

**SUPPLY, INSTALLATION, COMMISSIONING AND
TESTING OF 60 KVA DIESEL GENERATOR SET**

AT

**STATE LIFE INSURANCE,
ZONAL OFFICE MAIN DOUR ROAD NAWABSHAH (BENAZIRABAD)**

TENDER NO. SBA/P&GS/DG/02/2021



STATE LIFE
INSURANCE CORPORATION OF PAKISTAN

Date: _____

ASSISTANT MANAGER (P&GS)
State Life Insurance Zonal Office,
Main Dour Road, Nawabshah
Benazirabad 0244-386001

Sub: SUPPLY, INSTALLATION, TESTING & COMMISSIONING OF 60 KVA DIESEL GENERATOR SET AT STATE LIFE INSURANCE, ZONAL OFFICE MAIN DOUR ROAD, NAWABSHAH (BENAZIRABAD).

Dear Sir,

Having gone through the Tender Documents & BOQ for the subject work, we hereby submit our Financial Bid for your consideration please.

Pay Order / Demand Draft having No. _____ drawn on: _____

Bank Dated: _____ consisting of 2% Bid Security.

Thanking You,

Yours Sincerely,

Signature: _____

Name: _____

Designation: _____

M/s: _____

**TENDER FOR SUPPLY, INSTALLATION, COMMISSIONING & TESTING OF 60 KVA
STANDBY DIESEL GENERATOR SET AT STATE LIFE INSURANCE, ZONAL OFFICE MAIN
DOUR ROAD NAWABSHAH (BENAZIRABAD)**

**APPLICATION INSTRUCTIONS
FOR THE BIDDERS**

All Tenderers desiring to PARTICIPATE for this TENDER should complete the following documents.

All inquiries related to Tender documents should be addressed in writing to:

ASSISTANT MANAGER (P&GS)

State Life Insurance Zonal Office,
Main Dour Road, Nawabshah
Benazirabad 0244-386001

1. Firm shall submit copies of the following certificates/information:

- i. Pakistan Engineering Council (if registered)
- ii. License to Electrical Contractor (Electric Inspector Govt. of Sindh)
- iii. GST Registration Certificate.
- iv. SST Registration Certificate from SRB.
- v. NTN Number

Please complete the following:

- 1.** a. SUBMITTED BY.....
- b. REGISTERED ADDRESS.....

2. COMPANY INFORMATION

- a. FULL/FIRM NAME OF THE COMPANY.....
- b. REGISTERED OFFICE ADDRESS.....
- c. DESCRIPTION OF COMPANY FIRM.....
- d. TELEPHONE NUMBER.....
- e. E-MAIL.....FAX.....
- f. CONTRACT'S NAME/ TITLE.....
- g. NAME OF PRESENT EXECUTIVE
DIRECTOR AND THEIR POSITION.....

IN THE COMPANY WITH BIO-DATA.....

FINANCIAL BID DOCUMENTS

SUPPLY, INSTALLATION, COMMISSIONING AND TESTING OF 60 KVA DIESEL GENERATOR SET

TENDER NO. SBA/P&GS/DG/02/2021

AT

**STATE LIFE INSURANCE,
ZONAL OFFICE MAIN DOUR ROAD NAWABSHAH (BENAZIRABAD)**

01



STATE LIFE
INSURANCE CORPORATION OF PAKISTAN

INSTRUCTIONS TO TENDERERS/ SUPPLIERS OF EQUIPMENT AND MATERIAL - RELEVANT TECHNICAL DATA ON WHICH THE TENDER IS BASED
(To be filled in and signed by the Tenderer)

TENDER NO. SBA/P&GS/DG/02/2021

1. The Tenderer shall fill the name of only one manufacturer for the equipment on which the tender is based. He shall *be* bound to supply the equipment from the same manufacturer.
2. The Tenderer should preferably be the sole / authorized agent of the equipment and have complete back-up services i.e., spares parts, tools and trained engineers.
3. The Tenderer must fill the following list of equipment / material and manufacturer's Technical data.

