BHARAT HEAVY ELECTRICALS LTD.,
ELECTROPORCELAINS DIVISION
BANGALORE

FOR TECHNICAL BID

1010 kVA , 415 V 3Ph. 50 Hz DG SET
with acoustic enclosure and AMF Panel

EPD Premises

Tender Document

(NIT, Conditions & Specifications)

REVISION DETAILS: (00)	**PREPARED**		**DATE**
			30.11.2015
	APPROVED	**ISSUED**	

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TENDERER'S UNDERTAKING / CONFIRMATION

The tenderer is required to furnish the following undertaking / confirmation on his letterhead failing which his offer is not likely to be entertained. Here, the tenderer may also list out his own conditions or his deviations from the tender, if any, giving exact reference of specific clause of condition of tender keeping in mind that uncalled for deviations from tender or own conditions of the tenderer may result in rejection of his offer.

To

BHEL, EPD,
Malleswaram complex,
Bangalore-560012

Dear Sirs,

NIT FOR DG SET WORK INCLUDING MODIFICATION OF ACOUSTIC TREATMENT & VENTILATION OF DG ROOM FOR EPD PREMISES OF BHEL, BANGALORE

CONFIRMATION OF OUR ACCEPTANCE OF TENDER CONDITIONS AND SPECIFICATIONS

We hereby confirm our acceptance of terms/conditions/specifications of NIT in full and further confirm that our offer is in total conformity with the requirement of specifications / conditions / BOQ / Drawings of the NIT.

We further confirm that our offer does not have any of our own conditions or any deviations from NIT except the following (The tenderer may list out his deviations / conditions, if any, here with adequate reference to the tender clauses. In case of no deviation, the tenderer may mention 'NO DEVIATION'. Additional sheets may be used, if required, but the number of sheets attached should be specified here.) :

Signature (Tenderer)

Date _____ Seal _____

1.0 THE WORK :

Supply, installation, testing and commissioning of Diesel Generating set along with associated accessories / systems including modification of Ventilation and Acoustic Treatment of DG Room for **EPD Premises of BHEL at Bangalore** as per the schedule of quantities, specifications and drawings.

Brief description of items included for 1010 KVA DG set, **Quantity : 1 No**.

a. Diesel Engine.

b. Alternator

c. Exhaust Chimney

d. Diesel Tank (Day Oil)

e. AMF Panel.

f. Control / signal wiring.

g. Cables and cable jointing

h. Modification of Ventilation System for DG Room.

i. Modification of Acoustic Treatment of DG Room.

j. Obtaining clearances / approvals / licenses from concerned authorities.

2.0 DG POWER SUPPLY SYSTEM

2.1 THE SITE

The site of works or installation is EPD Premises of Bharat Heavy Electricals Limited (BHEL), Bangalore.

2.2 SCOPE AND SPECIAL CONDITIONS

2.2.1 SCOPE :

In general, the contractor shall supply, store, erect, test and commission all the equipment required for DG set and associated Electrical Installation in conformity with relevant rules and regulations. The contractor shall furnish all the materials, Labour, tools and equipment as shown in the accompanying drawings and in the BOQ and specifications herein after described. The scope shall include supply, erection, testing and commissioning of DG set, exhaust chimney, Day Oil Tank, power & control cabling, AMF Panel, acoustic treatment of DG room and associated accessories / work as required for satisfactory functioning of DG power supply system.

The proposed DG set is planned to be installed in a hall (DG room) on ground floor in which three functioning DG sets of 2 X 500KVA and 1 X 1000 KVA are already existing and the foundation for the proposed DG set is also existing. However, any modification, replace one 500 KVA with new 1000 KVA, shifting etc of the existing foundation and acoustic enclosure, if called for, shall be in the scope of this work.

2.2.2 LICENSED CONTRACTOR :

The contractor shall be a licensed Electrical Contractor, possessing a valid Electrical Contractor's license in the state, employing licensed supervisors and skilled workers having valid permits as per the regulations of Indian Electricity Rules and local Electrical Inspector's requirements.

2.2.3 DEFINITIONS / ABBREVIATIONS :

The following abbreviations used in the Bill of Quantities specifications and drawings represent:-

I.S.S	:	Indian Standard Specifications.
B.I.S	:	Bureau of Indian Standards.
I.E.R	:	Indian Electricity Rules 1956 amended upto date.
B.S.	:	British Standard.
B.S.C.P.	:	British Standard Code of Practice.
H.R.C.	:	High Rupturing Capacity.
G.I.	:	Galvanized Iron.
MS	:	Mild Steel.
CI	:	Cast Iron.
APLSTS	:	Aluminum Conductor, Paper Insulated Lead Sheathed, Double Steel Tape Armored and Serving.
PVC	:	Polyvinyl Chloride.
HT	:	High Tension.
A/AMP	:	Ampere.
KV	:	Kilo Volts.
PT	:	Potential Transformer.

CT	:	Current Transformer.
OCB	:	Oil Circuit Breaker.
VCB	:	Vacuum Circuit Breaker.
ACB	:	Air Circuit Breaker.
CFS	:	Combination Fuse Switch.
MCCB	:	Moulded Case Circuit Breaker.
MCB	:	Miniature Circuit Breaker.
IC	:	Iron Clad.
ICTPN	:	Iron Clad Triple Pole & Neutral.
ICDP	:	Iron Clad Double Pole.
DB	:	Distribution Board.
KVA	:	Kilo Volt Ampere.
NC	:	Normally Closed.
KVAR	:	Kilo Volt Ampere - Reactive.
SWG	:	Standard Wire Gauge.

2.2.4 REGULATIONS AND CODES & STANDARDS :

The installation shall conform in all respects to Environment Pollution Control Rules 1986 and Central Pollution Control Board with regard to noise and air pollution, Indian Standard Code of Practice for Electrical wiring installations. It shall also be in conformity with the current Indian Electricity Rules and the Regulations and requirements of the local Electric Supply Authority in so far as these become applicable to the installation. Wherever this specification calls for a higher standard of materials and/or workmanship than those required by any of the above regulations these specifications shall take precedence over the said regulation and standards. In general, the materials, equipment and workmanship not covered by the above shall conform to the following Indian Standards, unless otherwise called for:-

i. Diesel Generators

a. Equipment :

Diesel Engine

IS-10000, BS- 5514 and as per standard practice of Diesel engine manufacturer's association of USA.

Generator

IS-4722/ IEC-60034, IS12065, IS12075

Fuel Oil for DG Set	IS15217
Diesel Fuels – Specifications	IS1460
Recommended Practice for Hot-Dip Galvanizing of Iron and Steel	IS 2629
Methods for testing uniformity of coating of zinc coated articles	IS 2633

b. Installation:

The installation work shall conform to Indian Electricity Act and Indian Electricity Rules as amended up to the date this specification is issued. Any approval required from statutory authorities shall be obtained by the Contractor. Nothing in this specification shall be construed to relieve the Contractor of this responsibility.

c. Performance:

Equipment complying with other internationally accepted standards such as ASA, IEC, BS, VDE etc. will also be considered if they ensure performance and constructional features equivalent to or superior to standards listed above. In such a case, the Bidder shall clearly indicate the standard(s) adopted and also furnish a copy in English of the latest revision of the standards along with copies of all official amendments in force as on date of opening of bid. Bidder shall clearly bring out the salient features for comparison.

d. Type

Diesel Engine

Stationary type, four stroke with Vertical in line or 'V' type cylinder arrangement and turbo charged, water cooled.

