by the Engineer. Subsequent actions shall follow as in case of fresh offer for inspection. No extension of delivery/ completion period shall be granted on this account.

12.7 REJECTON

Purchaser reserves the right to reject any equipment if during the tests at works or site, the test value achieved do not comply with the respective standard/ specifications and exceeds that tolerable limits. Rejection of any equipment will not be held as a valid reason for delay in timely completion of the work.

12.8 No equipment to be furnished or used in connection with this contract shall be dispatched, until factory inspection and acceptance test have been carried out satisfactorily and dispatch authorization issued by Engineer of Contract. Such factory inspection of the equipment or approval of acceptance tests shall not however, relieve the Bidder from full responsibility for supplying equipment conforming to the requirements of this contract, nor prejudice any claim, right or privilege which the Purchaser may have because of the use of defective or unsatisfactory equipment. Should Purchaser waive the right to inspect any equipment, such waiver shall not relieve the Bidder in any way from his obligations under this contract. The inspection/waiver by Engineer and/ or approval of test certificates shall in no way limit the liabilities and responsibilities of the Bidder in respect of the agreed quality assurance program, and the desired performance of the equipment.

12.9 In all cases where the contract provides for tests whether at the premises or works of the Bidder or of any Sub-Bidder, the Bidder shall provide free of charge such items as labour, materials, electricity, fuel, water, stores, apparatus and instruments as may be reasonably required to carry out effectively, such tests on the equipment in accordance with the contract and shall give facilities to the Engineer or to his authorized representative to accomplish inspection.

All the expenses incurred for testing including material consumed in testing shall be to the Bidder's account.

12.10 Purchaser will not entertain any request for waiver of inspection on the ground that sub-vendors are not agreeing for the Purchaser's inspection. It is the responsibility of the Bidder to ensure that all the requirements of the Purchaser as envisaged in the technical specifications are incorporated.

12.11 The Bidder is required to record the following certificates on the invoices and challans of each and every consignment:

"Certified that material being dispatched against the above invoices and challan has been inspected and tested by the representative of Engineer of the contract on (date) and all the test results were satisfactory, as per approved test certificate enclosed."

Or

Certified that inspection of material being dispatched against the above invoice and challan has been waived off by Engineer of Contract vide letter No.....Dt..... (Copy enclosed) and all the acceptance and routine tests as per relevant standards and those provided in Contract, have been conducted and all the test results were found satisfactory as per test certificates enclosed."

12.12 In case the inspection or testing of the material is to be carried out outside India, all the expenditure including boarding and lodging etc. of the inspecting officer/ officers shall be

borne by the contractor and information regarding inspection has to given at least 8 weeks in advance.

13. PACKING

13.1 All equipment 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.
While packing all the materials, the limitations from the point of view of availability of transportation facilities in India should be taken into account. The Bidder shall be responsible for any loss or damage during transportation, handling and storage.

13.2 The Bidder shall include and provide for security protection and packing the plant so as to avoid loss or damage during transport by any mode.

13.3 All packing shall allow for easy removal and checking at site. Wherever necessary, proper arrangement for attaching slings for lifting shall be provided. All packages shall be clearly marked for with signs showing 'UP' and 'DOWN' side of boxes, and handling and unpacking instructions as considered necessary. Special precautions shall be taken to prevent rusting of steel and iron parts during transit and storage. Gas seals or other methods proposed to be adopted for protection against moisture during transit shall be to the satisfaction of the engineer.

13.4 The cases containing easily damageable material shall be very carefully packed and marked with appropriate caution symbols i.e. FRAGILE, HANDLE WITH CARE, USE NO HOOKS etc.

13.5 Each package delivered under the contract shall be marked by the Bidder at his expense and such marking must be distinct (all previous irrelevant marking being carefully obliterated). Such marking shall show the description and quantity of contents, the name of consignee and address, the gross and net weights of the package, the name of Bidder with a distinctive number of mark sufficient for purpose of identification. All markings shall be carried out with such materials as to ensure quickness of drying, fastness and legibility.

13.6 Each Package shall contain a note quoting specifically the name of the Bidder, the number and date of contract or order and the name of office placing the contract, nomenclature of the stores and include a schedule of parts for each complete equipment giving the parts number with reference to the General Arrangement/ Assembly drawing and the quantity of each part, drawing number and tag numbers.

13.7 All equipment/ material shall be suitably packed for transport, carriage at site and outdoor storage during transit. The Bidder shall be responsible for any damage to the equipment during transit. The contents of each package shall bear marking that can be readily identified from the package list and packing shall provide complete protection from moisture, termites and mechanical shocks etc.

13.8 Any material found short inside the packing cases shall be supplied by the Bidder without any extra cost.

13.9 Notwithstanding anything stated in this clause the Bidder shall be entirely responsible for any loss, damage or depreciation to the stores.

14. DESPATCH OF EQUIPMENT

14.1 Detailed dispatch instructions will be intimated to the Bidder. All materials shall be dispatched by road.

14.2 The Bidder shall intimate, at least thirty (30) days in advance to the consignee as well as the concerned Superintending Engineer at site, the probable date when the equipment will be ready for dispatch from the works. Notification of delivery or dispatch in regard to each and every consignment shall be made to the Purchaser immediately after dispatch or delivery. The supplier shall further supply to the consignee a priced invoice and packing account of all stores delivered or dispatched by him. All packages, containers, bundles and loose materials forming parts of each and every consignment shall be described fully in the packing account, and full details of the contents of packages and quantity of material shall be given to enable the consignee to check the stores on arrival at destination.

14.3 A list in duplicate containing details of equipment for verification at site shall also be placed inside each package and shall correspond with the advice note. One additional copy of each of the package lists shall also be sent to the consignee.

15. TYPE TESTING, INSPECTION, TESTING & INSPECTION CERTIFICATE

The Bidder shall supply type tested (including special test as per technical specification) equipments and materials. The test reports/details shall be furnished by the Bidder in the bid.

