



BHARAT HEAVY ELECTRICALS LIMITED

INSULATOR PLANT, JAGDISHPUR
Fax No: 05361-270140,270110, 270109

TENDER DOCUMENT FOR

Gas Generating Set with O&M 3 X 1400 KWe, 11kv capacity

Tender Enquiry No: BHEL/IP/MM/CAP/OT-4/2007

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Material Description	Unit	Quantity	Tender submission Last Date & time	Tender opening date & time
Gas Generating Set with O&M 3 X 1400 KWe, 11kv capacity.	No.	01	12-07-2007, 2.30 PM	12-07-2007 3.00 PM

BHARAT HEAVY ELECTRICALS LIMITED

Insulator plant

Industrial Area, Jagdishpur 227817

Dist. Sultanpur (U.P.)

SPECIFICATION FOR GAS GENSETS**1.0 BROAD SPECIFICATIONS**

NATURAL GAS BASED RECIPROCATING ENGINE DRIVEN COUPLED ALTERNATOR WITH BROAD SPECIFICATIONS AS FOLLOWS:

SL NO	PARAMETER	RATING	REMARK
01	Electrical Output	1400 Kwe	The estimated running hours and expected units of generation per year over a period of 10 years is provided in <i>Annexure - IV</i> for reference.
02	Voltage	11 Kv	
03	Number of Phases	3 Phase	
04	Frequency	50 Hz	
05	Protection	CLASS F IP - 22	The IP rating given is indicative. Vendor should suggest required protection based on site ambient conditions.
06	Type of genset	Continuous duty for base load application.	Waste heat utilisation for steam generation and or VAM will be added at a later stage. Type of genset should be offered suitably.
07	Fuel	R-LNG piped supply	The specification of R-LNG is provided in <i>Annexure - I</i>
08	Type of operation	Parallel running	Auto load sharing facility should be incorporated.
09	No of sets to be supplied and installed	2 Nos in I Stage 1 No in II Stage	I Stage in 07-08 II Stage in 08-09
10	Operation & Maintenance	Under the scope of supplier	O & M Contract could be for a minimum of 10 years. The scope of O & M is given in <i>Annexure- III</i>

SPECIFICATION FOR GAS GENSETS

2.0 BASIC REQUIREMENTS

2.1 The gas genset comprising of gas engine, alternator and all the accessories should be designed, manufactured, tested and supplied to suit the ambient conditions of the site given below:

- a. Ambient Temperatures : 47⁰ C Maximum & 2⁰ C Minimum
- b. Relative Humidity : 10 to 90%
- c. Height above mean sea level : ~ 120 mtr.

The entire captive power plant including CHP equipment to be added later viz., waste heat boiler, VAM etc., is to be placed at a ground level industrial building to be constructed exclusively for the purpose.

- 2.2 The electrical output of lean burn genset should be net 1400 KWe minimum excluding all auxiliaries like lube oil circulation pump, remote radiators, heaters, air washers etc. on 11 kV, 3 phase, 50 Hz, guaranteed with no negative tolerance at alternator out put terminal.
- 2.3 The Genset should be designed for black start by suitably rated battery. The battery along with a battery charger should also be in the scope of the vendor. The detailed specification of the battery should be provided in the techno-commercial bid.
- 2.4 The gas engine and the alternator to be of compact design and connected through a flexible coupling and should be mounted on a common base frame. The anti-vibration mountings as required / recommended by the supplier should also be supplied along with the generating set.
- 2.5 The gas generating set should be of state of the art design with lean burn combustion system and the emission rate from the engine should comply with the prevalent norms / legislations. The possible emission regulations during the next 5 years in the country should also be considered. The NOX, CO, CO₂ & other emission constituents and its concentration level should be indicated at various load conditions.
- 2.6 The gas generating sets should be suitable for continuous operation at the rated electrical output. The electrical load on the power plant at different shifts of operation and the load pattern in two phases of the proposed plant is given in *Annexure - 1*.
- 2.7 The type of gas generating set offered should have satisfactorily completed at least **24000** hours of operation and preferably under the site conditions aforementioned on **continuous duty application**. Service backup and spares warehousing facility should be available in India and details in this regard should be furnished.