DG set including stack height, acoustics, air emission and fuel oil installation shall meet the requirement given by gazette notification of Ministry of Environment & Forest, CPCB guidelines, all statutory requirement of Govt. of India and State Pollution Board Guidelines & as updated as on date of bid opening.

ii. Technical Requirements

a.	Electrical output	As specified in BOQ.
b.	Ambient temperature	50 degree.
c.	Relative Humidity	100%
d.	Fuel	All types of diesel fuel available in India
e.	Rated Speed	1500 rpm
f.	Duty	Round the clock continuous running, of which one hour at 10% overload at rated speed
g.	Governor	Electronic Governor (A1 type as per BS:5514)
h.	Vibrations	Max. 250 microns peak to peak with anti-vibration pads
j.	Starting	Electrical self-starting thru battery
k.	Fuel service tank (day oil tank)	990 litres
l.	Air intake system	Dry type air filter, minimum efficiency 90% down to 5 microns size
m.	Cooling	Forced water cooled for Engine & Air cooled for Alternator.
n.	Paint Shade	Grey RAL9002 for all equipment

iii. Switch Gears :

a.	AC Circuit Breaker	:	IS 2516 (Part-I) Sec.1, 2 & 3 (Part-II)
b.	Switches and switch isolators above 200 V but not exceeding 1.1 KV. :		IS 4710 – 1968
c.	Markings & Arrangements for Switchgear bus bars, main connection and auxiliary wiring.:		I.S. 375 – 1963
d.	Normal duty air break switches & composite units for air break switches and fuses for voltage not exceeding 1000 volts.:		I.S. 4064 – 1967
e.	Heavy duty air break switches and composite units of air break switches and fuses for 1000 V.:		I.S. 4047 – 1967
f.	Enclosed distribution fuse boards & outputs for voltage Not exceeding 1000 volts.:		I.S. 2675 – 1966
g.	Installation & Maintenance Of Switchgear.		I.S. 3072 - 1965 (Part-I)
h.	HRC Cartridge Fuse Links 650 V	:	I.S. 2208 – 1962

iv. Cables :

a.	Code of practice for installation and maintenance of paper, insulated power cables (upto & including 33 KV).	:	I.S. 1255 - 1967
b.	PVC insulated cables (For voltage upto 1100 V (Part-I) with aluminium conductors.	:	I.S. 694 - 1964 (Part-II)
c.	PVC insulated (Heavy duty) electric cables Part-I for voltage upto 1100 V.	:	I.S. 1554 – 1964
v.	Rigid Steel Conduits for Electrical Wiring.	:	I.S. 1953 – 1972
vi.	Rigid non metallic conduit for Electrical Installations.	:	I.S. 2509 – 1973
vii.	Accessories for rigid steel conduits for Electrical wiring.	:	I.S. 3837 - 1966

viii.	Boxes for the enclosure of electrical accessories Part-I Steel.	:	I.S. 5133 - 1969 (I)
ix.	3 pin plugs & socket outlets.	:	I.S. 1293 - 1967
x.	Ceiling Roses.	:	I.S. 371 - 1966
xi.	Adhesive insulating tapes for Electrical purposes (Part-I & II).	:	I.S. 2448 - 1968
xii.	General and safety requirements for electrical lighting fittings.	:	I.S. 1913 - 1969
xiii.	Watertight electric light fittings.	:	I.S. 3553 - 1966
xiv.	Floodlights.	:	I.S. 1947 - 1961
xv.	Electric ceiling fan and regulators.	:	I.S. 347 - 1966
xvi.	Propeller type AC ventilating fans.	:	I.S. 2312 - 1967
xvii.	Code of practice for earthing.	:	I.S. 3043 – 1966
xviii.	Glossary of terms for electrical cables and conductors.	:	I.S. 1885 - 1971
xix.	Code of practice for safety of buildings (general) electrical installations.	:	I.S. 1646 - 1961
xx.	Protection of buildings and allied structures against Lighting.	:	I.S. 2309 - 1963
xxi.	Current Transformers.	:	I.S. 2705 – 1964 (Part-I to III)
xxii.	Voltage Transformers.	:	I.S. 3156 - 1965 & 1966 (Part-I to III)
xxiii.	Shunt capacitors for power system.	:	I.S. 2834 - 1964
xxiv.	Direct acting electrical indicating instruments.	:	I.S. 1248 - 1964.

2.2.5 INSPECTION AND APPROVAL OF THE WORK BY LOCAL AUTHORITY :

On completion of this work, the contractor shall obtain and deliver to the Employer / Owners/Engineer-in-charge the certificate of inspection and approvals by the Electrical Inspectorate of Local Government and/or any other statutory authority as may be required. The Consultant/ Engineer-in-charge shall have access to the manufacturer's premises for inspection of any items of the tender for which the contractor has to make arrangement with different manufacturer minimum 15 days' notice to be given to the consultants/Engineer-in-charge for the same.

2.2.6 DRAWINGS :

The Drawings, Specifications and bill of quantities shall be considered as a part of this contract and any work of materials shown on the drawing and not called for in the specifications or vice versa shall be executed as if specifically called for in both. The design drawings or tender drawings indicate the extent and general arrangement of various equipment and their wiring etc. and are essentially diagrammatic. The work shall be installed as indicated on the drawings, however any minor change if found essential to coordinate the installation of the work with other traders shall be made without any additional cost to the Owners. The data given herein and on the drawings is as could be secured but its complete accuracy is not guaranteed. The drawings and specification are for the assistance and guidance of the contractor. The exact location, distance and levels etc will, be governed by the space conditions. The contractor shall visit site and examine all relevant Drawings before starting the work and report to the Engineer-in-charge / Consultants any discrepancies which in his opinion appear on them and get them clarified. He shall not be entitled for any extras for commissions or defects in Drawings when they conflict with other work.

2.2.7 SHOP DRAWINGS :

The contractor shall prepare and submit to the Consultants/Engineer-in-charge for their approval detailed shop drawings of the entire installation within 7 days from the date of signing of contract. The approval of drawings however will not exonerate the contractor of his responsibility to execute the work as per conditions of the contract.

2.2.8 COMPLETION DRAWINGS :

At the completion of the work and before issuance of certificate of 'virtual completion', the contractor shall submit to the Owner, layout drawings drawn at approved scale indicating the complete work as installed, in 6 sets and the originals after securing approval of the same from the Consultants.

2.2.9 FOREMAN / SUPERVISOR :

The contractor shall employ competent, licensed qualified full time electrical foreman/ supervisors to direct the work of electrical installations in accordance with the drawings and specifications. The Foremen/Supervisor shall be available at all times on the site to receive instructions from the Consultants/Engineer-in-charge for the day to day activities throughout the duration of the contract. The Foreman/Supervisor shall correlate the progress of the work in conjunction with all the relevant requirements of Electricity Supply Authority. The skilled workers employed for the work should possess competency certificate from the electrical Inspectorate of the Local Government for relevant work.

2.2.10 CLEANLINESS AND SITE CLEARANCE :

The contractor shall ensure to keep the site clean by removing the debris and waste/excess materials from the site then and there. All the fixtures, plant and equipment after their installation and commissioning shall be cleaned up by the contractor without leaving any marks or stains and a fresh coat of painting shall be applied before handing over.

2.2.11 GUARANTEE AND DEFECTS LIABILITY PERIOD :

The contractor shall guarantee that all equipment shall be free of any defects due to defective materials and bad workmanship and that the equipment shall operate satisfactorily and the performance and efficiencies of the equipment shall not be less than the desired values. The guarantee shall be valid for a period of 12 months, or more if so offered by tenderer, after taking over and any parts found defective shall be replaced free of cost by the contractor. If the performance during the guarantee period is not satisfactory, the guarantee will be extended till satisfactory which the performance should be found absolutely satisfactory. The services of the contractor's personnel if requisitioned during this period for such work shall be made available free of any cost of the Owner.

If the defects be not remedied within a reasonable time, the Owner may proceed to do so the contractor's risk and expenses without prejudice to any other rights.

2.2.12 PRICES AND RATES :

The prices quoted shall be basic cost plus all taxes, duties, freight, labour, installation, testing and commissioning etc complete as required to be indicated separately. The space allocated for major equipment shall be taken into consideration before ordering the equipment and equipment shall fit into the space provided with required clearances all around as per relevant ISS and IER or as per manufacturer's recommendations.

2.2.13 AGREEMENT :

Successful Tenderer shall be required to enter into an agreement as per Standard proforma. The Tenderer shall indicate specifically the service facility available at the site of installation for servicing the Generating Set during the guarantee period and also providing service beyond the guarantee period.

2.2.14 TESTING :

DIESEL GENERATING SET:

The following tests shall be conducted on Alternator and DG set:

Factory Tests:

The factory test shall incorporate the following:

i. Type tests.

ii. Routine tests.

iii. High Voltage test.

iv. Short Circuit current test.

v. Instantaneous short circuit.

vi. Insulation resistance test.