In the event of any discrepancy in the test reports i.e. any test report not acceptable due to any design/manufacturing changes or due to non-compliance with the requirement stipulated in the Technical Specification and/or IEC/ IS, same, shall be carried out without any additional cost implication to the Purchaser. The Purchaser reserves the right to get any or all type tests conducted/ repeated.

The reports for all type tests and additional type tests as per technical specification furnished by the Bidder shall be of the tests conducted within last 10(five) years prior to the date of bid opening. The type tests conducted should have either been conducted in accredited laboratory (accredited based on ISO/ IEC Guide 25/ 17025 or EN 45001 by the national accreditation body of the country where laboratory is located) or witnessed by UPPTCL or representative authorized by UPPTCL or Utility or representative of accredited test lab or reputed consultant.

15.1 Pre-commissioning Tests

On completion of erection of the equipment and before charging, each item of the equipment shall be thoroughly cleaned and then inspected jointly by the Purchaser

and the Contractor for correctness and completeness of installation and acceptability for charging, leading to initial pre-commissioning tests at Site. The list of pre-commissioning tests to be performed are given in respective chapters and shall be included in the Contractor's quality assurance programme.

15.2 Commissioning Tests

15.2.1 The available instrumentation and control equipment will to be used during such tests and the Purchaser will calibrate, all such measuring equipment and devices as far as practicable.

15.2.2 Any special equipment, tools and tackles required for the successful completion of the Commissioning Tests shall be provided by the Contractor, free of cost.

15.2.3 The specific tests requirement on equipment have been brought out in the respective chapters of the technical specification.

15.2.4 The Contractor shall be responsible for obtaining statutory clearances from the concerned authorities for commissioning the equipment and the switchyard. However necessary fee shall be reimbursed by POWERGRID on production of requisite documents.

16. MATERIAL WORKMANSHIP

16.1 General Requirement

Where the specification does not contain references 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. All joints and fastenings shall be devised, constructed and documented so that the component parts shall be accurately positioned and restrained to fulfil 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 the 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 also be interchangeable 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 modern practices will be accepted. Installation shall be considered 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, instructions and the Specification. All factory assembled rotating machinery shall be checked for alignment and adjustments made as necessary to re-establish the manufacturer's limits.

Suitable guards shall be provided for the protection of personnel on all exposed rotating and/ or moving machine parts and shall be designed for easy installation and removal for maintenance purposes. The spare equipment(s) shall be installed at designated locations and tested for healthiness.

The Bidder 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 Bidder 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 Bidder 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 in available. He shall help Purchaser in establishing equivalent Indian make and Indian Contractor. The same shall be applicable to other consumables too.

A cast iron or welded steel base plate shall be provided for all rotating equipment which are to be installed on a concrete base unless otherwise agreed to by the Purchaser. Each base plate shall support the unit and its drive assembly, shall be of design with pads for anchoring the units and shall have a raised up all around and shall have threaded in air connections, of so required.

16.2 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 favourable to the growth of fungi and mildew. The indoor equipments located in non-air conditioned areas shall also be of same type.

16.3 Space Heaters

The heaters shall be suitable for continuous operation at 240V AC supply. On-off switch and fuse shall be provided for the heater.

One or more adequately rated thermostatically connected heaters shall be supplied to prevent condensation in any compartment. The heaters shall be installed in the lower portion of the compartment and electrical connections shall be made sufficiently away from below the heaters 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 the air and shall consist of coiled resistance wire centred in a 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 resistance wire wound on a ceramic and completely covered with a ceramic material to prevent any contact between the wire and the air. Alternatively, they shall consist of a resistance wire mounted into a tubular ceramic body built into an envelope 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 sherns or that of insulator wire or other component in the compartments.

16.4 FUNGI STATIC VARNISH

Besides the space heaters, special moisture and fungus resistant varnish shall be applied on 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 of the varnish.

16.5 Ventilation opening

In order to ensure adequate ventilation, compartments shall have ventilation openings provided with fine wire mesh of brass to prevent the entry of insects and to reduce to a minimum the entry of dirt and dust. Outdoor compartment openings shall be provided with shutter type blinds and suitable provision shall be made so as to avoid any communication of air/ dust with any part in the enclosures of the Control Cabinets, Junction boxes and Marshalling Boxes, panels etc.

16.6 Degree of Protection

The enclosures of the Control Cabinets, Junction boxes and Marshalling Boxes, panels etc. to be installed shall provide 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 possibility of entry of water is limited: IP-41.
e) For LT Switchgear (AC & DC distribution Boards) : IP-52

The degree of protection shall be in accordance with IS: 13947 (Part-I) / IEC-60947(Part-I) / IS 12063 / IEC-60529. Type test report for degree of protection test,

shall be submitted for approval.

16.7 RATING PLATES, NAME PLATES AND LABELS

Each main and auxiliary item of substation is to have permanently attached to it in a conspicuous position a rating plate of non-corrosive material upon which is to be engraved manufacturer's name, year of manufacture, equipment name, type or serial number together with details of the loading conditions under which the item of substation in question has been designed to operate, and such diagram plates as may be required by the Purchaser. The rating plate of each equipment shall be according to IEC requirement.

All such nameplates, instructions plates, rating plates CB, CT, VT, SA, Isolators and Relay & Protection panels equipments shall be bilingual with Hindi inscription first followed by English.

Alternatively, two separate plates one with Hindi and the other with English inscriptions may be provided.

16.8 FIRST FILL OF CONSUMABLES, OIL AND LUBRICANTS

All the first fill of consumables such as oils, lubricants, filling compounds, touch up paints, soldering/brazing material for all copper piping of circuit breakers and essential chemicals etc. which will be required to put the equipment, covered under the scope of the specifications, into successful operation, shall be furnished by the Bidder unless specifically excluded under the exclusions in these specifications and documents.