SPECIFICATION FOR GAS GENSETS

- 2.8 The Safety features incorporated in the genset should be described in detail separately. The features indicated is only indicative, bidders to suggest and incorporate state of the art features for ensuring safe operation of gensets.
- All the controls should operate in a fail-safe mode i.e., failure of any control should not lead to running of genset in unsafe mode.
 - All exposed rotating parts should be provided with adequate guards of non-sparking type.
 - All electrical connections and engine-mounted auxiliaries should be of flameproof construction.
 - Driver belt and other synthetic components used should be of anti-static and fire resistant type.
 - The piping / ducting should be routed in a manner so as to provide clear headroom and accessibility within the package. Adequate clearances should be provided for all the mountings / sub-assemblies / engineered components.
- 2.9 The techno-commercial bid should provide OGA (Overall General Arrangement) drawing and P & I Diagram clearly indicating the battery limits.
- 2.10 The manufacturing quality assurance plan for the generating set should be provided along with the techno-commercial bid. The manufacturing process should preferably be accredited to international quality management system standards like ISO:9001:2000. Details of the same should be provided in the techno-commercial bid.
- 2.11 The lean burn gas generating set should be newly manufactured / constructed against the order for BHEL. **Reconditioned, rebuilt, refurbished sets are not acceptable.**
- 2.12 The manufacturer in accordance with ISO-3046 or other equivalent international standards should carry out the performance testing of each gas generating set. The bidders to indicate the reference standard.
- 2.13 The bidders should indicate the guaranteed specific fuel consumption at part loads i.e., 50% & 75% and 100% at 0.8 & 0.95 pf. The specific fuel consumption figure should be within the tolerance range of +5 %.
- 2.14 The performance testing of each engine should be carried out by gas engine manufacturer in accordance with ISO 3046 or other equivalent test procedure mutually agreed, at their works on a fully equipped test bed in the presence of buyer / buyer's representative. The load v/s fuel consumption test should be conducted as follows:
- a. Part loads : 50%, 75% & 90% - ½ hour each
 - b. Full load : 100% - 4 hours continuous
- The fuel consumption as tested should be verified w.r.t. the offered fuel consumption values. In the event of actual / measured fuel consumption exceeding + 5% of that guaranteed, the engine will be rejected and the bidder should offer another genset for testing within a period of 2 weeks if all efforts to reduce fuel consumption on the engine first offered are unsuccessful.

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The following information should be provided in the techno-commercial bids

SL NO	DESCRIPTION	Unit	REMARKS
1	Mechanical output of the engine	BKW	The output should be as per the ISO-ICFN rating. Offers to specify the standard reference conditions of ambient temperature, barometric pressure, relative humidity, methane number etc.
2	Electrical output of the alternator	Kwe	The output should be as per the ISO-ICFN rating. Offers to specify the standard reference conditions of ambient temperature, barometric pressure, relative humidity, methane number etc.
3	Energy input	KW	Figures to be indicated for loading values of 50%, 75%, 90% and Full load.
4	Gas consumption	SCM/Hr	- do -
5	Specific Fuel consumption	kWh / SCM	- do -
6	Mechanical Efficiency	%	- do -
7	Electrical Efficiency	%	- do -
8	Thermal Efficiency	%	- do -
9	Genset Efficiency	%	- do -
10	Lube oil consumption	Kg / Hr	
11	Specific lube oil consumption	Grams / kWh	
12	Main dimensions of the genset Length Width	Mm Mm	

	Height	Mm	
13	Weight of the genset a. Empty b. Filled	Kg Kg	
14	Deration of the genset Due to changes in reference ambient conditions.	%	Complete details should be provided
15	Deration of the genset over a period of time of the operating hours.	%	Complete details should be provided. Details of the genset scheduled maintenance period (for top & complete overhaul etc.,) and deration in output during the intervening period should be clearly indicated.
16	Deration of the genset for changes in methane number.	%	Complete details should be provided
17	Guaranteed plant availability	No. of hours per year	
18	Sound pressure levels at a distance of 1 meter as per DIN 45635	DB	
19	Auxiliary consumption load	KW	
20	Cooling system		Details regarding type, size, rating etc, to be provided.
21	Painting standards & colour		

SPECIFICATION FOR GAS GENSETS

GAS ENGINE

1. The gas engine offered should be spark ignited lean burn air & gas mixture fired, 4 stroke, turbocharged, after cooled with high performance electronic ignition type and electronically controlled air/gas mixture system.
2. The gas engine offered should be capable of giving a mechanical output to the alternator so as to generate the electric power as stated in the broad specifications. All the auxiliary equipment required for the engine viz., lube oil circulation, cooling water circulation, pre-heaters etc., should be self driven by the genset.
3. Constant speed electronic governor preferably of WOODWARD make adjustable for speed setting over the operating range should be provided.
4. The engine should be provided with a suitable type of silencer for noise level reduction.
5. The gas engine offered should be complete in all respects comprising of valve train, cooling system, combustion air/fuel gas system, shielded ignition system, lubricating system, electric actuator, air intake system, exhaust system, starting system, batteries, instrument system, safety system and other accessories. The detailed technical catalogues & write up of the engine with all its sub-systems, mountings and accessories along with detailed technical specifications of the components & bought out items should be provided in the techno-commercial bids.
6. The manufacturing and testing of the gas engine should be with reference to international standards, the reference standard adopted should be indicated in the techno-commercial bid.
7. The offer should include detailed write-up on the ignition system employed for the engine along with detailed specifications for the sub-assemblies & components and reference standards.
8. Gas engine should be provided with remote radiator having temperature controller, gauges, expansion tank, filter, interface piping, valves etc. The remote radiator to be designed for maximum air inlet temp. of 47⁰C & the design data sheet to be provided for the same.
9. The ducting insulation should be such that the skin temperature does not exceed more than 5⁰C above room temperature.
10. The following technical details pertaining to the gas engine should be provided in the techno-commercial bid:

SL NO	DESCRIPTION	Unit	REMARKS
1	Engine type		
2	Manufacturer		
3	Working principle		
4	Configuration		
5	No. of cylinders	Numbers	
6	Bore	Mm	
7	Stroke	Mm	