These tests shall be conducted as per the requirements of B.S.: 2613 or IS: 4722 and the original test certificates shall be furnished.

Valid Type test Certificates for the model offered shall be furnished.

Site Tests :
After the erection and wiring and earthing of DG set, the following tests shall be conducted :

i. Insulation resistance of the generator.

ii. Speed, No-Load Voltage and full load voltage regulation.

iii. Frequency at no-load, half load & full load.

iv. Full load test for 6 hours at rated voltage, speed and frequency.

The readings shall be observed with calibrated meters. Only one meter shall be used for the test. The readings shall be properly tabulated and submitted in Triplicate.

Testing of Controls:
All the safety controls and protective devices of the DG set shall be tested for correct calibration and operation. The results of the tests shall be tabulated and submitted in Triplicate.

2.2.15 TESTING, COMMISSIONING AND TRIAL RUNS :
Contractor shall carry out the following works within the quoted rates.

a. Importing (if required), loading, unloading, handling, transporting to site, installing, testing and commissioning DG set.

b. Trial run of the set for a minimum period of 2 hours continuously on No Load. On satisfactory completion of no load run the set shall be run for a period of three days for 8 hours every day at 100% load. All consumables i.e. fuel oil etc shall be made available by the contractor and the cost of same borne by the Contractors for testing.

c. Handing over of the entire work after satisfactory completion, testing and commissioning along with 3 sets of documents consisting of detailed data and catalogue of the equipment.

Before dispatch of the equipment it shall be got inspected (if so required by Owners) by the Engineer-in-charge / Consultants and its performance witnessed at manufacturers works.

3.0 TECHNICAL SPECIFICATIONS :

3.1 DG SET :

Specified rating (KVA) at 0.8 p.f. 415 volts, 50 cycles per second max. speed: 1500 RPM Diesel Generating Set comprising the following:

a. ENGINE :

Water cooled Diesel Engine developing specified BHP at 1500 RPM, under NTP conditions of BS: 5514 with capacity of 10% overloading for one hour in 12 hours duration with following components and technical specifications:

Engine Rating : As specified in BOQ
Engine BHP : As specified in BOQ

Air Intake System:

- Air intake manifold
- Dry type air cleaner
- Vacuum indicator

Exhaust System :

- Turbocharger
- Flexible connection
- Exhaust manifold
- Residential silencer

Coolant System :

- Engine water pump
- Radiator
- Coolant additive concentrate
- By pass thermostat.

Lubricating System :

- Oil pan.
- Engine mounted lub oil pump
- Full flow lub oil filter.
- Lube oil by-pass filter.
- AC motor driven Lube oil priming pump.

Fuel System :

- PT fuel pump with Electronic Governor.
- PTD injector.
- 24V DC solenoid coil.
- Replaceable fuel filter.

Starting System :

- 24V DC electric starter.
- 24V DC battery charging alternator.

Others :

- Vibration damper.
- Flywheel with housing.

b. ALTERNATOR :

- Synchronous alternator of rating as specified in BOQ, suitable for continuous operation at 1500 RPM, designed at 40 °C ambient temperature generating 415 volts at 0.8 pf. (lag), 50 Hz, 3 phase, 4 wire system. The alternator shall be brushless type, self-excited & self-regulated through an AVR. The alternator will be suitable for tropical climate and shall generally confirm to IS: 4722. The salient features of the alternator are:

- ± 0.1% voltage regulation (max) in static conditions.

- IP: 23 protection with class 'H' insulation & temperature rise limited to class "H"
- Permanent lubricating bearing.
- Permissible overload of 10% for one hour in 12 hours of operation.

c. BASE FRAME

Engine and alternator are mounted, coupled and aligned on a common channel iron fabricated Base Frame with pre-drilled holes.

d. FUEL TANK (DAY OIL TANK)

Daily service fuel tank 990 ltrs from 14 SWG sheet metal complete with drain valve, air vent, inlet and outlet connection.

e. BATTERIES

Four nos. batteries of 12V, 180 AH capacity in dry and uncharged condition with its leads.

f. CONTROL PANEL :

Control Panel shall be totally enclosed dead front dust and vermin proof pattern free standing type sheet steel 14 gauge construction incorporating & complete with the following devices for each DG Set.

1 No. AC Ammeter of suitable scale with selector switch.

1 No. AC voltmeter 0-500 volts with selector switch.

1 No. Mode selector switch OFF/ALT/MAINS/LOAD.

1 No. Frequency Meter.

1 No. KWH Meter.

1 Set Current Transformers of suitable ratio for Metering.

1 No. Battery charger consisting:

a. Transformer and Rectifier.

b. DC Ammeter.

c. DC voltmeter.

d. Charging rate selector switch OFF/TRICKLE/BOOST.

e. Charging mode/fully charged mode indication.

1 No. Hooter.

1 No. Main supply TP Contactor of suitable rating.

1 Set HRC Fuses for short circuit protection for main supply.

1 No. Alternator Contactor 3 pole.

1 No. Thermal overload relay for overload protection for AC Generator.

1 No. single phase preventer.

1 No. Mains supply voltage monitor.

1 Set indicating lamps, 'LOAD ON SET' 'LOAD ON MAINS' fails to start battery charger, Low lube oil pressure, high water temperature.

1 Set push button, start, stop, reset.

Complete wiring and arrangement for auto start and required inter locking comprising generally the following or as specified in schedule of quantities.

g. ARRANGEMENT :

The engine to be directly coupled to the Alternator through a specifically designed flexible coupling in order to form a compact arrangement and both the units engine and alternator to be mounted on a rigid fabricated steel bed plate including foundation bolts channels etc.

4.0 MV SWITCHGEAR MAIN BOARD / LT PANEL :

4.1 SCOPE :

This section covers the detailed requirements of medium voltage switch board for 415/433 V 3 phase 50 Hz 4 wire system to be supplied, installed and its testing & commissioning.

4.2 TYPE OF BOARD :

The medium voltage switch board shall comprise any one of the following types of switch gears or combination thereof as specified in schedule.

i. Air circuit breakers draw out type.

ii. Fuse Switch Units / MCCBs.

The board shall be indoor type having incoming, sectionalisation and outgoing switch gears as specified. The design shall be cubicle type or industrial type compartmentalized as specified. The degree of enclosure protection shall be IP 42 as per IS: 2147-1962.

4.3 GENERAL CONSTRUCTION :

The switch board shall be floor mounted free standing totally enclosed and extensible type. The switch board shall be vermin proof and shall be suitable for the claimant conditions as specified. The design shall include all provisions for safety operating and maintenance personnel. The general construction shall conform to IS: 8623/77 for factory assembled switch board.

4.4 CUBICLE TYPE BOARDS :

Cubicle type switch board shall be fabricated out of sheet not less than 2.0 mm (14G) thick. Wherever necessary, such steel members shall be stiffened by angle iron frame work. General construction shall employ the principle of compartmentalization and segregation for each circuit unless otherwise approved. Incomer and bus section panels or sections shall be separate and independent and shall not be mixed with sections required for feeders. Each section of the rear accessible type board shall have hinged access doors at the rear. Overall height of the board shall not exceed 2.35 meters. Operating levers, handle etc. of highest panel shall not be at a height more than 1.7 m. Multi-tier mounting of feeders is permissible. The general arrangement for multitier construction shall be such that the horizontal tiers formed presents a pleasing and esthetic look. The general arrangement shall be got approved before fabrication. Cable entries for various feeders shall be either from the rear/top or from the front as specified through cable alleys and shall be through gland plates. There shall be separate gland plate for each cable entry so that there will not be dislocation of already wired Circuit when new feeders are added. Cable entry plates shall, therefore, be sectionalized and shall be provided on top & bottom of panel. The construction shall include necessary cable supports for clamping the cable in the cable alley or rear cable chamber as the case may be. The lower part (200 mm from bottom) of the panel/Board will be left empty. No internals/accessories shall be fixed in this portion.