17. Surface finish

All interiors and exteriors of tanks, control cubicles and other metal parts shall be thoroughly 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 painting shall be made of corrosion resisting material. All machine finished or bright surfaces shall be coated with a suitable preventive compound and suitably wrapped or otherwise 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. 631 of IS: 5.

18. HOT DIP GALVANISING

All ferrous parts including all sizes of nuts, bolts, plain and spring washers, support channels, structures, shall be hot dip galvanized conforming to latest version of IS: 2629 or any other equivalent authoritative standard. However, hardware less than M12 size shall be electrogalvanized.

Minimum weight of zinc coating shall be 610 gm/ sq.mm and minimum thickness of coating shall be 85 microns for all items thicker than 6 mm. For items lower than 6mm thickness, requirement of coating shall be as per relevant ASTM. For surface which shall be embedded in concrete, the zinc coating shall be 610 gm/sq. m minimum.

The galvanized surfaces shall have a continuous and uniform thick coating of zinc, firmly adhering to the surface of steel. The finished surface shall be clean and smooth and shall be free from defects like discoloured patches, bare spots, unevenness of coating, spelter which is loosely attached to the steel globules, spiky deposits, blistered surface, flaking or peeling off, etc. The presence of any of these defects noticed on visual or microscopic inspection shall render the material liable to rejection.

After galvanizing, no drilling or welding shall be performed on the galvanized parts of the equipment excepting that nuts may be threaded after galvanizing. Sodium dichromate treatment shall be provided to avoid formation of white rust after hot dip galvanization.

Galvanised material must be transported properly to ensure that galvanised surfaces are not damaged during transit. Application of zinc rich paint at site shall not be allowed.

19. PAINTING

19.1 All sheet steel work shall be degreased, pickled, phosphated in accordance with the IS-6005 “Code of practice for phosphating iron and sheet”. All surfaces, which will not be easily accessible after shop assembly, shall beforehand be treated and protected for the life of the equipment. The surfaces, which are to be finished painted after installation or require corrosion protection until installation, shall be shop painted with at least two coats of primer. Oil, grease, dirt and swaf shall be thoroughly removed by emulsion cleaning. Rust and scale shall be removed by pickling with dilute acid followed by washing with running water, rinsing with slightly alkaline hot water and drying.

19.2 After phosphating, thorough rinsing shall be carried out with clean water followed by final rinsing with dilute dichromate solution and oven drying. The phosphate coating shall be sealed with application of two coats of ready mixed, stoving type zinc chromate primer. The first coat may be “flash dried” while the second coat shall be stoved.

19.3 After application of the primer, two coats of finishing synthetic enamel paint shall be applied, each coat followed by stoving. The second finishing coat shall be applied after inspection of first coat of painting.

19.4 The exterior and interior colour of the paint in case of new substations shall

preferably be RAL 7032 for all equipment, marshalling boxes, junction boxes, control cabinets, panels etc. unless specifically mentioned under respective sections of the equipments. Glossy white colour inside the equipments /boards/panels/junction boxes is also acceptable. The exterior colour for panels shall bematching with the existing panels in case of extension of a substation. Each coatof primer and finishing paint shall be of slightly different shade to enable inspection of the painting. A small quantity of finishing paint shall be supplied for minor touching up required at site after installation of the equipments.

19.5 COLOUR SCHEME AND CODES FOR PIPE SERVICE

The Bidder shall propose a colour scheme for the those equipments/ 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.
- All steel structures, plates etc. shall be painted with non-corrosive paint with a suitable primer.

It may be noted that normally all electrical equipments in switchyard are painted with shade 631 of IS-5. The indoor cubicles, GIS enclosures and other miscellaneous items, the colour scheme shall be approved by the Purchaser during detailed engineering.

For aluminium casted surfaces, the surface shall be with smooth finish. Further, in case of aluminium enclosures the surface shall be coated with powder (coating thickness of 60 microns) after surface preparation for painting.

20. TOOLS AND TACKLES

The Contractor shall supply with the equipment one complete set of all special tools and tackles for the erection, assembly, dis-assembly and maintenance of the equipment. However, these tools and tackles shall be separately, packed and brought on to Site.

21. CONTROL CABINETS, JUNCTION BOXES, TERMINAL BOXES & MARSHALLING BOXES FOR OUTDOOR EQUIPMENT

21.1 All types of boxes, cabinets etc. shall generally conform to and be tested in accordance with IS- 5039/ IS-8623, IEC-60439, as applicable, and the clauses given below.

21.2 Control cabinets, junction boxes, marshalling boxes and terminal boxes shall be made of sheet steel or aluminum enclosure and shall be dust, water and vermin proof. Sheet steel used shall be at least 2.0 mm thick cold rolled or 2.5 mm hot rolled. The box shall be properly braces to prevent wobbling. There shall be sufficient reinforcement to provide level surfaces, resistance to vibrations and rigidity during transportation and installation.

In case of aluminum enclosed box, the thickness of aluminum shall be such that it provides adequate rigidity and long life as comparable with sheet steel of specified thickness.

21.3 Cabinet/boxes shall be free standing floor mounting type, wall mounting type or pedestal mounting type as per requirements. A canopy and sealing arrangements for operating rods shall be provided in marshalling boxes/ Control cabinets to prevent ingress of rain water.

21.4 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 the gasket shall be such that it does not get damaged/cracked during the operation of the equipment.

21.5 All doors, removable covers and plates shall be provided gasket all around with suitably profiled EPDM/Neoprene gaskets. The gasket shall be tested in accordance with approved quality plan, IS:11149 and IS:3400. The quality of gasket shall be such that it does not get damaged/cracked during 10(ten) years of operation 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.

21.6 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 at least 150 mm above 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 plate. Gland plate shall have provision for some future glands to be provided later, if required.

21.7 A 240V, single phase, 50 Hz, 15 amp AC plug and socket shall be provided in the cabinet with ON-OFF switch for connection of hand lamps. Plug and socket shall be of industrial grade.