8	Piston displacement	Cc	
9	Nominal speed	RPM	BHEL prefers to have medium or low speed engines.
10	Aspiration Type		
11	Compression ratio	Ratio	
12	Cooling system		
13	Starter motor output	KW	
14	Starter motor voltage	Volts	
15	Combustion air data		
16	Air mass flow rate		
17	Air volume	m ³	
18	Max. admissible pressure drop in front of in-take filter	mm Hg / mm water column	
19	Type and specification of in-take air filter		Micron rating of the in-take filter to have protection against fine dust upto 2 microns in the ambient air. The specification of inlet air filter to be provided.
20	Exhaust gas data		
20a	Temperature at full load	⁰ C	
20b	Mass flow rate – wet		
20c	Mass flow rate – dry		
20d	Volume – wet		
20e	Volume – dry		
20f	Max. admissible exhaust back pressure after engine		
20g	Emission constituents & its concentrations		Reference to standards if any and its compliance status should be provided.
21	Thermal Energy Balance		
21a	Energy input	Kw	
21b	Heat dissipated at Intercooler	Kw	

21c	Heat dissipated from Lube oil	Kw	
21d	Heat dissipated from jacket water	Kw	
21e	Heat in exhaust gas total	Kw	
21f	Surface heat	Kw	
21g	Balance heat	Kw	
22	Cooling water circuit (lube oil heat)		
22a	Nominal output	KW	
22b	Max. oil temperature	°C	
22c	Nominal pressure of engine jacket water	Bar	
22d	Loss of nominal pressure of engine jacket water	Bar	
22e	Safety Valve setting	Bar	
23	Engine Jacket water – Heat		
23a	Nominal output	KW	
23b	Max. engine jacket water temperature (outlet of engine)	°C	
23c	Engine jacket water flow rate	m ³ /h	
23d	Safety valve setting	Bar	
24	Intercooler		If more than one intercooler stages are provided, the similar data should be provided for additional stages also.
24a	Nominal output	KW	
24b	Max. inlet cooling water temp at intercooler	°C	
24c	Nominal pressure of cooling water	Bar	
24d	Intercooler water pressure drop	Bar	
24e	Safety valve setting	Bar	

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ELECTRIC GENERATOR

1. The electric power generated is intended for use in Industrial plant for motive power, heating & lighting uses. Predominantly, the load is inductive type arising out of motors of various capacities. The rating of the maximum size of a single motor is 160 kW.
2. The generator rating is 11 kV (11000 Volts), 3 Phase, 50 Hz. The generators should be rated at 0.80 Power Factor
3. The generator should be of direct connected type, drip-proof, screen protected, synchronous, fan cooled, AC revolving field type with direct connected brushless exciter for 250% short circuit sustain and motor starting.
4. The detailed constructional features of the alternator should be provided and the suitability should be confirmed for the ambient conditions given in this specification.
5. The generator rotor should be dynamically balanced. The reference standard should be indicated in the techno-commercial bid.
6. The generator should have a microprocessor based digital voltage regulator and the voltage regulation should be within $\pm 0.5\%$ at any power factor variation between 0.8 to unity, and at any variation from no load to full load and at any variation from cold to hot.
7. The generator should have isochronous frequency regulation under varying loads from no load to full load. The random frequency variation should not exceed $\pm 0.25\%$ of its mean value.
8. The design of the alternator should take into consideration for the improved harmonics and paralleling ability.
9. The manufacturing and testing of the alternator should be with reference to international standards, the reference standard adopted should be indicated in the techno-commercial bid.
10. Telephone influence factor (TIF) should be better than 50 and THF to be better than 2% as per BS4999 Part 40
11. The alternator temperature rise not to exceed 105°C (absolute value). Offer to indicate the class of insulation adopted. Forced cooling if required can be adopted. Details of the cooling system incorporated to be detailed in the techno-commercial bid.
12. The radio interference levels should be in compliance with BS800 and VDE levels to G & N

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13.The following technical details of the generators should be provided in the techno-commercial bid :

SL NO	DESCRIPTION	Unit	REMARKS
1	Type		
2	Model No.		
3	Manufacturer		
4	Rating		
5	Driving power		
6	Number of bearings		
7	No of poles		
8	Cooling system		
9	Rating at PF=1.0, 0.95, 0.90 & 0.80		
10	Rated output at PF=1.0, 0.95, 0.90 & 0.80		
11	Frequency		
12	Voltage		
13	Speed		
14	Permissible over speed		
15	Power factor lagging		
16	Efficiency at PF=1.0, 0.95, 0.90 & 0.80	%	
17	Efficiency at full load, 75% load, 50% load	%	
18	Moment of inertia		
19	Mass		
20	Radio interference level		Offer to indicate the reference standard and actual level.
21	Type of Construction		
22	Protection Class		
23	Insulation Class		
24	Temperature rise at maximum load and under COP		If forced cooling system is incorporated, provide details.