4.5 BUS BAR AND CONNECTIONS :

The bus bar shall be of Copper of high conductivity electrolytic quality and of adequate section. Current density shall not exceed 130 amps/sq.cm. The bus bar system may comprise a system of main horizontal bus bars and auxiliary vertical bus bar run in bus bar alleys on either side in which the circuit could be arranged with front access for cable entries. In the case of rear access, horizontal bus system shall run suitably either at the top or bottom. All connections to individual circuits from the bus bar shall be with solid connections. All bus bars and connections shall be suitably sleeved with PVC heat shrinkable sleeves in approved manner and colour coded.

4.6 INCOMER/TERMINATION :

Incomer / termination shall be suitable for receiving bus trunking or cable as required in BOQ.

4.7 INSTRUMENTS :

All voltmeters and ammeters shall be digital flush mounted type conforming to class 1.5 of IS-1248 for accuracy. All voltmeters shall be protected with HRC cartridge fuses and provided with selector switch. Ammeter of suitable range with required ratio CTs & ammeter selector switch shall be provided.

i. **Indicator Lamps:**
On all the incomers of M. V. panels, ON/Off indicator lamps shall be provided suitable for operation on AC 230V supply. Necessary filter lenses G/Y/R/A shall be provided depending upon the function. All lamps shall be protected by proper rating HRC fuses. Where specified phase indicator lamps are provided. These shall be associated with necessary ON/OFF toggle switch for each lamp.

ii. **Control (Auxiliary Wiring) :**
All control/auxiliary wiring, indication etc. shall be with suitable, copper conductor cable PVC insulated conforming to IS : 1554 Part-I. Wiring shall be suitably protected within the switch board. Runs of wires shall be neatly bunched and suitably supported and clamped. Means shall be provided for clear identifications of the wires. Where wires are drawn through steel conduits, the work shall conform to CPWD General specifications for Electrical works (Part-I-1972 Internal) amended upto date and IS: 732 as the case may be or as specified. Identification ferrules shall be used at both ends of the wires. All control wirings meant for external connections are to be brought out on a terminal board.

4.8 OPERATIONAL REQUIREMENTS :

The indoor type MV board shall conform to the following:

i. The board shall comprise of incomers outgoing feeders and bus coupler as specified. The incomer shall be Air Circuit Breaker/MCCB or fuse switch unit as specified. The bus coupler shall be either a circuit breaker of double break isolating switch or switch fuse unit as specified. The outgoing feeders shall be Air circuit breaker or switch fuse units or MCCBs as specified.

ii. Bus bar for phase and neutral should have a rating as specified in sub-head “Bus Bars& Connections”.

iii. The entire switch board shall be cubicle type generally conforming to IS : 8623/77 as factory assembled switch board.

iv. The incomer panel shall be suitable for receiving bus trunking/Cables as specified.

v. All air circuit breaker or MCCBs shall have suitable adjustable tripping current and the time delay setting.

vi. The entire board shall have a common earth bar of 50x6mm copper with two terminals for earth connections.

4.9 RATING AND REQUIREMENTS :

i. **AIR CIRCUIT BREAKER (ACB)**
Air circuit breaker shall be 4 Pole/TPN double breaks type as specified, suitable for 43 KA breaking capacity (31 MVA at 415 V) conforming to IS : 2516. Rated Current shall be as per capacities specified. The equipment shall be complete with the following:

a. Necessary circuit breaker carriage with draw out mechanism for isolating purposes.

b. Necessary - isolating plugs and sockets.

c. Necessary - mechanical electrical interlock and automatic safety shutters gear with arrangement for pad locking.

d. Necessary - independent manual spring closing mechanism with mechanical ON/OFF indication.

e. Necessary bus bars with bolted type neutral links.

f. Emergency Trip Button.

g. Following protection arrangement shall be provided.

3 O/C and 1 E/F with IDMT relays with O.L./shunt trip coils.

The over current Elements of the IDMT relays shall have adjustable setting for a range or 50% to 200%. E/F elements of IDMT relays shall have adjustable setting for a range of 10% to 40%.

h. Necessary set of auxiliary switches.

j. Necessary set of CTs with ratio as specified.

k. Necessary indication, metering requirements as specified i.e. ON/OFF indication lamps, selector switch, fuses, ammeter, volts meter etc.

ii. **FUSE SWITCH UNITS / MCCBS :**
All fuse switch units / MCCBs for feeders or outgoing circuits shall be suitable for a Breaking capacity of 43 KA (31 MVA at 415 V) capacity at 415V, 3 phase, 50 HZ AC system conforming to IS: 4064. The number of units and rated current shall be as per detailed requirements specified. The fuse switch unit shall be of double breaks pattern either front or side operated type. The units shall be complete with the following:

a. Necessary HRC cartridge fuses conforming to IS: 2206.

b. Necessary on load operating mechanism quick break make type.

c. Necessary set of CTs together with an ammeter and selector switch as specified.

d. Necessary inter-connections to bus bars.

e. Necessary isolating plugs and sockets for front operated switches to enable withdrawing the entire unit and replacing with another unit without disconnecting the cable as a maintenance operation.

f. Necessary neutral link inside the fuse switch unit.

iii. **TEST AT MANUFACTURERS WORK :**
All routine tests specified in IS: 8623-1977 shall be carried out and test certificates produced to the Owners/Consultants.

iv. **INSTALLATION :**
The installation work shall cover assembly of various sections of the panels lining up, grouting the units etc. In the case of multiple panel switch boards after connecting up the bus bars etc., all joints shall be insulated with necessary insulation tape or approved insulation compound. A common earth bar shall be at the back of switch board connecting all the sections for connection to frame earth, system. All protection and other control wirings for indication etc. shall be completed before calibration and commissioning checks are commenced. All relays, meters etc. shall be mounted and connected with appropriate wiring.

v. **TESTING AND COMMISSIONING :**
Commissioning checks and tests shall include all wiring checks and checking up of connections. Primary/secondary injection tests for the relay adjustment to routine megger test. Checks and test shall include the following.

a. Operation checks and lubrication of all moving parts.

b. Interlock function checks.

c. Continuity checks of wiring fuses etc. as required.

d. Insulation test: When measured with 500 V megger the insulation resistance shall not be less than 100 mega ohms.

e. Trip tests and protection gear test.

4.10 ENGRAVED PVC LABELS

Engraved PVC labels shall be provided on all incoming and outgoing feeders. Circuit diagram showing the arrangement of the circuit inside the distribution board shall be pasted on the inside of the panel door and covered with a transparent laminated plastic sheet.

4.11 LT PANEL FABRICATION AND ACCESSORIES (CONDITIONS) :

i. The execution of the job shall be done in a workman like manner to give structurally sound and neat appearance. Bad workmanship will not be accepted and defects, if any, shall be got rectified at contractors own risk and cost to the satisfaction of Owners/Consultant.

ii. If any item is to be different than whatever mentioned in the schedule, it should be specifically brought out while quoting for the tender, otherwise no deviation will be allowed for the change of items and Schedule of items will be strictly followed.

iii. Whenever, the make of items is not given, the tenderer should clearly mention the make offered by him while quoting the rates.

iv. BHEL may, get inspected the equipment like DG Set and LT panels by the authorised representatives or by BHEL Engineers at manufacturer's works. Prior intimation shall be given by the Contractor about the readiness of the equipment at factory/works. The Owners shall bear the expenses for this inspection by its representatives at works of particular firms.

v. Routine and manufacturer's type test certificates for the DG Set, LT panels and ACBs shall be furnished by the contractor while delivering the above equipment.

vi. All material required to be used on work should be as per NIT Specifications and should be got approved from Owners/Consultant before installation. All rejected material should be removed from site immediately. The contractor shall stand guarantee for a period of one year from handing over of installation for the materials and equipment installed.

vii. Earthing shall invariably be done in presence of authorised representatives of Owners/Consultant.

viii. The Contractor shall terminate cables and make necessary connection and interconnections.

ix. Contractor or his representative will have to sign site order book and comply with remarks therein.

x. The UG cables shall conform to ISS: 1954/part-I/1976.

xi. The LT panels/switch boards shall be got fabricated from the panel builders who generally satisfy the following conditions :

   a. Panel manufacturer should have CPRI certificate for short circuit test for LT panels.

   b. The panel manufacturer should have the approval of Tariff Advisory Committee.

   c. Panel manufacturer should have full facility of seven tank process for treatment of panels to the satisfaction of Owners/Consultant.

   d. Panel manufacturer should have the facility and should perform the temperature rise test at rated current to the satisfaction of Owners/Consultant, if required.

e. Panel manufacturer should have full facility for conducting other specified tests at works to the satisfaction of Owners/Consultant.

xii. Tenderer should indicate in his technical bid the make of L T Panel he proposes to offer along with the makes of ACB etc. He should also enclose along with the tender :

a. The test certificates and approvals issued to manufacturer by CPRI and TAC respectively.

b. An undertaking from the manufacturer that his panels satisfy the stipulated conditions of the tender and that he will supply the panels for this work to meet with completion schedule of NIT.