Sr. #.	Equipment / Material for Generator 60 KVA with In Built AMF Panel	Name of Manufacturer	Country of Origin
01.	Diesel Engine		
02.	Alternator		
03.	ATS Panel		
04.	Canopy		
05.	L. T. Cables Pakistan Cable or equivalent		
06.	MCCB Terasaki / Schneider/ ABB/ Germany/ Japan/ France/ Italy or equivalent		
07.	Conduits/ Accessories (If required)		
08.	Cable Tray, Trucking (if required)		
09.	Earthing		

TENDERER'S SEAL & SIGNATURE

SALIENT TERMS AND CONDITIONS OF CONTRACT

TENDER NO. SBA/P&GS/DG/02/2021

01.	Amount of Bid Security	2% of Total quoted amount in shape of Pay Order/Bank Draft in favour of State Life Insurance Corporation of Pakistan.
02.	Release of Bid Security	i. Shall be released to unsuccessful bidders after the acceptance of bid of successful bidder. ii. To successful bidder on satisfactory completion of entire work.
03.	Method of Mode of Payment	<ul style="list-style-type: none">• 15% Mobilization Advance against Guarantee FROM Schedule Bank.• 40% on delivery of equipment at site.• 40% on Testing & Commissioning.• 05% Retention Money.
04.	Retention Money	5% of amount of work done.
05.	Release of Retention Money	Retention Money 5% will be released on completion of defects liability period of 01 year.
06.	Liquidated Damages in case of non-completion of work within the stipulated period.	Rs. 500/- (Five Hundred) per day.
07.	Limit of Liquidated Damages	10% of Contract Sum
08.	Date of Commencement	Within Seven (07) Days from the Date of Issuance of Letter of Award
09.	Time of Completion of Work from the date of Commencement of Work	Ninety (30) Days from commencement of work (Saturday & Sunday included)
10.	Period of Honoring Interim Bill	Within Fifteen (15) Days of Engineer's Certificate.
11.	Validity of Tender	One Hundred & Fifty (150) Days (from the date of Opening of Tender)
12.	Defects Liability Period	One (01) Year from the Date of Commissioning.

TENDERER'S SEAL & SIGNATURE

1. GENERAL TERMS.

- 1.1. Tender is invited for supply installation, commissioning and testing of 60 KVA D.G Set as per attached B.O.Q at State Life Insurance, Zonal Office Main Dour Road Nawabshah (Benazirabad).
- 1.2. Tenders shall be submitted in sealed envelopes.
- 1.3. Tenderers are requested to visit the site and ensure that their offers are completed in all respect and that all terms & conditions mentioned in this document shall be strictly complied with. Tenderer must ensure/study the specification. Schedules and B.O.Q as are attached with offer to avoid any debate/discussion/dispute during/after execution of work.
- 1.4. Tender documents (all papers) must be signed and stamped to signify the acceptance of tender's conditions.
- 1.5. Technical services and operating conditions for achieving the performance shall be the responsibility of the Tenderer.
- 1.6. The successful supplier will be required to submit the schedule of supply and installation within Seven (07) Days from the acceptance of Letter of Award.
- 1.7. State Life Insurance Corporation of Pakistan (SLIC) have right to accept / reject the lowest or any tender received for this job as per provisions of PPRA.
- 1.8. Any conditional tender will not be accepted and will be liable to rejection.
- 1.9. Tender without bid security will not be accepted / entertained.
- 1.10. Contractor has to clean the site in every respect from unused material, debris and tools on completion of work.
- 1.11. State Life Insurance Corporation of Pakistan will not be responsible for any loss to life or theft of tool/equipment or consumable material and will not accept any claim, liabilities or compensation.