25	Maximum ambient temperature		
26	Total harmonic distortion		
27	Reactance & time constants		
27a	Direct axis synchronous reactance X_d		
27b	Direct axis transient reactance X'_d		
27c	Direct axis sub transient reactance X''_d		
27d	Sub transient reactance time constant		
27e	Negative sequence reactance X_2		
27f	Zero sequence reactance X_0		
27g	Quadrature axis synchronous reactance X_q		
27h	Quadrature axis sub-transient reactance X''_q		
27i	Armature time constant direct-current T_a		
27j	Transient direct axis open circuit field time constant T'_{do}		
27k	Transient direct axis short circuit time constant T'_d		

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CONTROL SYSTEM

1. The genset should be offered with a complete control system for operational control, monitoring, data logging, fault identification, re-set, remote monitoring and other features which can enhance the operational ease, efficiency and safety of the genset.
2. The control system should be microprocessor based, on-site programmable with suitable diagnostics. The system should be provided with adequate memory for data storage as well as computer connectivity for data transfer / mass storage.
3. The indicative features of the control panel is provided below, control system with improvised features may be offered and the details of the complete features offered should be provided in the techno-commercial bid:

I. Digital metering / indication of the following parameters:

- a. 3 Phase AC voltage
- b. Current
- c. Kilowatts
- d. Total kilowatts
- e. Per phase kilowatts
- f. KVA total
- g. KVAR total
- h. KVARh total
- i. Power factor
- j. % of rating
- k. Frequency
- l. DC Voltage
- m. Engine coolant temperature
- n. Engine oil pressure
- o. Engine RPM
- p. Hours operated

II. System diagnostics

III. Controls for the following:

- a. Auto start / stop
- b. Emergency stop
- c. Cycle crank
- d. Voltage control
- e. Cool down timer
- f. Phase selector switch

IV. Alarms for the following:

- a. Engine oil pressure low
- b. Engine coolant temperature high
- c. Engine over speed

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- d. Engine over crank
- e. Emergency stop
- f. Inter cooler temperature high
- g. Exhaust temperature high
- h. Overloading as a set percent
- i. Engine start / stop during auto load sharing
- a. Over voltage
- b. Under voltage
- c. Reverse power relay
- d. Over frequency
- e. Under frequency
- f. Over current

V. Protective relays (programmable) for

- a. Over voltage
- b. Under voltage
- c. Reverse power relay
- d. Over frequency
- e. Under frequency
- f. Over current

ENGINE STARTING SYSTEM

1. Black starting of the engine should be from battery banks – BHEL would prefer 24V DC battery system.
2. A suitable battery charger should be part of the engine starting system. The battery charger should have trickle, float-cum-boost charging arrangement– BHEL would prefer 24V DC battery charger.

ELECTRICAL DISTRIBUTION SYSTEM

1. The genset should be offered with a electrical distribution system for evacuating the power generated along with the necessary operational control, monitoring, data logging, fault identification, re-set, remote monitoring and other features which can enhance the operational ease, efficiency and safety of the genset and its power evacuation system.
2. The electrical distribution system offered along with the generator sets should have an auto synchronising panel, incoming panel with individual VCB for each genset, one neutral grounding panel & one auxiliary panel for different power plant auxiliaries. BHEL will draw out power from the genset incomer breaker panel for feeding to different load centres.
3. The indicative features of the electrical distribution system is provided below, electrical distribution system with improvised features may be offered and the details of the same should be provided in the techno-commercial bid.

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Auto Synchronising panel

Auto synchronising panel between gas gensets consisting of following metering & protection accessories should be provided along with the gensets:

- 12 window Annunciator with test, accept & reset push button
- Hooter alarm for Annunciator
- Ammeter
- Voltmeter with selector switch and control fuse
- KW Meter
- KVAR Meter
- Power factor meter
- KWH Meter
- Running Hour Meter
- Reverse Power Relay
- Differential Relay
- Trip Circuit Supervision Relay
- Master Trip Relay
- Standby Earth Fault Relay
- Voltage Control Over Current Relay
- Auto-Synchronising Module
- Auxiliary Contactor & others Accessories
- Over Voltage Relay
- Under Voltage Relay

Genset breaker panel

Genset breaker panel comprising of 11 kV VCBs for each genset complying to IEC standard. It should have voltage & over current protection & comprising of following accessories:

12kV, 630 Amps, 50 Hz VCB with Electric spring charging mechanism having

- IP67 protection for High Voltage live parts & for SF6 tank
- IP2X protection for front cover mechanism
- IP 3X protection for cable covers
- IP 54 protection for outdoor enclosure
- Type tested as per IEC 60056, 60129, 60265, 60298, 60420, 60529 & 60694
- 21 kA short circuit breaking current capacity
- 52 kA rated making capacity
- 21 kA rated short time current capacity for 3 sec
- Power frequency withstand voltage of 28 kV

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Impulse voltage withstand capacity of 95 kV
Approx 45 ms total opening time
Approx 40 ms closing time
Breaker control switch
Potential transformer
Voltmeter with selector switch
Indicating lamp
Ammeter with selector switch
Double Core Current transformer
Core I - Metering class-1
Core II - Protection class-5P10

Neutral Grounding Panel consisting of following accessories:

Motorised Single pole isolator
Current Transformer for differential relay
Stainless steel resistor

Auxiliary panel(MCC) for power plant auxiliaries

NOTE : The panels should be of good construction and should provide the necessary protection called for. The make, construction type and standards adopted should be indicated in the techno-commercial bid.