21.8 For illumination, a 20 Watts fluorescent tube or 15 watts CFL/LED bulb shall be provided. The switching of the fittings shall be controlled by the door switch.

For junction boxes of smaller sizes such as lighting junction box, manual operated earth switch mechanism box etc., plug socket, heater and illumination is not required to be provided.

21.9 All control switches shall be of rotary type. Toggle piano switches shall not be accepted.

21.10 Positive earthing of the cabinet shall be ensured by providing two separate earthing pads. The earth wire/ strip shall be terminated on to the earthing pad and secured by the

use of self-etching washer. Earthing of hinged door shall be done by using a separate earth wire.

21.11 The bay marshalling kiosks shall be provided with danger plate and a diagram showing the numbering/connection/ feruling by pasting the same on the inside of the door.

21.12 The following routine tests alongwith the routine tests as per IS: 5039 shall also be conducted:
Check for wiring
Visual and dimension check

The enclosure of bay marshalling kiosk, junction box, terminal box shall be type tested for IP-55 as per IS: 13947. After IP-55 test, 2.5 kVrms for 1 (one) minute, insulation resistance and functional test should be conducted.

21.13 Auxiliary Switches

All the auxiliary switches shall be fully type tested as per relevant IS.

The following type test reports on auxiliary switches shall be submitted:

a) Electrical endurance test - A minimum of 2000 operation for 2A D. C. with a time constant greater than or equal to 20 millisecond with a subsequent examination of mV drop/visual defects/temperature rise test.
b) Mechanical endurance test. A minimum of 1,00,000 operations with a subsequent checking of contact pressure test/visual examination.
c) Heat run test on contacts.
d) IR/HV test etc.

22. TERMINAL BLOCKS AND WIRING

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

22.2 Terminal blocks shall be 1100 V grade and have continuous rating to carry the maximum expected current on the terminals. These 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.

22.3 But preferably the terminal blocks shall be non-disconnecting stud type of Elmex type CATM4, phoenix cage clamp type or equivalent. The insulating material of terminal block shall be nylon which shall be free of halogens, fluorocarbons etc.

22.4 Terminal blocks 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.

22.5 The terminals shall be such that maximum contact area is achieved when a cable is terminated. The terminal shall have a locking characteristic to prevent cable form escaping form the terminal clamp unless it is done intentionally.

22.6 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.

22.7 The terminal blocks shall be of extensible design.

22.8 The terminal blocks shall have locking arrangement to prevent its escape from the mounting rails.

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

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

a) All circuits except CT circuits - Minimum of 2 nos. of 2.5 sq. mm copper flexible
b) All CT circuits - Minimum of 4 nos. of 2.5 sq.mm copper flexible

22.11 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.

22.12 At least 20% spare terminals shall be provided on each panel/cubicle/box and these spare terminals shall be uniformly distributed on all terminal rows.

22.13 There shall be minimum clearance of 250 mm 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.

22.14 The Bidder shall furnish all wire, conduits and terminals for the necessary interphase electrical connections (where applicable) as well as between phases and common terminal boxes or control cabinets.

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

23. LAMPS & SOCKETS

23.1 Lamps

All incandescent lamps shall use a socket base as per IS-1258, except in the case of signal lamps.

23.2 Sockets

All sockets (convenience outlets) shall be suitable to accept both 5 Amp & 15 Amp pin round Standard Indian plugs. They shall be switched sockets with shutters.

23.3 Hand Lamp

A 240 Volts, single Phase, 50 Hz AC plug point shall be provided in the interior of each cubicle with ON- OFF Switch for connection of hand lamps.

23.4 Switches and Fuses

Each panel shall be provided with necessary arrangements for receiving, distributing, isolating and fusing of DC and AC supplies for various control, signalling, lighting and space heater circuits. The incoming and sub-circuits shall be separately provided with miniature circuit breaker/ switchfuse units. Selection of the main and Sub-circuit fuse ratings shall be such as to ensure selective clearance of sub-circuit faults. Potential circuits for relaying and metering shall be protected by HRC fuses.

All fuses shall be of HRC cartridge type conforming to IS-9228 mounted on plug-in type fuse bases. Miniature circuit breakers with thermal protection and alarm contacts will also be accepted. All accessible live connection to fuse bases shall be adequately shrouded. Fuses shall have operation indicators for indicating blown fuse condition. Fuse carrier base shall have imprints to the fuse rating and voltage. All control switches shall be of rotary type. Toggle piano switches shall not be accepted.

24. Bushings, Hollow Column Insulators, Support Insulators:

24.1 Bushings shall be manufactured and tested in accordance with IS:2099 & IEC- 60137 while hollow column insulators shall be manufactured and tested in accordance with IEC-62155/IS:5621. The support insulators shall be manufactured and tested as per IS:2544/IEC-60168 and IEC-60273. The insulators shall also conform to IEC-60815 as applicable. The bidder may also offer composite hollow insulators, conforming to IEC-61462.

24.2 Support insulators, bushings and hollow column insulators shall be manufactured from high quality porcelain Porcelain used shall be homogeneous, free from laminations cavities and other flaws or imperfections that might affect the mechanical or dielectric quality and shall be thoroughly vitrified tough and impervious to moisture.

24.3 Glazing of the porcelain shall be uniform brown in colour, free from blisters, burrs and similar other defects.

24.4 Support insulators/bushings/hollow column insulators shall be designed to have ample insulation, mechanical strength and rigidity for the conditions under which they will be used.

24.5 When operating at normal rated voltage there shall be no electric discharge between the conductors and bushing which would cause corrosion or injury to conductors, insulators or supports by the formation of substances produced by chemical action. No radio interference shall be caused by the insulators/bushings when operating at the

normal rated voltage.