2. PRICES AND ESCALATION

- 2.1. Quoted price shall be inclusive of Supply, Transportation, Insurance, Octroi, Loading, Unloading, Lifting and fixing of equipment at Site, as specified in the Tender.
- 2.2. No price escalation claim will be entertained in any reason due to change in Taxes, Levy, Wages, Currencies fluctuation or any other change announced by the Central Government / Provincial Government or any local Authority.
- 2.3. The contractor / firm will be bound to pay all federal/provincial government taxes levied on the jobs i.e. GST, SST, Income Tax and any tax in future if imposed by the government during the current contract and the quoted rates will be inclusive of all taxes.
- 2.4. Contractor will arrange N.O.C permission or any other requirement as per Site if required from any Government Authority / Electrical Inspector. Official Fee for such provision will be paid by State Life Insurance Corporation of Pakistan (SLIC) separately.

3. MODE OF PAYMENT

As per Salient Terms.

4. DEFECT LIABILITY PERIOD AND CERTIFICATE:

- 4.1. The contractor shall furnish a completion certificate that the work has been completed and materials supplied strictly conform to the specification as laid down in the contract. The contractor will also submit single line diagram and as built drawing after completion of work.
 - 4.2. The contractor will replace the components if not found according to specification or found defective due to faulty design, material or workmanship.
 - 4.3. Cost of removal, rechecking and cartage charges for defective materials sent back to place of manufacturing be borne by the contractor.
 - 4.4. Cost of all parts required for generator during defect liability period shall be borne by contractor.
5. The installation, in General, shall be carried out in conformity with the Pakistan Electricity Rules, 1973 and the latest edition of the Regulations for the Electrical Equipment of Buildings by the Institution of Electrical Engineers, London (I.E.E). However, in case of conflict between these specifications and the I.E.E Regulations, these specifications shall be followed.
6. The Contractor shall be responsible for submitting the test certificates and getting the installation passed by the Electric Inspector, Government of Sindh. Any special requirements HESCO shall be complied with.

7. PRE - BID VISIT:

Tenderers are requested to visit the site before submission of Tender/Bid and ensure that their offers are completed in all respects and that all terms and conditions mentioned in the tender documents shall be strictly complied with. Tenderer must ensure/study the specifications, schedule and BOQ as are attached with offer to avoid any debate/discussion/dispute during/after execution of work.

No TA / DA will be given to Tenderers for Pre- Bid Visit.

8. DEFECT LIABILITY PERIOD:

During Defect Liability Period contractor will provide the services free of cost and maintain the DG Set properly.

- Contractor shall provide maintenance visit in alternate months.
- Emergency visit shall be carried out on call if any fault occurred.

9. SIGNING OF CONTRACT AGREEMENT:

Upon acceptance of the bid the contractor shall execute with the State Life Insurance Corporation of Pakistan a proper agreement on non-judicial stamp paper containing certain terms & conditions in the form prescribed by State Life within Seven (07) Days from the acceptance of Letter of Award.

FINANCIAL BID

BILL OF QUANTITIES (BOQ)

TENDER NO. SBA/P&GS/DG/02/2021

BILL OF QUANTITIES (BOQ)

TENDER NO. SBA/P&GS/DG/02/2021

PROVISION OF 60 KVA D. G. SET at State Life Insurance Zonal Office Main Dour Road Nawabshah (Benazirabad).

Sr.#	Description	Unit	Qty.	Unit Rate (Rupees)	Total Amount (Rupees)
(1)	(2)	(3)	(4)	(5)	(6)
1	<p>Supply, installation, testing and commissioning of the following items of work (unless specifically stated otherwise), including all material, labour, tools, plant, accessories, etc. required for proper completion of each item as per specifications. General/ Specifications for Electrical Works shall be applicable to all BOQ items). The Contractor will visit the site, inspect the existing condition of the works and nature of balance works before quoting the price in Tender. In 'the result of such inspection and check of the works, if Contractor found any rectification or remedial works necessary to be executed for balance works, the Contractor shall accommodate the cost of such works in the quoted rates.</p> <p><u>D. G. SET</u></p> <p>Following the rating of complete D. G. Set with Inbuilt AMF control/ instruments (to be connected with ATS panel) and all control Wiring/interlocks between DG Set panel and utility supply, pipe work, foundation pads and all related civil works etc., complete in all respect.</p> <p>a) 60 KVA Prime</p> <p>b) Foundation and related civil works (60 kVA)</p> <p>c) Sound and weather proof canopy</p> <p>d) Suitable battery for 60 KVA DG set</p>				

TENDER NO. SBA/P&GS/DG/02/2021

PROVISION OF 60 KVA D. G. SET at State Life Insurance Zonal Office Main Dour Road Nawabshah (Benazirabad).