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BROAD SCOPE OF SUPPLY

VENDORS

A. Mechanical System:

1. Spark ignited gas engine with required type of vibration isolators and gas pressure regulator mounted on a common base frame.
2. Remote Radiator with temperature controller, gauges, expansion tank, filter, interface piping, valves etc. The remote radiator to be designed for ambient conditions given in the specifications & the design data sheet to be provided for the same.
3. Jacket & cooling water circulating system comprising of day tank, pump (main & standby), interface piping ,valves etc to different parts of gas engine
4. Jacket water heater with pump to be provided in the engine
5. Piping system of both exhaust & jacket water to be suitably designed to take care of back pressure from Heat Recovery Unit & VAM respectively. Supplier to provide back pressure calculation of exhaust piping considering the Heat Recovery Unit
6. Exhaust System comprising of exhaust ducting with insulation & supports
7. Required Expansion Bellows, exhaust silencer, Valves & 3 Way Divertor Dampers compatible to take up the Heat Recovery Unit at a later stage
8. Exhaust Duct with suitable hood & insulation for each genset. The surface temperature above the insulation should not exceed 5°C above the ambient.
9. Gas header, piping from header to individual Genset, Isolation valves, PRV, Pressure gauges at upstream & downstream with isolation valves with filters with suitable support structure
10. Any other items which form part of the gas engine and which are essential for the operation of the engine as per the parameters described in this specification.

B. Electrical System:

1. Self-excited, Self-regulated three phase generator having
Construction as per IMP 24
Protection Class as per IP 22
F Insulation Class
2. Genset accessories –Automatic digital voltage regulator, Cable termination box.
3. Genset Control Panel
4. Starting system
5. Flexible connections
6. Auto Synchronising panel
7. Genset breaker panel
8. Neutral Grounding Panel
9. Auxiliary panel(MCC) for power plant auxiliaries
10. Any other items which form part of the gas genset alternator and electrical system and which are essential for the operation of the engine as per the parameters described in this specification.

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SCOPE OF WORK AT SITE

VENDOR'S

1. Unloading of genset and its auxiliaries at site
2. Shifting of genset and its auxiliaries at site
3. Erection & alignment of genset
4. Erection and alignment of all auxiliary equipment
5. Piping & insulation
6. Cleaning & pickling of cooling water & gas piping
7. Erection of exhaust duct for each genset
8. Painting of tanks, piping, supporting structures etc
9. Installation of all electrical & control panels supplied by the supplier
10. Testing and commissioning of the genset

BHEL's scope & battery limits:

1. Power cabling (material & laying) from alternator to respective Genset breakers under suppliers supervision
2. Power Cabling (material & laying) from Auxiliary panel to power plant auxiliaries
3. Cable Trays(material & laying)
4. Earthing Pits & Earthing (material & laying) of genset panels under suppliers supervision
5. To arrange for all civil works viz., foundation if required, civil support structures / platforms, cable trenches, and others including earth grid, earth pits, ventilation system etc.
6. To arrange for crane facility at site if required
7. Provide piped R-LNG gas at 4 kg/cm² max. to the header at one point inside the power plant as per the specifications mentioned in *Annexure-1* of this tender specification
8. Water supply at the inlet of water day tank at one point as per the water quality mentioned in *Annexure-2* of this tender specification

SPECIFICATION FOR GAS GENSETS

Specific Techno Commercial Requirement

1. The offers should be in two part system i.e.,
 - a. The bill of quantity of supply should be listed in both bids. However the prices will appear against the bill of quantity in the price bid only.
2. The price bid should be submitted considering the following alternatives:
 - a. Alternative – 1 : For two number of gensets and its O & M contract for 10 years.
 - b. Alternative – 2 : For three number of gensets to be supplied in 2 phases as given in the broad specification and its O & M contract for 10 years.

BHEL reserves the right to opt for any of the alternatives given above while deciding the tender.
3. **QUALIFICATION CRITERIA:** Over and above meeting to the technical specification as detailed in this specification, the past proven experience will be the qualifying criteria for accepting or rejecting the offer.
 - a. The vendor should have supplied similar lean burn gas based genset offered which has been in operation for a minimum of **24,000 hours in 3 years**.
 - b. The supplier should furnish the list of customers along with the year of supply, address and contact telephone numbers to whom the genset has been supplied. Vendors are also requested to furnish performance certificate from their customers.
 - c. Service backup and spares warehousing facility should be available in **India**. These details should be provided in the techno-commercial bid.
 - d. The gas engine offered should give a minimum output of 3.80 kwh / SCM of Natural Gas or better.**

Failure to meet any of the above qualification requirements, the offer is liable to be rejected.

4. Inspection of the genset and its accessories as per the supplier's scope of supply in India and abroad will be carried out by BHEL. Supplier to submit necessary test reports for all components and calibration certificates as required.

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5. The audited financial statement (balance sheet) of the genset manufacturer/s and the Indian agency / representative for the last three years should be provided along with the techno-commercial offer.
6. EVALUATION OF TENDER : The tender shall be evaluated based on the following criterion.
 - A. The total landed cost of the equipment & its accessories inclusive of all taxes, duties and E & C
 - B. The Operation & Maintenance cost over a period of 10 years. The estimated running hours and expected units of generation per year over a period of 10 years is provided in Annexure – IV
 - C. The cost to BHEL will be arrived at by the summation of A & B stated above.
7. BHEL will accept only those offers who have agreed for undertaking the O & M contract for 10 years and have submitted their bids accordingly.