24.6 Bushing porcelain shall be robust and capable of withstanding the internal pressures likely to occur in service. The design and location of clamps and the shape and the strength of the porcelain flange securing the bushing to the tank shall be such that there is no risk of fracture. All portions of the assembled porcelain enclosures and supports other than gaskets, which may in any way be exposed to the atmosphere shall be composed of completely non hygroscopic material such as metal or glazed porcelain.

24.7 All iron parts shall be hot dip galvanised and all joints shall be air tight. Surface of joints shall be trued up porcelain parts by grinding and metal parts by machining. Insulator/bushing design shall be such as to ensure a uniform compressive pressure on the joints.

24.8 Tests

In bushing, hollow column insulators and support insulators shall conform to type tests and shall be subjected to routine tests in accordance with IS: 2099 & IS:2544 & IS : 5621.

25. MOTORS

Motors shall be “Squirrel Cage” three phase induction motors of sufficient size capable of satisfactory operation for the application and duty as required for the driven equipment and shall be subjected to routine tests as per applicable standards. The motors shall be of approved make.

25.1 Enclosures

a) Motors to be installed outdoor without enclosure shall have hose proof enclosure equivalent to IP-55 as per IS: 4691. For motors to be installed indoor i.e. inside a box, the motor enclosure, shall be dust proof equivalent to IP-44 as per IS: 4691.
b) Two independent earthing points shall be provided on opposite sides of the motor for bolted connection of earthing conductor.
c) Motors shall have drain plugs so located that they will drain water resulting from condensation or other causes from all pockets in the motor casing.
d) Motors weighing more than 25 Kg. shall be provided with eyebolts, lugs or other means to facilitate lifting.

25.2 Operational Features

a) Continuous motor rating (name plate rating) shall be at least ten (10) percent above the maximum load demand of the driven equipment at design duty point and the motor shall not be over loaded at any operating point of driven equipment that will rise in service.

b) Motor shall be capable at giving rated output without reduction in the expected life span when operated continuously in the system having the particulars as given in Clause 15.0 of this Section.

25.3 Starting Requirements:

a) All induction motors shall be suitable for full voltage direct-on-line starting. These shall be capable of starting and accelerating to the rated speed alongwith the driven equipment without exceeding the acceptable winding temperature even when the supply voltage drops down to 80% of the rated voltage.

b) Motors shall be capable of withstanding the electrodynamic stresses and heating imposed if it is started at a voltage of 110% of the rated value.

c) The locked rotor current shall not exceed six (6) times the rated full load current for all motors, subject to tolerance as given in IS:325.

d) Motors when started with the driven equipment imposing full starting torque under the supply voltage conditions specified under Clause 15.0 shall be capable of withstanding atleast two successive starts from cold condition at room temperature and one start from hot condition without injurious heating of winding. The motors shall also be suitable for three equally spread starts per hour under the above referred supply condition.

e) The locked rotor withstand time under hot condition at 110% of rated voltage shall be more than starting time with the driven equipment of minimum permissible voltage by at least two seconds or 15% of the accelerating time whichever is greater. In case it is not possible to meet the above requirement, the Bidder shall offer centrifugal type speed switch mounted on the motor shaft which shall remain closed for speed lower than 20% and open for speeds above 20% of the rated speed. The speed switch shall be capable of withstanding 120% of the rated speed in either direction of rotation.

25.4 Running Requirements:

a) The maximum permissible temperature rise over the ambient temperature of 50 degree C shall be within the limits specified in IS:325 (for 3 - phase induction motors) after adjustment due to increased ambient temperature specified.

b) The double amplitude of motor vibration shall be within the limits specified in IS: 4729. Vibration shall also be within the limits specified by the relevant standard for the driven equipment when measured at the motor bearings.

c) All the induction motors shall be capable of running at 80% of rated voltage for a period of 5 minutes with rated load commencing from hot condition.

25.5 TESTING AND COMMISSIONING

An indicative list of tests is given below. Contractor shall perform any additional test based on specialities of the items as per the field Q.P./Instructions of the equipment Contractor or Purchaser without any extra cost to the Purchaser. The Contractor shall arrange all instruments required for conducting these tests alongwith calibration certificates and shall furnish the list of instruments to the Purchaser for approval.

(a) Insulation resistance.

(b) Phase sequence and proper direction of rotation.

(c) Any motor operating incorrectly shall be checked to determine the cause and the conditions corrected.

SECTION–4

GUARANTEED TECHNICAL PARTICULARS

Bidder has to ensure all the major parameters given in the Annexure-DG (Total Pages-2)

250kVA DIESEL GENERATOR SET (MAJOR TECHNICAL PARAMETERS)

S.No.	PARTICULARS			
A	**ALTERNATOR**			
1	Net Rated Output at 50°C temperature & 1000m of altitude after reducing DG Set auxiliaries loads		**250kVA**	Please furnish deration calculation as per annexure in section-5
2	Rated Terminal Voltage		415V AC	
3	No. of Phases		3	
4	Rated Power Factor		0.8 lag	
5	Rated Speed		1500 RPM	
6	Rated Frequency		50 Hz	
7	Standard	BS 2613/IS 4722/IEC 60034; latest edition		
8	Type of Exciter Used	Brushless, Self-Excited		
9	Class of Winding Insulation		Class H	
10	Permissible Temperature Rise		Class F	
11	Degree of Protection		IP-23	
12	Overload Capacity	10% Overload for 1 hour in every 12 hours of continuous running		
13	Terminal Box	Seven (7) output terminals (R, Y, B, R', Y', B' & N)		
14	Each output terminal suitable for cable size of		2Runs of 300 sq.mm XLPE cable	
	Neutral Formation		Inside AMF Panel	
B	**ENGINE**			
1	Standard	IS 10002/BS 5514/ISO 3046/ IS 13018; latest edition		
2	Rating at 50°C ambient and altitude upto 1000 meter	As per Manufacturer Datasheet		
3	Rated Speed		1500 RPM	
4	No. of Strokes		4	
5	Cylinder Design		Multi-Cylinder	
6	Type of Cylinder Arrangement	V-Type or Inline Type		
7	Method of Aspiration	Turbo-Charged		
8	Method of Engine Cooling	Water-Cooled (Through Radiator)		
9	Method of Starting	Battery Operated Auto Start		
10	Ignition Voltage		24V DC	
11	Type of Governor	Electronic as per ISO 8528 or latest IS/BS standards		
12	Balancing	Dynamically balanced flywheel		
13	Air-Suction & Exhaust	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.		
14	Air Filter	Dry Type (Replaceable)		
15	Lubricating System	Forced (Closed Loop)		
16	Fuel Type	High Speed Diesel oil (HSD) as per IS:1460		
17	Fuel Injection	Mechanical/Electronic		
18	Emission Levels	In accordance with latest Notifications of MOEF/CPCB (certificate to be furnished)		