Sr.#	Description	Unit	Qty.	Unit Rate (Rupees)	Total Amount (Rupees)
(1)	(2)	(3)	(4)	(5)	(6)
2	Supply and installation of TP ATS Panel with all imported components of adequate ratings/ specifications along with the single core/ multi core PVC/ PVC copper conductor cable connected with the Panels of the electric substation coupled with HESCO's electric supply as auto change over switching having necessary inter locking with HESCO's electric supply, (by visiting the site to observe the site condition).	Job	1		
3	Rubber pads underneath to control vibration of Generator.	Job	1		
	Misc. Material Like PVC pipe, Flexible pipe, tape etc	Job	1		
4	Power cable 25mm x 4 core about 2 Meter	job	1		
5	Control cable for ATS	job	1		

TENDER NO. SBA/P&GS/DG/2021

PROVISION OF 60 KVA D. G. SET at State Life Insurance Zonal Office Main Dour Road Nawabshah (Benazirabad).

Sr.#	Description	Unit	Qty.	Unit Rate (Rupees)	Total Amount (Rupees)
(1)	(2)	(3)	(4)	(5)	(6)
6	<u>EARTHING</u> Supply of necessary material, cables (Make Pakistan Cables) of recommendable sizes for earthing system, Rod type earth electrode including earthing lead, inspection chamber all accessories etc., complete in all respects by mentioning the specifications of adequate system recommendable for the supplied D. G. Set of 60 KVA along with connections my mentioning the specifications below: Cost of Spare parts:	Job	1		
7	i. Air Filter ii. Oil Filter iii. Fuel Filter iv. Driving Belt v. Set of diodes for excitation system. vi. Additional spares if any recommended.		1 set 1 set 1 set 1 set		
	<u>MISCELLANEOUS</u> Any other item including circuit breaker, MCCB of Japan/ France/ Germany or equivalent make whether specified or not but required for a complete and functional system as per the site requirements.	Job	1		
	Total Amount Carried over to Summary of Cost (INCLUSIVE OF ALL TAXES)				

TENDERER'S SEAL & SIGNATURE

MANUFACTURER'S TECHNICAL DATA

TENDER NO. SBA/P&GS/DG/02/2021

MANUFACTURER'S TECHNICAL DATA

(To be filled - in and signed by the Tenderer)

TENDER NO. SBA/P&GS/DG/02/2021

Sr. #	Data Required	Data Submitted
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1. ENGINE: (Perkin / Hyundai/Cummins / Caterpillar OR Equivalent)

- 1.1. Manufacturer's Name.
- 1.2. Maximum Engine Rating BHP.
- 1.3. Continuous Output Rating – BHP
- 1.4. De - Eating Factor:
 - 1.4.1 For Altitude of 15 Meters above NSL.
 - 1.4.2 For Inlet Air Temperature of Zero Degree Centigrade
 - 1.4.2 Others, if any
- 1.5. Engine Rating at Site – BHP
- 1.6. Period of Maximum Engine Rating – Hours
- 1.7. Operating Speed – RPM
- 1.8. Bore and Stroke – Inches / mm
- 1.9. No. of Cylinders
- 1.10. Arrangement of Cylinders - n line / v
- 1.11. Engine Capacity - cu. in. / cc
- 1.12. Compression Ratio
- 1.13. Coupling

MANUFACTURER'S TECHNICAL DATA

(To be filled - in and signed by the Tenderer)