4.12 EVEN DISTRIBUTION :

It shall be ensured that total load of various distribution boards panels or consuming devices is divided evenly between the phases and number of ways.

4.13 RUBBER MATTING :

All panels shall be provided with 12 mm x 1000 mm shock proof rubber matting along the length of panel/board duly housed on wooden foot rest.

5.0 CABLES AND EARTHING :

5.1 CABLES :

5.1.1 GENERAL :

The cables shall be supplied, inspected, laid, tested and commissioned in accordance with drawings. Specifications, cable manufacturer's Instructions and Indian Standard IS: 1554-1976.

5.1.2 MATERIAL :

The MV cable shall be PVC insulated aluminum conductor armoured cable of 1100 volt grade.

5.1.3 INSPECTION :

All cables shall be inspected upon receipt at site and checked for any damage during transit.

5.1.4 JOINTS IN CABLES :

The contractor shall take care to see that all the cables received at site are apportioned to various locations in such a manner as to ensure maximum utilisation and avoidance of cable jointing. This apportioning shall be got approved by the Engineer-in-charge before the cables are out to lengths.

Where joints are unavoidable the location of such joints shall be got approved.

5.1.5 JOINTING BOXES FOR CABLES :

Cable joint boxes shall be of appropriate size, suitable for PVC insulated armoured cables of particular voltage rating.

5.1.6 JOINTING CABLES :

All cable joints shall be made in suitable, approved cable joint boxes, jointing of cables in the joint boxes and the filling in of compound shall be done in accordance with manufacturer's instructions and in approved manner. All straight T-joints shall be done in epoxy mould boxes with epoxy resin.

All terminal ends of conductors shall be heavily soldered upto atleast 50 mm length where applicable.

All cables shall be joined colour to colour and tested for continuity and insulation resistance before jointing commences. The sheath of cables must not be removed until preparations for jointing are completed. Joints shall be finished on the same day as commenced and sufficient protection from the weather shall be arranged. Joints shall be made by means of suitable solder for conductors, the conductors being firmly butted into the connections or thimbles or ferrules and the whole soldered with proper solder and soldering flux or crimped. The conductors shall be efficiently insulated with high voltage insulating tape and by using spreaders of approved size and pattern. The joints shall be completely topped up with epoxy compound so as to ensure that the box is properly filled.

5.1.7 CABLE TERMINATIONS :

Cable termination shall be done in cable terminal box using cable glands and the cable ends sealed with sealing compound.

5.1.8 BONDING OF CABLES :

Where a cable enters any piece of apparatus, it shall be connected to the casing by means of an approved type of armoured clamp and gland. The clamps must grip the armouring firmly to the gland or casing, so that no undue stress is passed on the cable conductor due to vibration. The glands shall be fixed to the lead sheath by means of either a 'plumbing joint' or a cone of approved material, capable of being compressed into lead sheath. The gland or cone shall be capable of effecting a good electrical bond between both the armouring of the cable, and the casing.

5.1.9 LAYING OF CABLES :

Cables shall be laid by skilled and experienced workmen using adequate rollers to minimise stretching of cable. The cable drums shall be placed on jacks before unwinding the cable. Great care shall be exercised in laying cables to avoid forming kinks. The relative position of the cables, laid on the cable tray shall changes in direction in horizontal and vertical planes, the cable shall be bent smooth with a radius of bend not less than 12 times the diameter of cable. Distinguishing marks shall be made on the cable ends for identification. Insulation tapes of appropriate voltage and in red, yellow and blue colours shall be wrapped just below the sockets for phase identification.

5.1.10 CABLES INSIDE BUILDING :

Cables inside buildings shall be laid on the cable trays/trenches. All cables passing through walls shall run through Asbestos Cement pipes of adequate diameter or as directed. Parallel cables shall be spaced atleast 50 mm apart maintaining their relative position over the entire length.

5.1.11 TESTING OF CABLES :

Test shall be conducted for insulation between phases and between phase and earth for each length of cable, before and after jointing. On completion of cable laying work, the following tests shall be conducted in the presence of the Engineer-in-charge.

a. Insulation Resistance Test (Sectional and Overall)

b. Continuity/Resistance Test

c. Sheathing continuity test,

d. Earth test.

All tests shall be carried out in accordance with relevant standard code of practice and electricity rules. The Contractor shall provide necessary instruments, equipment and labour for conducting the above tests and shall bear all expenses in connection with such tests. All tests shall be carried out in the presence of the Engineer-in-charge.

5.2 EARTHING SYSTEM :

5.2.1 EARTHING :

All the non-current carrying metal parts of electrical installation shall be earthed properly. All metal conduits, trunking, cable sheaths, switchgear, distribution boards, light fittings and all other parts made of metal shall be bonded together and connected by means of specified earthing conductors to an efficient earthing system. All earthing shall be in conformity with Indian Electricity Rules and Indian Standards IS: 3043-1966.

5.2.2 EARTHING CONDUCTORS :

Earthing conductors shall be of Electrolytic Copper and shall be protected against mechanical injury or corrosion.

5.2.3 SIZING OF EARTHING CONDUCTORS :

The cross sectional area of copper earthing conductor shall not be smaller than half of the largest current carrying conductor subject to an upper limit of 80 sq.mm. If the area of the largest current carrying conductor or bus bar exceeds 169 sq.mm. to provide atleast half the cross sectional area, of the current carrying conductor or bus bars. All fixtures, outlet boxes and junction boxes shall be earthed with 16 SWG copper wire. All single phase metal clad switches and distribution boards shall be earthed with 4 mm dia copper wire.

All 3 phase switches and distribution boards upto 60 amps rating shall be earthed with 2 Nos. distinct and independent 3 mm dia copper wires. All 3 phase switches and distribution boards upto 100 amps rating shall be earthed with 2 Nos. distinct and independent 4 mm dia copper wires. All switches, bus bar, ducts and distribution boards of rating 200 amps and above shall be earthed with a minimum of 2 Nos separate and independent 25 mm x 3 mm copper tape.

5.2.4 CONNECTION OF EARTHING CONDUCTORS :

Main earthing conductors shall be taken from the earth connections at the main switch boards to an earth electrode with which the connection is to be made. Sub-mains earthing conductors shall run from the main switch board to the sub-distribution boards. Final distribution boards earthing conduits shall run from sub-distribution boards.

Circuit earthing conductor shall run from the exposed metal of equipment and shall be connected to any point on the main earthing conductor, or its distribution boards or to an earth leakage circuit breaker. Metal conduits, cable sheathing and armouring shall be earthed at the end adjacent to switch boards at which they originate, or otherwise at the commencement of the run by an earthing conductor in effective electrical contact with cable sheathing. Where equipment is connected by flexible cord, all exposed metal parts of the equipment shall be earthed by means of an earthing conductor enclosed with the current carrying conductors within the flexible cord. Switches, accessories, light fittings etc which are rigidly secured in effective electrical contact with a run of metallic conduit shall not be considered as a part of the earthing conductor for earthing purposes, even though the run of metallic conduit is earthed.

5.2.5 PROHIBITED CONNECTIONS :

Neutral conductor, sprinkler pipes, or pipes conveying gas, water, or inflammable liquid, structural steel work, metallic enclosures, metallic conduits and lighting protection system conductors shall not be used as a means of earthing system. The electrical resistance measured between earth connection at the main switchboard and any other point on the completed installation shall be low enough to permit the passage of current necessary to operate fuse or circuit breakers, and shall not exceed 1 ohm.