C	**ENGINE-ALTERNATOR SET**			
1	Maximum Starting Time		30 sec	
2	Interval Between Starting Impulse		10 sec	
3	Maximum no. of starting Impulse		3	
4	Maximum Voltage Variation		± 1 %	
5	Maximum Frequency Variation		± 2 %	
6	Voltage Adjustment Range	90% to 110% of Nominal Voltage		
7	Balancing	Dynamic Balanced Rotor to minimize vibration		
8	Maximum Vibration Level		250 microns	
9	Coupling of Engine & Alternator	Directly coupled by means of self-aligning flexible flange coupling & with a protecting guard to avoid accidental contact		
10	Mounting Arrangement	DG set enclosed in the acoustic enclosure shall be installed on Concrete Pedestal. 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.		
E	**BATTERY**			
1	Type		Lead-Acid	
2	Capacity in AH		180 AH	
3	Voltage of each Battery Set		24V DC	
4	No. of Battery Set		2 Nos. (i.e. Main + Standby)	
F	**BATTERY CHARGER**			
1	Type of Charger		SMPS based	
2	Input	230V AC, 50 HZ, Single Phase		
3	Output Current		12 Amps	
4	Output Voltage		As per 24V battery system	
5	Qty. of Battery Charger		2 sets	
6	Automatic Float/Boost Charge Provision		Yes	
7	Ripple	Not more than 1% (RMS)		
G	**FUEL TANK & FUEL PUMP**			
1	Capacity		990 ltrs (1 No.)	
2	Material of Construction		MS Sheet	
3	Sheet Thickness (Minimum)		2 mm	
4	Accessories	Level Indicator, Filling Inlet with removable screen, outlet, drain plug, an air vent, air-breather and necessary piping		
5	Painting	Oil Resistant Paint		
6	Erection	In accordance with Indian Explosive Act of 1932		
7	Location	Outside Acoustic Enclosure		
8	Fuel Pump Type	Electrically Driven		
9	Fuel Pump Rating	Adequate to fill the fuel tank in 30 minutes		
F	**ACOUSTIC ENCLOSURE**			
1	Minimum Sheet Thickness		2 mm	
2	Acoustic Material		Rockwool (Min.thickness 50mm)	
3	Max. Noise Level	75 dBA at a distance of 1 meter (as per CPCB Norms)		

SECTION-5

Following documents shall be submitted during detailed Engg. Stage:

Sl. No.	Doc. No.	Doc. Title
1	TB-DS-404-563-01	GTP and GA of DG Set
2	TB-CL-404-563-02	Deration Calculation of DG Set
3	TB-CL-404-563-03	Battery Sizing Calculation of Diesel engine
4	TB-DG-404-563-04	AMF Panel Drawing
5	TB-DG-404-563-05	Foundation Drawing of DG Set
6	TB-DG-404-563-06	GA drawing of Day Fuel Tank

SCHEDULE TO BE FILLED UP BY THE BIDDER

SCHEDULE-1	Make of important components and details
SCHEDULE-2	Technical deviation
SCHEDULE-3	Schedule of unpriced BOQ
SCHEDULE-4	Deration calculation

SCHEDULE-1

MAKE OF IMPORTANT COMPONENTS OF EQUIPMENTS AND DETAILS

ITEM NAME	NAME OF MANUFACTURER	PLACE OF MANUFACTURE OF ITEM	PLACE OF TESTING & INSPECTION	COMPLIANCE WITH ISO 9001 (YES/NO)

Place Signature of the authorized representative of

Bidder 'name ----------

Date

Designation----------

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

SCHEDULE-2

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. 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.
2. If there is NIL deviation, even then the format to be filled as **NIL DEVIATION**
3. Continuation sheets of like size and format may be used as per the Bidder's Requirement and shall be annexed to this schedule.

Place Signature of the authorized representative of

Bidder 'name ----------

Date Designation----------

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

SCHEDULE-3

Bidders shall attach signed and stamped **unpriced** copy of this BOQ with their technical offer:

Sl. No.	Item Description	Qty	Whether Unit Rates have been furnished in priced bid?
1.	250 kVA DG Set alongwith all accessories and Standard tools & tackles as per technical specification	1 Set	YES
2.	Mandatory Spares as per technical specification	1 Set	YES
3.	Erection, Testing & Commissioning of complete 250kVA DG Set as per technical specification	1 Set	YES

Signature of the authorized representative of Bidder

Name :

Designation :

Place :

Date :

SCHEDULE-4

Deration calculation

Project: 400/220/132 kV GIS Substation, Ballia				
250KVA DIESEL GENERATOR SET				
Doc. No. : TB-404-562-033 Rev. 01				**Schedule-4 to Section-5**
		DERATION CALCULATION TO BE FILLED BY BIDDER		**SHEET 1 OF 2**

Alternator Sizing Calculation

DERATION CALCULATION FOR 250 kVA DG Set of make……with Alternator make…….