TENDER NO. SBA/P&GS/DG/02/2021

Sr. #	Data Required	Data Submitted
1.14.	Mounting	
1.15.	Cooling System	
1.16.	Ignition System	
1.17.	Overload Capability	
1.18.	Governor	
1.18.1	Type	
1.18.2	Make	
1.19.	Efficiency (%)	
1.19.1	At 100% rated load	
1.19.2	At 75% rated load	
1.19.3	At 50% rated load	
1.19.4	At 25% rated load	
1.20.	Fuel consumption (Lit./Hr.)	
1.20.1	At 100% rated load	
1.20.2	At 75% rated load	
1.20.3	At 50% rated load	
1.20.4	At 25% rated load	
1.20.5	At 0% rated load	

MANUFACTURER'S TECHNICAL DATA

(To be filled - in and signed by the Tenderer)

Sr. #	Data Required	Data Submitted
2.	ALTERNATOR: (Caterpillar/Newage Stamford/ Leroy Somer/Meccalte) OR Equivalent.	
2.1.	Manufacturers Name	
2.2.	Design Output Rating	
2.3.	Continuous Output at Site	
2.4.	Power Consumption in Auxiliaries	
2.5.	Net Power Available	
2.6.	Rated Voltage	
2.7.	Rated Current per Phase	
2.8.	Power Factor	
2.9.	Speed	
2.10.	Frequency	
2.11.	Insulation Class	
2.11.1	Stator	
2.11.2	Rotor	
2.11.3	Exciter	
2.12.	Overload Capability	
2.13.	Harmonic Content - %	
2.14.	Temperature Rise - Degree Celsius	
2.15.	Frequency Regulation - %	

MANUFACTURER'S TECHNICAL DATA

(To be filled - in and signed by the Tenderer)

Sr. #	Data Required	Data Submitted
2.16.	Deviation Factor - %	
2.17.	Voltage Regulation	
2.17.1	Type	
2.17.2	Regulator	
2.17.3	Regulation - %	
2.17.4	Voltage - %	
2.17.5	Response Time – Sec	
2.18.	Efficiency %	
2.18.1	At 100% rated load	=
2.18.2	At 75% rated load	=
2.18.3	At 50% rated load	=
2.18.4	At 25% rated load	=
2.19.	Exciter	
2.19.1	Type	
2.19.2	Related Voltage – Volts	
2.19.3	Full Load Current – Amps	
2.20.	Radio Frequency interference	
2.21.	Telephone Influence / Interference	
2.22.	Charger Capacity	

MANUFACTURER'S TECHNICAL DATA

(To be filled - in and signed by the Tenderer)

Sr. #	Data Required	Data Submitted
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2.23. Batteries

2.23.1 Type

2.23.2 Rating – AH

3. ACCESSORIES:

(Contractor to state whether or not these accessories are provided)

3.1. Crankcase Heater

3.2. Automatic Water Makeup System

3.3. Dueling for Radiator

3.4. Exhaust System

3.4.1 Residential

3.4.2 Industrial

3.5. Meters / Gauges to Indicate

3.5.1 Engine Speed in RPM

3.5.2 Lube Oil Pressure in Bars

3.5.3 Engine Water Temperature in °C

3.5.4 Engine Running Hours in Hrs.

3.5.5 Battery Charging Current in Amps.

3.6. Alarm / Indicating Lamps for:

3.6.1 Engine Over Speed

MANUFACTURER'S TECHNICAL DATA

(To be filled - in and signed by the Tenderer)

Sr. #	Data Required	Data Submitted
3.6.2	Low Lube Oil Pressure	
3.6.3	High Engine Water Temperature	
3.6.4	Over Voltage	
3.6.5	Under Voltage	
3.6.6	Short Circuit / Tripping of Main Circuit Breaker	
3.6.7	Low Fuel Level	
3.6.8	High Fuel Level	
3.6.9	Charger Failure	
3.6.10	Over Cranking	
3.6.11	Charging Alternator Failure	
3.7.	Safety devices for instantaneous shut down due to:	
3.7.1	Engine Over Speed	
3.7.2	Low Lube Oil Pressure	
3.7.3	High Water Temperature Shut Down	
3.7.4	Under voltage	
3.8.	Safety devices for adjustable delayed shut down through shut down timer due to:	
3.8.1	Over Voltage	
3.8.2	Short Circuit / Tripping of Main Circuit Breaker	
3.8.3	Low Fuel Level in Tank	