5.2.6 EARTH CONNECTIONS :

All metal clad switch and other equipment carrying single phase current, shall be connected to earth by a single connection.

All metal clad switches/equipment carrying medium voltage shall be connected with earth by two separate and distinct connections. The earthing conductors inside the building wherever exposed shall be properly protected from mechanical injury by running the same in GI pipe of adequate size. The overlapping in copper strips at joints where required shall be minimum 75 mm. The joints shall be riveted and brazed in approved manner. Swathed lugs of adequate capacity and size shall be used for termination of all conductor wires above 6 sq.mm. size. Lugs shall be bolted to the equipment body to be earthed after the metal body is cleaned of paint and other oily substances and properly tinned.

5.2.7 RESISTANCE TO EARTH :

The resistance of earthing system shall not exceed 1 ohm.

5.2.8 EARTHING STATION (PLATE EARTHING) :

Earthing electrode shall consist of a tinned copper plate not less than 600 mm x 600 mm x 3 mm thick. The plate electrode shall be buried as far as practicable below permanent moisture level but in any case not less than 3 meters below ground level.

Wherever possible, earth electrodes shall be located as near the water tap, water drain or a down take pipe as possible. Earth electrodes shall not be installed in proximity to a metal fence. It shall be kept clear of the building foundations and in no case shall it be nearer than 2 meters from the outer face of the wall.

The earth plate shall be set vertically and surrounded with 150 mm thick layer of charcoal dust and salt mixture. A 20 mm GI pipe shall run from the top edge of the plate to the ground level. The top of the pipe shall be provided with a funnel and a mesh for watering the earth through the pipe. The funnel over the GI pipe shall be housed in a masonry chamber approximately 100 mm x 300 mm x 300 mm deep.

5.3 TESTING :

5.3.1 GENERAL :

At the completion of the work, the entire installation shall be subjected to the following tests:

1. Wiring continuity test.
2. Insulation resistance test.
3. Earth continuity test.
4. Earth resistivity test.

Beside the above, any other test specified by the local authority shall also be carried out. All tested and calibrated instruments for testing, labour, materials and incidentals necessary to conduct the above tests shall be provided by the contractor at his own cost.

5.3.2 TESTING OF WIRING :

All wiring system shall be tested for continuity of circuits, short circuits, and earthing after wiring is completed and before installation is energized.

5.3.3 TESTING OF EARTH CONTINUITY PATH :

The earth continuity of conductor metallic envelopes of cables shall be tested for electric continuity and the electrical resistance of the same, along with the earthing lead but excluding any added resistance or earth leakage circuit breaker, measured from the connection with the earth electrode to any point in the earth continuity conductor in the completed installation, shall not exceed one ohm.

6.0 Acoustic Enclosure

6.1 Modification

Modification to Existing Acoustic Enclosure along with DG Room Ventilation as required shall be quoted as an additional item, BHEL may order it optionally. Bidders are required to visit the plant site and assess the requirements & quote

6.2 EXHAUST PACKAGE

The Exhaust Package consists of all components of Exhaust Assembly like hood, sound attenuator, fan, duct piece assembled together by means of flexible connections and then fixed rigidly on the supporting frame incorporating vibration isolation pads.

6.3 EXHAUST ASSEMBLY:

The exhaust assembly comprises exhaust hood, sound attenuator,

fan and the duct piece placed on the supporting base frame in required sequence and fixed firmly on to the base frame. Flexible connections will be provided between sound attenuator and the fan and between fan and the duct piece. A typical Exhaust Package is shown in Fig. EX-1.

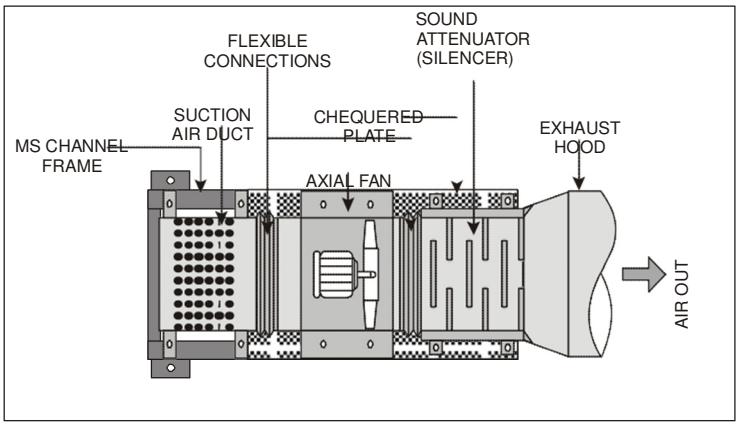

FIG. EX-1 : EXHAUST PACKAGE

6.4 SUPPORTING BASE FRAME

The supporting base frame will comprise MS channel frame with MS chequered plate placed on it as described below:

6.4.1 MS Channel Frame:

The supporting frame for mounting the Fresh Air / Exhaust Package will be welded to MS channel frame (100mm x 50mm x 6mm thick). Two main pieces of MS channel will be placed parallel to each other and will be connected by welding MS channel pieces placed in-between in perpendicular direction to the main channel pieces. The number of such perpendicular pieces will normally be four or as per specification given in drawing / schedule of quantities. Necessary holes will be drilled in the frame for fixing Chequered plate as well as components of ventilation assembly placed over the Chequered plate. The welded portions will be given smooth finish by suitably grinding the spots and the entire frame will be provided with anti corrosive paint and then given two coats of approved shade and quality of paint.

6.4.2 MS Chequered Plate:

MS chequered plate, not less than 6mm thick, of size matching to the frame will be placed on the above MS channel and fixed to the frame by fastening nuts and bolts.

One end of the supporting base frame will be placed on the MS channel bracket grouting in the wall and the other end will be suspended from the ceiling. Where grouting in the wall is not feasible both the ends will be suspended from the ceiling with adequate provision to keep the assembly firmly in place without any swing in suspenders.

7.0 VIBRATION ISOLATORS

Vibration isolators shall be provided for all moving (rotating) equipment to isolate vibration of equipment and prevent it from being transmitted to supports of the equipment, which may be foundations or suspenders. Such equipment may be the water chilling machines, DG Sets, pumps, motors, AHUs, CSUs/FCUs, fans etc. Vibration isolators shall also be provided for fluid / air carriers like pipes and ducts. The objective of these isolators will be to prevent the possibility of vibrations of equipment / materials getting transmitted to their foundations / supports / suspenders.

Depending upon the actual application different types of vibration isolators shall be provided to suit the actual requirement at site.

7.1 RUBBER FOOT ISOLATORS :

The rubber foot mountings shall be so designed that the rubber is protected from oil and physical damage and only good quality of synthetic rubber shall be used. It shall be loaded in shear and compression, a combination to give longer life with the best load / deflection characteristics. It should retain its cushioning effect and should have no tendency to get compressed and gradually become solid in due course of time.

8.0 LIST OF APPROVED MAKES FOR EQUIPMENT AND MATERIALS

Only approved makes for different materials / equipment as given below shall be used for this work. No other make shall be accepted. Any make listed below but not conforming to Technical Specifications/ Standards prescribed in the Tender shall not be accepted.