SPECIFICATION FOR GAS GENSETS**Specification of GAS (R-LNG)**

Typical range of GAS composition

Sl. No.	Components		Range (Mole %)	
1	Methane	C1	84.5	98.77
2	Ethane	C2	9	0.69
3	Propane	C3	3	0.03
4	Butane	C4	2	0
5	Pentane	C5	0.25	0
6	Hexane	C6		0
7	Heptane	C7		0
8	Nitrogen	N2	1.25	0.51
			100	100

Oxygen (O₂) – not more than 0.5 Mole %

Total non Hydrocarbon – Not more than 2.0 Mole %

Total Sulphur including H₂S – Not more that 10PPM by weight expected H₂S content not more 4PPM by Volume.

Gas upon delivery meets the following specifications:

- i) Reasonably free from dust (max. size 5 micron but which could be 10 micron during commissioning period), gum, gum foaming constituents and other deleterious solids and / or liquid matter which will cause damage to or interfere with the operations of the Buyer's Facilities;
- ii) Water content in the range of 112 to 144 kg/ million standard cubic meters.
- iii) Gas will be supplied preferably at ambient temperature.
- iv) Gross Calorific value of not less than 8500 Kcal / SCM.
- v) Carbon Dioxide may vary between 0-5%.

SPECIFICATION FOR GAS GENSETS

ANNEXURE - II

QUALITY OF WATER AVAILABLE AT SITE

SL NO	PARAMETERS	UNITS	VALUES
01	Colour	Hazen	Colourless
02	Odour	Agreeable	Odourless
03	Temperature	°C	10 to 30
04	Turbidity	NTU	0.50
05	Conductivity	µmho/cm	805
06	pH		7.5
07	Suspended Solids	mg/l	Nil
08	Dissolved solids	mg/l	350 to 400
09	Total solids	mg/l	350 to 400
10	Alkalinity due to Phenolphthalein (as CaCO ₃)	mg/l	Nil
11	Alkalinity due to methyl orange (as CaCO ₃)	mg/l	310
12	Total hardness (as CaCO ₃)	mg/l	200 to 250
13	Free residual chlorine	mg/l	Nil
14	Calcium (as CaCO ₃)	mg/l	140 to 180
15	Magnesium (as CaCO ₃)	mg/l	50
16	Chlorides (as Cl)	mg/l	25 to 45
17	Sulphate (as SO ₄)	mg/l	3 to 5
18	Phosphate (as PO ₄)	mg/l	BDL
19	Nitrate (as NO ₃)	mg/l	5 to 10
20	Iron (Fe)	mg/l	BDL
21	Total Coliform		Absent
22	Fecal Coliform (E.Coli)		Absent

SPECIFICATION FOR GAS GENSETS

ANNEXURE – III

SCOPE OF OPERATION & MAINTENANCE

The operation & maintenance of the gensets should be undertaken by the suppliers / suppliers authorised representatives. If the O & M is carried out by authorised representative the full responsibility still rests with the suppliers. The scope of O & M contract is as follows:

1. The O & M contract is for the gas gensets installed at BHEL – Insulator plant Jagdishpur, Uttar Pradesh, India premises.
2. The gas gensets shall be guaranteed to operate a minimum of 8000 hours in a year. The estimated running hours and expected units of generation per year over a period of 10 years is provided in *Annexure – IV*.
3. The supplier shall ensure operating parameters within designed tolerances to ensure maximum life and optimum availability.
4. The scope of O & M contract covers the gas gensets, auxiliary equipment, accessories like battery, battery charger, etc., control panels, synchronising panel, genset breaker panels, auxiliary control panel and any other item supplied by the genset supplier.
5. The year wise O & M cost break up should be given for each genset individually based on the consideration of operating hours in a year. The estimated operating hours of each genset is provided in Annexure - IV. As it is proposed to install the third genset in II phase, the O & M period will start accordingly for the third set but O & M period for this will terminate along with the O & M period of I phase gensets.
6. The O & M contract shall cover the following:
 - a. Spares required for scheduled maintenance & breakdown maintenance.
 - b. Consumables like lube oil, greases, batteries etc.,
 - c. Manpower for operation & maintenance round the clock.
 - d. Tools and tackles required for O & M.
7. BHEL will provide the following :
 - a. Fuel
 - b. Water
 - c. Utilities like lighting, air-conditioning for control room, building and its maintenance
 - d. Canteen facilities on chargeable basis
 - e. Lifting and handling facilities for major maintenance.
 - f. Lockable store for storage of consumables, spares and tools.
 - g. Suitable accommodation for O & M staff on chargeable basis
 - h. Transportation facility for service engineers from nearest railway station / airport for emergency calls
 - i. Insurance of the plant & equipment against fire and natural calamities.
8. The vendor should alternatively give the offer for O & M considering that the canteen facility and accommodation facility is provided by BHEL free of cost.

SPECIFICATION FOR GAS GENSETS

9. The supplier should ensure compliance to all statutory requirements like Provident Fund, ESI, Minimum wages, etc., as per the prevailing rules in force at Jagdishpur, Uttar Pradesh for the workmen carrying out O & M.
10. The supplier shall provide necessary safety appliances for their workmen carrying out O & M. Necessary safety instructions & training for safe & efficient operation of the gensets shall be provided by the supplier.
11. The supplier shall maintain logs for recording gas genset operating parameters, discrepancies and corrections. Logs shall also be maintained for preventive and breakdown maintenance. The log format shall be mutually agreed upon.
12. Scheduled preventive maintenance shall be drawn and regularly monitored.
13. Billing of the O & M contract will be done once a month as per the rates, terms and conditions agreed upon.