GENERAL SPECIFICATIONS AND SCOPE OF WORKS

TENDER NO. SBA/P&GS/DG/02/2021

GENERAL SPECIFICATIONS AND SCOPE OF WORKS

TENDER NO. SBA/P&GS/DG/02/2021

1.0 SCOPE

The work under this section consists of supplying, installing, testing and commissioning of all material and services of the complete D. G. Sets including Inbuilt AMF and ATS Panel with required Interlocking and other equipment, as given in the Bill of Quantities.

The Tenderer shall be deemed to have considered the scope of work, all the conditions, obligations and requirements by visiting the site before quoting rates against items of Bill of Quantities, inspected the site and satisfied himself as to the nature of work, ground, the hydrological and climatic conditions, availability of materials, means of access to the site for manpower/machinery, risks, contingencies and other circumstances which may influence or affect his Tender.

The Contractor shall discuss the electrical layout with the Engineer/ client and co-ordinate at Site with other services for exact location and position of the Diesel Generator Sets, ATS Panel with required Interlocking, underground fuel storage tanks with piping network and routing of cables.

The D. G. Sets, with Inbuilt AMF and ATS Panel etc., and accessories shall comply with the relevant provisions of the Tender Document.

2.0 GENERAL

The Diesel generator set shall be of a standard design of reputed manufacturer, who shall have similar units in operations for similar applications and field conditions. The manufacturer shall also have adequate maintenance facilities in vicinity of the Project with technically qualified and experienced personnel trained for operation and on-site maintenance of equipment offered by the Contractor in the tender bid.

The sets shall be with sound proof canopy of residential type where specified and rated for continuous duty and suitable for outdoor/indoor installation as specified with protection class rating accordingly. It shall be capable for unbalance loads upto 30% of actual load and for continuous part load operation. The set shall be capable of starting and operation at the rated output at 0° Centigrade and at an altitude of 15 meters above mean sea level. The ratings must be substantiated with manufacturer's standard published data.

The Diesel Generator set shall, after reducing the power absorbed by the auxiliaries, deliver continuously rated power output with overload capability for operation at least 10% above the rated capacity for 1 hour continuously in any 12 hours operating in accordance with ISO 3046, AS 2789 & BS 5514 under the site conditions. All auxiliaries, accessories and connections between system along with all necessary cables, fittings, hardware, etc., for complete installation of Diesel Engine, Generator, Control/ Instrument Panel.

With required Interlocking, Fuel and Oil Storage, Batteries, Exhaust System with acoustic and residential Silencer etc., shall be furnished by the Contractor.

The engine shall be directly coupled to the generator, and shall have a rated speed of 1500 rpm. The set shall be capable of sustaining without damage, 25% over speed under any abnormal operating condition.

The engine-generator set shall be mounted on suitable rigid steel frame skid with vibration isolators. Heavy duty lifting eyes and jacking screws shall be provided on the skid. The foundation bolts and all other material/hardware for complete installation of the set shall be furnished with the set. Any excessive tensional vibration shall be avoided for both engine and alternator.

The set shall be suitable for full load starting. When the generator is operating at no-load, the application of full load current, taking into account the surge due to starting of equipment, should be possible with maximum transient voltage drop of 15% of the ' rated voltage, and the time taken to restore the generator voltage to 97% of rated value should not exceed 1.5 seconds.

The sets shall be capable for starting and accepting full load within 30 seconds after receipt of starting signal.

The D. G. Sets shall be from the following make **or equivalent**:

Caterpillar	-
Stamford	-
Cummins (CPG)	-
Meccalte	-
Leroy Somer	-
Hyundai	-

The Contractor shall submit the equipment layout and other installation details as per manufacturer's recommendations for approval of the Engineer at least 15 days prior to the installation of the set.