S.No.	Description of Items		Manufacturer
1.	DG Set : i. Engine	:	Cummins /Caterpillar/ FG Wilson (Perkins) / Mitsubishi
	ii. Alternator	:	Stamford / Leroy Somer / Kirloskar Electric Co / Jyoti
2.a.	AMF Panel	:	Manufacturer of DG set whose DG set is accepted / Trinitron / KEPL / Tricolite
b.	LT Panels / Emergency Panel	:	Trinitron / KEPL / Tricolite
3.	HT Cables (FRLS / XLPE Aluminium : 11 KV)	:	Finolex / Skytone / CCI
4.	LT Cables (FRLS / XLPE Aluminium : 1.1 KV)	:	Finolex / Skytone / CCI
5.	Control Cables	:	Finolex / Skytone / National
6.	PVC Insulated Copper Conductor FRLS Wires 650/1100 Volts Grade	:	Finolex / Skytone / CCI
7.	Cable Glands (Double Compression)	:	Comet / Dowells
8.	Crimping type Lugs / Thimbles	:	Dowells
9.	Air Circuit Breaker (ACB)	:	L&T / Siemens / Alstom
10.	Moulded Case Circuit Breaker (MCCB)	:	L&T / Alstom / Crompton
11.	Miniature Circuit Breaker (MCB)	:	MDS / Havells / Siemens / L&T
12.	E.L.C.B.	:	Legrand / Siemens / L&T
13.	Starters, Contactors, Push Button and Overload Relays	:	L&T / Siemens / Crompton
14.	Battery Charging Panel	:	Statcon / Exide
15.	Batteries (Sealed Maintenance Free)	:	Amaron / Exide
16.	Battery Charger	:	Logicstat / BCH / Amaron / Volstate / HVL Knife
17.	Current Transformers (Epoxy Cast Resin Only)	:	Automatic Electric / Kappa / Maxgilbor
18.	Analogue Energy / Power Meter	:	IMP / Rishab (L&T) / SPI

S.No.	Description of Items		Manufacturer
19.	Electronic Digital Energy / Power Meter (A/V/PF/Hz/KW/KWH) with LED Display	:	Enercon / AE / Secure Meter
20.	Toggle Switches, Selector Switches	:	Kaycee / Salzer (L&T)
21.	Push Buttons and Indicating Lamps (LED Type)	:	Schneider / L&T (ESBEE) / Siemens / Vaishno
22.	Protective & Auxiliary Relay	:	Alstom / ABB / L&T / Siemens
23.	Overload Relays with Built-in Single Phase Preventer	:	Schneider (Telemechanique) / ABB / L&T / Siemens
24.	Time Delay Relays	:	LT-LK / Bhartiya Cutler Hammer / L&T
25.	APFC Relay (Digital Microprocessor Based Compatible PC/PLC)	:	L&T / Siemens / Enercon
26.	Timer	:	Schneider (Telemechanique) / L&T / Siemens
27.	Changeover Switches	:	HH Elcon / Control & Switchgear
28.	Switch Fuse Units, HRC Fuse	:	L&T / Siemens / Alstom
29.	Capacitors Banks	:	Siemens / L&T / Ducati
30.	Cable Tray	:	Slotco / Pilco / MEK
31.	MS Conduits and its Accessories	:	Steel Craft / BEC
32.	GI Strip and Earthing Material	:	Bharati / Indiana
33.	Cable Tray	:	Indiana / Bharati / Slotco / Venus
34.	Terminal Strip	:	Connectwell / Elmex
35.	Jointing Kit XLPE (11 KV)	:	Ray Chem / Xicon / Birla 3M
36.	UPS (Online)	:	Tata Libert / Aplab / APC (American Power Co)
37.	Portable Fire Extinguishers	:	Vijay Fire / Minimax / Reliable
38.	Fuel Transfer Pump (flame proof)	:	Kirloskar / Crompton / Bharat Bijlee / Thusako
39.	Pipes / Valves / Sheet :		
	a. MS Pipes upto 200mm dia	:	TATA Steel / Jindal Hissar
	b. MS Pipes above 200 & upto 400mm dia	:	SAIL / Jindal (Heavy Duty Factory Rolled)
	c. MS Pipes above 400mm dia	:	SAIL (Heavy Duty Factory Rolled)

d. GS Sheet : For All Thicknesses : SAIL

S.No.	Description of Items		Manufacturer
	: For 22 G & 24 G	:	ISPAT / Nippon-Denro
	e. Aluminium Chequered Plate	:	Bharat Aluminium / Hindalco
	f. Gate / Globe Valve (Fire Safe)	:	Leader / Castle / Audco / Arpita
	g. Check Valve / NRV(Fire Safe)	:	Advance / Castle / Audco / Arpita
	h. Ball Valve (Fire Safe)	:	Advance / Castle / Audco / Arpita
40.	Axial Fan	:	Humidin / Nicotra / Comefri / Kruger
41.	a. Extruded Aluminium Grilles/ Diffusers (Anodised / Powder Coated).	:	Caryaire/ Dynamic/ Opella / Ravi Star
	b. Volume Control Dampers	:	Caryaire/ Ravistar/ Dynamic/ Continental
	c. Butterfly damper	:	Caryaire/ Dynamic/ Ravistar/ Continental
	d. Fire retarding canvas for flexible connection and Hessian	:	Novair / Pyroguard
	e. Sound Attenuator	:	Caryaire / Ravistar / Noisecon / Continental
42.	**Acoustic Lining :**		
	a. Fiberglass / Mineral Wool	:	Lloyd Insulation / Supreme / Owens Corning / Up-Twiga
	b. Hessian Fire Retarding	:	Navair/Pyroguard.
43.	Vibration Isolators :		
	• Springs, Neoprene Pads	:	Resistoflex / Emerald / Dunlop
	• Flexible Connections	:	Flexonics / Mason / Resistoflex
44.	Paint	:	Asian / Nerolac / ICI
45.	Any Other Item	:	Make and sample to be approved by Consultants

Note : If make of any equipment / material required for the work is not available in this list, the same should be brought to the notice of BHEL by the tenderer in writing before submitting his offer.

9.0 EQUIPMENT DATA

The following informations regarding the equipments offered shall be furnished by tenderer along with tender. The tenderer should fill out this proforma and attach to his offer along with technical catalogues / details without which the offer may not be considered.

S.No	Description	Details furnished by Tenderer
1.0	**DG Set (Engine + Alternator)**	
	a. Make and Model	
	b. Prime Power Rating : KVA	
	c. Output Voltage and Frequency	
	d. Power Factor	
	e. No. of Phases	
	f. Dimensions of assembled DG set : L x W x H (mm)	
1.1	**Engine**	
	I. PHYSICAL PARAMETERS :	
	a. Manufacturer	
	b. Make	
	c. Model	
	d. Configuration of Cylinders. (inline or vee-type, angle for vee-type).	
	e. Construction of body. (Mould casting or welded).	
	f. Number of cylinders	
	g. Bore : mm	
	h. Stroke : mm	
	j. Direction of rotation seen from fly wheel side (clockwise / anticlockwise).	
	k. Displacement : Cub, Inch, Ltrs :	
	l. Dimensions :	
	i. Length : mm	
	ii. Width : mm	
	iii. Height : mm	

S.No	Description	Details furnished by Tenderer
	m. Total wet weight (Engine + Radiator and Fan) : Kg	
	n. Aspiration (Natural / turbocharged / turbocharged with cooling)	
	p. Fuel	
	q. Vibration Isolators	
	r. Governor (Electronic / Pneumatic / Mechanical / any other)	
	s. Type of coupling	
	t. Day tank capacity : Ltrs	
	v. Compression Ratio	
	w. Compression air intake at 100% load : M^3 per minute	
	x. Piston Speed : M/sec	
	II. PERFORMANCE PARAMETERS :	
	a. Power developed : Gross BHP	
	: Net BHP	
	b. RPM to give above output	
	c. Fuel consumption at full load with radiator and fan : Ltr per hour	
	d. Fuel consumption at 75% load with radiator and fan : Ltr per hour	
	e. Lube oil consumption at full Load :	
	: Ltr per hour	
	f. Lube oil system capacity : Ltrs	
	g. Air intake at full load : CFM	
	h. Cooling Capacity (Engine + Radiator) : Ltrs	
	j. Fan air flow across radiator : M^3/min	
	k. Exhaust Temperature : Deg C	
	l. Engine water flow : Ltr per min.	