SL No.	Parameters	Unit	Values	Remarks
1	kVA Requirement from Alternator(415 V,0.8 pf) with Class H to F @ 50 deg C	kVA	250	**As per tender requirement**
2	Deration Applicable as per the specification :			
i)	Class H Insulation with Class F temperature rise	-	X	**As per Deration chart of alternator maufacturer**
ii)	50 deg C Ambient Temperature	-	y	
	Total Deration	-	(X*Y)	
3	Minimum Rating required for Alternator after deration	kVA	250/(X*Y)	**Please check whether this rating is standard available rating of offered make alternator otherwise choose next higher size**
4	Offered rating of Alternator to meet tender requirement	kVA	**Z**	**Please mention the model no. and make of offered alternator**

Hence offered Alternator Model is……..of make…….

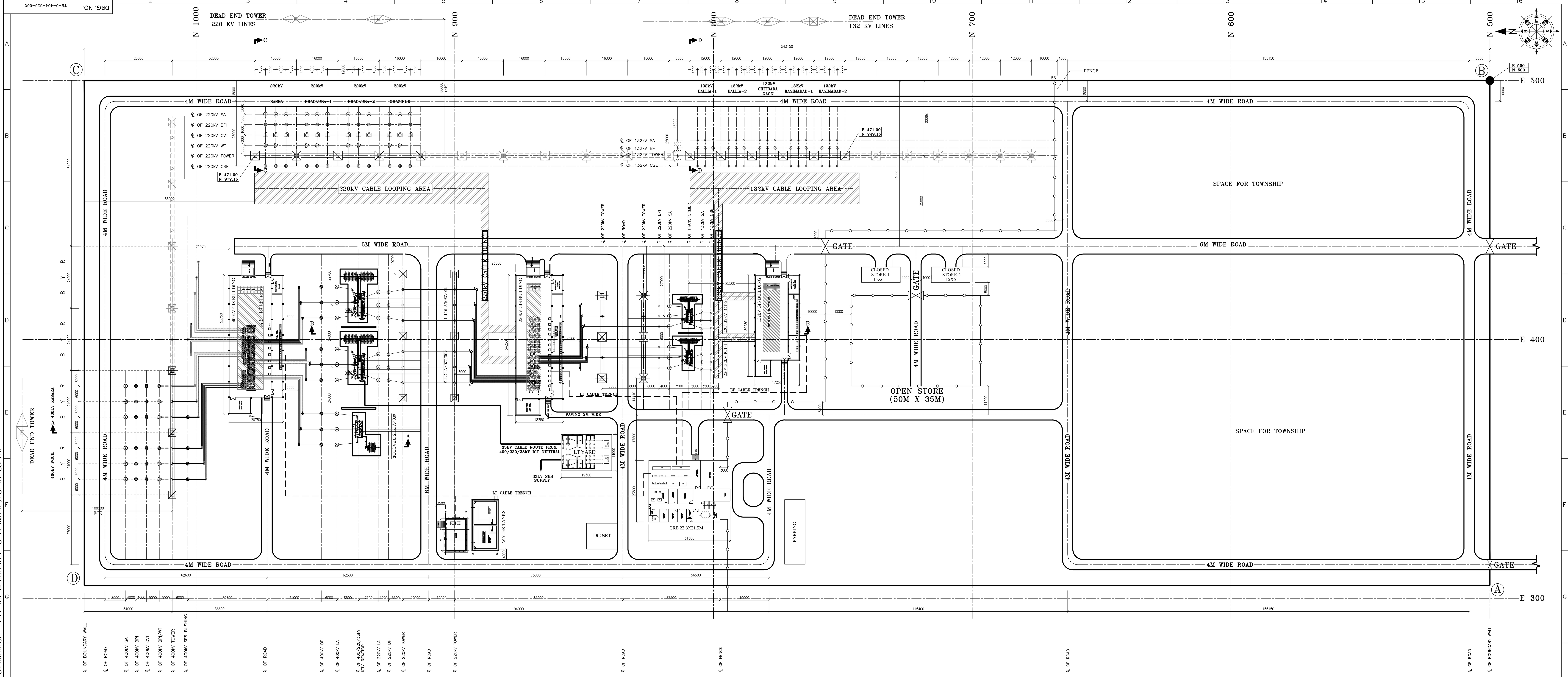
Engine Sizing Calculation

SHEET 2 OF 2

For 250kVA /200kWe DG Set of make…….. with engine make……. as per tender requirement

SL No.	Parameter	Unit	Value	Remarks
1	Gross Engine Power at 50 deg C Ambient Temperature (as per manufacturer catalogue)	kWb	A	**Before Auxiliary loss**
2	Radiator fan loss	kWm	B	
3	Restriction loss	kWm	C	
4	Hence net power available in engine shaft after ratiator fan loss	kWm	A-(B+C)=D	
5	Efficiency of alternator at full load	%	E	
6	Hence net output at alternator terminal	kWe	D*E	
		kVA	D*E/0.8	pf@0.8
7	As per tender specification rating of DG set	kWe	200.00	
		kVA	**250.00**	
Note:- Hence offered engine make…….and model……. is suitable to deliver 250 kVA/200 kWe which is as per tender requirement				

FIRST ANGLE PROJECTION | (ALL DIMENSIONS ARE IN MM.)