Necessary provision, including connections and a Local/OFF/Remote control switch shall be made in the Generator Panel of the D.G. Set. The cost of such provision, connection, testing and commissioning are deemed to be included in the Cost of D. G. Set and no separate payment shall be made against such works.

3.0 APPLICABLE STANDARDS/CODES

The Diesel engine and generator shall conform to the following standards as applicable.

BS 5514	- Reciprocating Internal Combustion Engine.
BS 4999	- General Requirements for Rotating Electrical Machines.
BS 5000-99	- Rotating Electrical Machines of particular types or for particular application.

For other equipment and materials related to the Diesel generator set, the Contractor shall follow relevant international standards, details of which shall be submitted to the Engineer for approval.

4.0 MATERIAL

4.1 Diesel Engine

The Diesel Engine shall be four strokes, compression ignition, suitable for continuous duty.

Starting shall be through electric starter motor operated on DC supply from lead acid batteries mounted on the skid. The batteries shall be furnished with the set.

The engine shall be equipped with an alternator type automatic charging system to charge the batteries during running of engine. A static battery charger installed in the control panel shall also be provided to charge the batteries when the engine is not running. Suitable interlocks shall be provided to prevent simultaneous operation of both charging systems.

The batteries shall be adequate to satisfy the following requirements:

- a. Crank the engine at ' firing speed for at least 15 seconds.
- b. If the engine does not start on the first attempt, crank the engine two more times for the above duration at an interval of 30 seconds between each cranking operation.

4.1.1 Air Intake

Air intake shall be through turbo charger and equipped with dry type filter. Suitable attenuators shall be installed to reduce noise at the air inlet.

4.1.2 Engine Lubrication

A gear type positive pressure lubrication pump shall be provided with efficient filtration arrangement for the lubrication system. A 230 V AC mains operated heater with thermostat shall be provided in the crankcase.

The heater shall be designed for automatic switching to ensure that temperature of oil is maintained for proper operation of the engine.

Engine shall have a constant oil level regulator, gravity fed from an engine mounted lube oil reservoir. Reservoir shall be equipped with an oil level gauge. Size of the reservoir should be suitable for 30 days continuous operation at full load.

A crankcase pressure release valve shall be provided to operate during excess pressure.

4.1.3 Engine Cooling

Engine shall have a forced air draft, water-cooled radiator supplied with a core guard. Cooling system shall have an engine driven centrifugal pump for cooling water circulation. Cooling shall be thermostatically controlled. An engine shut down timer shall be provided to keep the engine running on no-load after any operation of set, so that the engine is sufficiently cooled to start again instantly, if required, without rise in temperature above safe limits.

4.1.4 Exhaust System, Noise, Pollution

Exhaust system shall be equipped with a residential type silencer complete with muffler, exhaust manifold, flexible connector, exhaust elbow, exhaust pipe, rain cap, and associated fittings. The exhaust line shall be taken outside the building through the shortest possible and practical route, without any undue bends. This exhaust line shall be adequately covered with thermal insulation material over its entire length i.e. from the engine to the termination point. All supports for exhaust system shall be furnished.

In order to suppress the noise, acoustic entrance door and acoustic radiator duct along with residential grade silencer will be used for 60 kVA generator placed in the existing rented generator Place.

The exhaust fumes shall be burnt completely and be free of solid matters before escaping to the air.

4.1.5 Speed Governor

The speed governor shall be electronic type. Governor shall regulate engine speed so as to maintain the generator frequency within plus or minus 2% of the rated frequency. Stable engine speed shall be attained within 15 seconds after the engine has been started. Stable engine speed shall be restored within 10 seconds of any sudden change in load, from no load to full load. During this change of load or surge, the speed shall not vary by more than plus or minus 5% of the rated speed

Surface Fuel Storage Tank, Fuel Transfer Pumps, Fuel Piping Network and Day Tank of D.G Set are to be provided as per the requirements.