SPECIFICATION FOR GAS GENSETS**ANNEXURE – IV****ESTIMATED RUNNING HOURS AND EXPECTED UNITS OF GENERATION OVER THE YEARS**

DESCRIPTION	08-09	09-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-18
EXPECTED UNITS LIKELY TO BE GENERATED PER YEAR (kWH)	13667326	18141251	18141251	22954871	22954871	22954871	22954871	22954871	22954871	22954871
Max no. of hours of operation of genset no 1 of 1.4MW	8000	8000	8000	8000	8000	8000	8000	8000	8000	8000
Max no. of hours of operation of genset no 2 of 1.4MW	6600	6600	6600	6600	6600	6600	6600	6600	6600	6600
Max no. of hours of operation of genset no 3 of 1.4MW	0	2920	2920	5840	5840	5840	5840	5840	5840	5840
SHIFT WISE ELECTRIC LOAD in kW										
in 3rd Shift (11 PM to 7 AM)	1164	1503	1503	1974	1974	1974	1974	1974	1974	1974
in 2nd Shift (3 PM to 11 PM)	1546	2022	2022	2611	2611	2611	2611	2611	2611	2611
in 1st Shift (7AM to 3 PM)	1971	2689	2689	3278	3278	3278	3278	3278	3278	3278

GENERAL TERMS AND CONDITIONS

1. Sealed Tenders are invited for the following work from experienced parties who meet the Qualification Criteria.

Material Description	Unit	Quantity	Tender submission Last Date & time	Tender opening date & time
Gas Generating Set with O&M 3 X 1400 KWe, 11kv capacity.	No.	01	12-07-2007, 2.30 PM	12-07-2007 3.00 PM

2. Address for purchase, submission & opening of Tender

a) **Purchase and opening of tender:**

Office of the Dy. G.M. / (MM)
 Insulator Plant
 Bharat Heavy Electricals Limited
 Jagdishpur Industrial Area
 Jagdishpur
 Distt Sultanpur (UP) 227 817
 Tel : 05361 270140
 Fax : 05361 270110
 Email: babulal@bhelepd.com

Contact Person: Shri G. K. Babulal, Dy. Gen. Mgr/MM

b) **Submission of tenders:**

AA) By Post/ Courier at

BHEL IP, Jagdishpur Liaison office
 2/247A, Vikas khand, Gomti Nagar (near Mayo Hospital)
 Lucknow (U.P) – 226016
 Phone: 0522-2398130, 2398142

or

BB) By hand : In the tender box located at BHEL, Insulator Plant, Jagdishpur (U.P.)

3. BHEL takes no responsibility for any delay / loss of documents or correspondence sent by courier or post.
4. The offer is to be submitted in a sealed envelope properly marked .The tender shall be submitted in two parts. The first part shall consist of the techno-commercial offer without price schedule and marked on top of the envelope as “Part I -Techno-commercial Bid” along with tender enquiry no. and due date. The second part shall be the price schedule and marked on top of the envelope as “Part II - Price Bid” along with tender enquiry no and due date. Each part shall be in a separate sealed envelope. Both the parts shall then be put in a bigger sealed envelope. The tender enquiry no. & due date of opening must be clearly mentioned on top of the envelope.

5. Part I of the bid will be opened first and scrutinized. Successful bidders in techno-commercial bid Part – I will only be considered for opening of Price Schedule i.e. Part – II. Date of opening of Price Bid will be intimated separately to the Tenderers who qualify in the Techno-Commercial bid.
6. Offers should be strictly in accordance with the tender specifications & other terms and conditions enclosed herewith.
7. Only Tenderers who have previous experience are expected to quote for this Item. Offer from Tenderer who does not have proven and established experience in the field is liable to be rejected.
8. Details of similar equipment of above specification supplied earlier to other parties & their performance to be provided along with the offer in the techno-commercial offer.
9. Guarantee and Test Certificates are required along with the supply
10. Erection & Commissioning shall be done by supplier.
11. In the price bid cost of main equipment, E & C charges, Taxes, P & F Excise duty etc are to be quoted separately
12. Equipment will be inspected before dispatch by BHEL
13. Please quote your rates for FOR BHEL, Jagdishpur for indigeneous supply. FOB/CIF offer for import items.
14. Our payment terms are: 80% against receipt of material at site, 10% after Erection & Commissioning and balance 10% against performance bank guarantee.
15. AS delivery is the essence of the contract, BHEL's standard LD clause is applicable.
16. Operational manual & necessary drawings shall be provided to BHEL at the time of supply.
17. Prices to be firm with validity with validity of 90 days from the date of opening.
18. Parties are requested to adhere to commercial terms of BHEL, otherwise the loading in the commercial comparative statement will be as per loading factor enclosed.
19. BHEL reserves the right to accept or reject any of the bid / all bids with or without deviation or cancel / withdraw the invitation for bid without assigning any reason whatsoever and in such case no bidder shall have any claim arising out of such action by BHEL.
20. Order shall be awarded to technically suitable L-1 bidder only
21. L-1 (lowest bidder) shall be worked out based upon the cost to BHEL.basis.
22. Price to be mentioned both in words and figures in price bid
23. Tax / Excise break ups to be given clearly
24. Guarantee /Performance Guarantee of equipment shall be given by supplier

25. Unloading of materials at BHEL shall be done under the supervision of supplier.

27 Right of Acceptance:- BHEL reserves the right to reject any or all tenders without assigning any reason there of.

28. Risk Factor- BHEL has the option to terminate the contract and to purchase the material at the risk & cost of the vendor if vendor fails to deliver the material within the stipulated time mentioned in the contract.