BILL OF QUANTITY:–

S.NO.	DESCRIPTION	SYMBOL	QUANTITY (NOS.)
1	420 kV INDOOR GIS		01
2	420 KV, 1–ph SF6 TO AIR BUSHING		21
3	420kV, 1–ph CVT		06
4	360kV, 1–ph SURGE ARRESTER		15
5	420kV, 8 KN , 1–ph, BUS POST INSULATOR		24
6	420kV, 1mH , 1–ph, WT		04

S.NO.	DESCRIPTION	SYMBOL	QUANTITY (NOS.)
1	220 kV INDOOR GIS		01
2	220 KV, 1–ph SF6 TO AIR BUSHING		12
3	220kV, 1–ph CVT		12
4(i)	198kV, 1–ph SURGE ARRESTER		12
4(ii)	216kV, 1–ph SURGE ARRESTER		12
5	220kV, 8 KN , 1–ph, BUS POST INSULATOR		24
6	220kV, 0.5mH , 1–ph, WT		08
7	XLPE CABLE TERMINATION (CABLE SEALING END)		12

S.NO.	DESCRIPTION	SYMBOL	QUANTITY (NOS.)
1	132 kV INDOOR GIS		01
2	120kV, 1–ph SURGE ARRESTER		21
3	132kV, 6 KN , 1–ph, BUS POST INSULATOR		24
4	XLPE CABLE TERMINATION (CABLE SEALING END)		24

CONDUCTOR SIZE DETAILS

EQUIPMENT INTERCONNECTION	400 KV	TWIN 'MOOSE' CONDUCTOR
JACK BUS & JUMPERS	400 KV	TWIN 'MOOSE' CONDUCTOR

CONDUCTOR SIZE DETAILS

EQUIPMENT INTERCONNECTION	220 KV	TWIN 'ZEBRA' CONDUCTOR
JACK BUS & JUMPERS	220 KV	TWIN 'ZEBRA' CONDUCTOR

CONDUCTOR SIZE DETAILS

EQUIPMENT INTERCONNECTION	132 KV	TWIN 'PANTHER' CONDUCTOR
JACK BUS & JUMPERS	132 KV	TWIN 'PANTHER' CONDUCTOR

MINIMUM CLEARANCE TABLE	400kV	220kV	132kV	33kV
PHASE TO PHASE (PP) (mm)	4000	2100	1300	320
PHASE TO EARTH (PE) (mm)	3500	2100	1300	320
SECTION CLEARANCE (SC) (mm)	6500	5000	4000	3000
HEIGHT OF CONDUCTOR CENTRE LINE OF FIRST LEVEL (MIN.) MM. (FROM PLINTH LEVEL)	8000	5500	4500	3600
GROUND CLEARANCE TO NEAREST PART NOT AT EARTH POTENTIAL OF AN INSULATOR SUPPORTING LIVE CONDUCTOR	2550	2500	2500	2500
CREEPAGE DISTANCE (mm/kV)	25	25	25	25

LEGEND TABLE:–

	TENSION INSULATOR
	TWIN MOOSE ACSR CONDUCTOR
	SHIELD WIRE
	FENCE
	400kV SUSPENSION INSULATOR
	CONNECTION TO TWIN ACSR MOOSE CONDUCTOR
	PROPOSED SCOPE
	EXISTING/FUTURE SCOPE
	GIB (GAS INSULATED BUS DUCT)
	TOWER WITH PEAK
	LM (LIGHTNING MAST)

NOTES:–

1. ALL DIMENSIONS ARE IN MM.
2. ALL STRUCTURE/CONDUCTOR HEIGHTS ARE ABOVE PLINTH LEVEL. PLINTH LEVEL – 300 MM ABOVE G.L. (GROUND LEVEL)
3. ALL FLEXIBLE CONNECTIONS ARE WITH TWIN MOOSE ACSR CONDUCTOR WITH 450 MM SPACING.
4. LOCATION OF WTS ARE INDICATIVE ONLY AND THE EXACT LOCATION WILL BE BASED ON PLCC REQUIREMENT THEREFORE THE FDN. SHALL BE PROVIDED IN ALL THREE PHASE.
5. LA PRESSURE RELIEF VALVE SHALL NOT BE TOWARDS TRANSFORMER SIDE/ANY EQUIPMENT KEPT NEAR LIGHTNING ARRESTER.
6. GIS/BUS DUCT LAYOUT IS TENTATIVE AND SHALL BE FINALIZED AFTER VENDOR FINALIZATION OF GIS.
7. CONTROL ROOM BUILDING AND GIS BUILDING LAYOUT SHAL BE SUBMITTED SEPARATELY.

REF. DRG. NO.	TITLE
TB–3–404–510–001	SINGLE LINE DIAGRAM 400/220/132kV GIS S/S

LOI NO. : 336/ESD–765kV/10 RASARA/Vol–3 DATED 03.08.2018

ADDITIONAL INFORMATION
W.O.No. 87002
STATUS OF DRAWING CONTRACT
DISTRIBUTION OF PRINTS

ग्राहक/परियोजना का नाम / NAME OF CUSTOMER / PROJECT: UTTAR PRADESH POWER TRANSMIISSIION CORPORATIION LIMITED
400/220/132kV GIS SUBSTATION AT RASARA, BALLIA (U.P.)

बीएचईएल भारत हेवी इलेक्ट्रिकल्स लिमिटेड पारेषण परियोजना विभाग
BHARAT HEAVY ELECTRICALS LTD. TRANSMISSION PROJECTS DIVISION

	नाम /NAME	हस्ता./SIGN.	दि./DATE
DRAWN	PK		21.09.18
CHECKED	MM/DKM		
APPROVED	AG		

REV.	DATE	ALTERED / CHECKED / APPROVED	ZONE / DESCRIPTION
01	28.11.18	PK / MM/DKM / AG	DRAWING REVISED AS PER UPPTCL COMMENTS DATED 10.10.18
02	20.12.18	PK / MM/DKM / AG	DRAWING REVISED AS PER UPPTCL COMMENTS DATED 15.12.18

विभाग DEPT. TBEM
कोड CODE 422
अनुपात / SCALE
कार्ड कोड CARD CODE
शीर्षक/TITLE: PLAN & SECTION LAYOUT DRAWING FOR 400/220/132kV GIS SUB STATION
ड्राइंग.क्र./DRAWING NO. TB–0–404–316–002
पुनः/REV. 02
पृष्ठ क्र./SHEET No. 01 अगला पृष्ठ /NEXT SHEET 02

C:\Users\tdtripathi\Desktop\Ballia\TB-0-404-316-002 LAYOUT PLAN DRAWING 400220132kV GIS SUB STATION R02 20.12.18.dwg, 14-01-2019 10:34:44, DWG To PDF.pc3