S.No	Description	Details furnished by Tenderer
	m. Starting mechanism (Battery / compressed air) :	
	n. Battery : Make	
	: Capacity-Amp hours	
	p. Battery charger : Make	
	q. Starting time : Seconds	
1.2	**ALTERNATOR :**	
	a. Manufacturer	
	b. Make	
	c. Model	
	d. Type (Brushless ?)	
	e. Power : KVA	
	f. Voltage regulation (± 0.5%?)	
	g. Insulation class :	
	h. P F :	
	j. RPM for above power :	
	k. Rating (continuous ?) :	
	l. Voltage (415 V ?)	
	m. Voltage regulator (Automatic ?) :	
	n. Connection :	
	p. Rated voltage :	
	q. No. of Phases :	
	r. Standard Enclosure (IP class) :	
	s. Winding pitch :	
	t. Rotor winding :	
	v. Rotor (dynamically balanced?) :	
	w. Wave form distortion :	
	x. Total harmonic factor :	
1.3	**MAKE OF AMF PANEL :**	
1.4	**AIR CIRCUIT BREAKERS :**	

S.No	Description	Details furnished by Tenderer
	a. Manufacturer :	
	b. Make :	
	c. Model :	
	d. Breaking Capacities :	
	i. 1000 Amp ACB :	
	ii. 1250 Amp ACB :	
	iii. 1600 Amp ACB :	
	iv. 2500 Amp ACB :	
	e. Type (4-Pole Electrical draw out ?) :	
1.5	**BUS BAR (ALUMINIUM ?)**	
1.6	**CABLE MAKE :**	
1.7	**FUEL PUMP :**	
	a. Manufacturer	
	b. Make	
	c. Model	
	d. Type	
	e. HP	
	f. RPM	
	g. Voltage	
	h. Suction/discharge size : mm	
	j. Capacity Ltrs / Hour	
	k. Head Metric	
1.8	**TIME FOR STARTING / LOAD TRANSFER :**	
	a. Minimum time gap between mains failure and starting & attaining full speed of the set. : Seconds	
	b. Minimum time gap between mains failure & transfer of full load to the set : Seconds	
	c. Specify stages if load is to be transferred to the set in stages and time taken by each stage and total time : Seconds	

S.No	Description	Details furnished by Tenderer
	d. Confirm if the full load can be transferred at a time.	
1.9	Total dry weight of the set including engine alternator frame and all other accessories mounted together. : Kg	
1.10	Total quantity of Lube oil for one charge.: Litres	
2.0	**DG ROOM VENTILATION / ACOUSTIC TREATMENT**	
2.1	**AXIAL FANS**	
	a. Manufacturer	
	b. Type / Model	
	c. Bearings	
	d. Blades material	
	e. Vibration Isolator	
	f. Capacity (CFM)	
	g. Static pressure (mm)	
	h. Speed (RPM)	
	j. Limit load HP	
	k. Outlet velocity (M/Minute)	
	l. Fan size and model	
	m. Motor type	
	n. Manufacturer of motor	
	p. Motor BHP	
	q. Motor HP	
	r. Motor RPM	
	s. Permissible voltage fluctuations (415 ±.....%V)	
	t. Type of starter	
	u. Manufacturer of Starter	
2.2	**GRILLES / DIFFUSERS / DAMPERS** Make and material of the following :	
	a. Grilles / Diffusers	

S.No	Description	Details furnished by Tenderer
	b. Sound Attenuator	
2.3	**ACOUSTIC LINING**	
	a. Make (Manufacturer)	
	b. Density - Fiber Glass Kg/M^3	
	- Mineral Wool Kg/M^3	
2.4	**VIBRATION ISOLATION SYSTEM**	
	a. Manufacturer	
	b. Type	

*****

LIST OF DRAWINGS

S.No	Drg. No.	Description
I.	**DG SET :**	
i.	SK-MN-122/15	Site Layout of Power House

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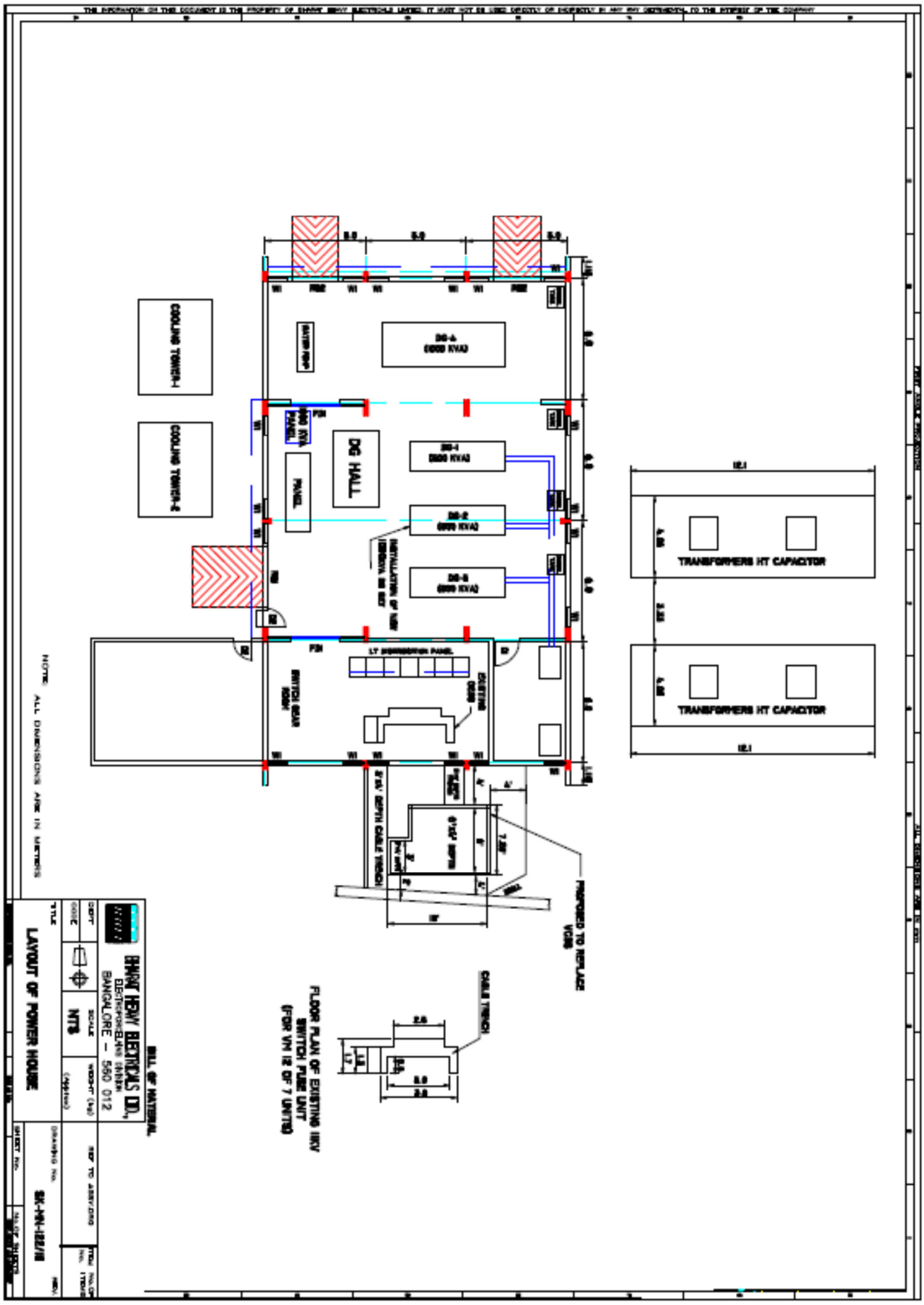

Pre-Qualification Criteria:

1. Offer shall be for new equipment and not for any refurbished or used equipment.
2. Vendor should either be a OEM (Original Equipment Manufacturer) or an Authorized Dealers/ Service Provider of the OEM. Authorized Dealers / Service providers to submit the authorization and competency certificate issued from OEM in executing DG set commissioning work of rating 1000 KVA and above and details of such works executed through OEM's in the last three years in their technical bid.
3. Vendors should have supplied and commissioned 1000 kVA DG set or above rating for a minimum 10 customers in the past three years (1.12.2012 to 30.11.2015). Relevant Purchase/Work orders issued from their for customers and the performance certificate with details of the time frame taken for the execution and completion of work with relevant commissioning certificates and documents issued by the customer should be submitted along with the techno-commercial bid. BHEL reserves the right for independent verification of the references provided.
4. Vendors should have certificates issued from Electrical Inspectorate during the last three years for executing the DG set commissioning works of 1000 kVA or higher ratings
5. Vendors to have valid necessary contractor, supervisory and wireman permit licenses from Electrical Inspectorate for carrying out the work with validity to carry out the work during the year 2016-17
6. Vendor should confirm compliance to all statutory conditions as per factories act and its relevant amendments for the Installation & Commissioning activity within the premises of BHEL. The workman of vendor should possess ESI, PF for executing the work at BHEL-EPD.