29. Party shall submit relevant documents for available VAT benefits as and when applicable.

30. Performance Bank Guarantee of 10% value of the contract value valid for 12 months from the date of commissioning shall be applicable or 18 months from the Date of Dispatch.

31. Consortium Bankers of BHEL are State Bank of India, ABN Amro Bank, Bank of Baroda, Canara Bank, HDFC Bank Ltd., Deutsche, AG, ICICI Bank Ltd., IDBI Ltd, Punjab National Bank, CITI Bank, NA, State Bank of Hyderabad, State Bank of Travancore, The Hongkong and Shanghai Banking Corporation Ltd

For & on behalf of BHEL

Dy. GM/ MM
BHEL, IP, Jagdishpur



INSULATOR PLANT, JAGDISHPUR

LOADING FACTORS SHEET

DEVIATIONS ARE LIMITED TO FOLLOWING ONLY, FURTHER DEVIATION ON ANY OF THE FOLLOWING MAY LEAD BHEL TO REJECT THE OFFER UNILATERALLY ON COMMERCIAL GROUNDS.

NOTE: THIS LOADING FACTOR INDICATED BELOW WILL BE ADDED ON QUOTED PRICE TO EVALUATE THE LOWEST QUOTE (in CASE OF DEVIATION TO BHEL'S TENDER SPECIFIED TERMS).

SL.NO	COMMERCIAL TERMS	BHEL STANDARD TERM	IF YOU QUOTE	LOADING FACTOR FOR NON – COMPLIANCE OF BHEL STANDARD TERM
A.	FOR INDIGENOUS SCOPE OF SUPPLY			
1	TERMS OF PAYMENT (WHERE SCOPE INCLUDES E&C) :	80% against receipt of material 10% against Erection & Commissioning 10% against Performance Bank Guarantee Note: No advance will be paid.	80% THROUGH BANK	2% ON THE 80% OF THE BASIC MATERIAL VALUE
		- SAME AS ABOVE-	80% AGAINST EXCHANGE OF DISPATCH DOCUMENTS (I.E. PROFORMA INVOICE)	2.50% ON THE 80% OF THE BASIC MATERIAL VALUE.
B.	FOR IMPORTED SCOPE OF SUPPLY :			
1	TERMS OF PAYMENT (WHERE SCOPE INCLUDES E&C)	80% against receipt of material 10% against Erection & Commissioning 10% against Performance Bank Guarantee Note: No advance will be paid.	80% THROUGH LETTER OF CREDIT. ALL BANK CHARGES OUTSIDE INDIA INCLUDING CONFIRMATION CHARGES TO BENEFICIARY'S ACCOUNT.	2% ON THE 80% OF THE BASIC MATERIAL VALUE
		-SAME AS ABOVE-	100% THROUGH LETTER OF CREDIT AGAINST DELIVERY. ALL BANK CHARGES OUTSIDE INDIA INCLUDING CONFIRMATION CHARGES TO BENEFICIARY'S ACCOUNT Note: If E & C Involved by the vendor this payment is not acceptable	3.5% ON THE 100% OF THE BASIC MATERIAL VALUE.

SL NO	COMMERCIAL TERMS	BHEL STANDARD TERM	IF YOU QUOTE	LOADING FACTOR FOR NON – COMPLIANCE OF BHEL STANDARD TERM
		-SAME AS ABOVE-	100% WITHIN 45 DAYS OF SIGNING OF HIGH SEA SALES AGREEMENT.	3% ON THE 100% OF THE CIF VALUE.
C	PERFORMANCE BANK GUARANTEE (COMMON FOR INDIGENOUS/IMPORTED/HSS)	PBG for 10% of the basic material cost shall be furnished in the BHEL prescribed format only.	IF NOT AGREED	10% OF THE BASIC MATERIAL VALUE.
		- SAME AS ABOVE -	IF 5% IS AGREED	5% OF THE BASIC MATERIAL VALUE.
		- SAME AS ABOVE -	OTHER THAN THE ABOVE.	(10% MINUS THE AGREED MAX. %) OF THE BASIC MATERIAL VALUE WILL BE LOADED.
D	PENALITY CLAUSE	½% Per week subject to a maximum 10% for delayed delivery	IF PENALITY CLAUSE IS NOT AGREED.	10% OF THE BASIC MATERIAL VALUE.
E	WARRANTY	24 months from the date of dispatch or 18 months from the date of commissioning whichever is earlier.	IF NOT AGREED FOR THE STIPULATED WARRANTY PERIOD IN THE ENQUIRY.	0.5% OF THE BASIC MATERIAL VALUE PER MONTH FOR THE DIFFERENCE IN PERIOD.