4.2 Generator

Generator shall be synchronous. The generator shall be capable of carrying continuously for 1 hour in every 12 hours, overload equal to 10% of rated output with field set for normal rated load excitation.

4.2.1 Excitation

Excitation shall be from brush less rotating diodes mounted on the main shaft for 3-phase full wave rectification.

4.2.2 Windings

Alternator windings shall have Class-F insulation and shall be impregnated for tropical use. The temperature rise of winding under normal operating conditions and at rated load shall not exceed the limits specified for Class-B insulation. Anti-condensate heaters shall be provided for windings. The heaters shall be thermostatically controlled for switching ON after the set has stopped. The thermostat range shall be adjustable and set to prevent overheating of windings. For protection of windings from damage due to overheating, thermistors shall be embedded to stop the set in case the temperature of winding rises above the safe value.

4.2.3 Voltage Regulation

Voltage regulator shall be solid state with provision for manual setting. Regulator shall be so designed to 'protect the exciter when the set is running at reduced speed during starting or idling of the' prime mover.

Voltage regulation shall be plus or minus 2.5% from no-load to full load. Transient voltage drop shall be less than 15% at full load and 0.8 power factor. Time required to restore to steady state conditions after transient voltage fluctuation shall not exceed 10 seconds.

4.2.4 Short Circuit Capability

Generator shall be capable of withstanding without injury a 30 seconds three-phase short circuit at its terminal when operating at rated output and power factor with fixed excitation.

4.2.5 Deviation Factor

The deviation factor of the open-circuit line-to-line terminal voltage shall not exceed 0.1

4.3 Control/ Instrument ATS Panels

The Control/Instrument Panel for the generator shall be designed for front access, completely assembled, wired and tested. The control panel shall conform to the constructional requirements as stated in these specifications Section - 8132 for L T Switch Boards. The panel shall comprise but not limited to the following main components.

4.3.1 Generator Panel

This shall incorporate protection and control equipment, measuring instruments, control and instrument transformers, voltage regulator, governor controls, battery charger, indicating lamps, etc.

4.3.2 Circuit Breaker

The circuit breaker shall be triple. pole with adjustable releases for thermal overload, instantaneous over current, under voltage and over voltage protections.

4.3.3 Instrumentation

LED/LCD display with adjustable contrast and backlight with auto power off providing following details:

AC metering

- i) Volts 3-phase (L-L & L-N)
- ii) Amps (per phase & Average)
- iii) Frequency (Hz)
- iv) KW (total & per phase)
- v) KVA (total & per phase)
- vi) KVAR (total & per phase)
- vii) Power Factor (overall & per phase)
- viii) KW hours
- ix) KVAR hours

An kWh (energy meter) shall be provided in compliance to the requirements of Electrical Inspector covering the region (area), in addition to the above mentioned metering.

DC metering

- i) Battery Volts
- ii) Engine hours run
- iii) Engine Jacket Water Temperature
- iv) Lube Oil Pressure
- v) Lube Oil Temperature
- vi) Crank attempt counter
- vii) Start counter
- viii) Engine Speed
- ix) Fuel Oil Level

4.3.4 **Safety Devices**

Following safety devices shall be provided. The audible alarm shall operate on any fault condition and shall be resettable manually and automatically through a timer after 15 minutes whichever is earlier:

A = Alarm SD = Shutdown TD = Adjustable Time Delay

i)	Engine Over speed	A	SD
ii)	Low lube oil pressure	A	SD
iii)	High water temperature	A	SD
iv)	Over voltage	A	SD (TD=0 - 30 Sec)
v)	Under voltage	A	-
vi)	Short circuit and tripping of circuit breaker	A	SD (TD=0 - 1 min.)
vii)	Low level in fuel day tank	A	SD (TD=0 - 5 min.)
viii)	High level in fuel day tank	A	-
ix)	Charger failure	A	-
x)	Winding temperature high	A	SD (TD=0 - 2 min)
xi)	Over crank	A	SD
xii)	Low crankcase oil level	A	-
xiii)	High crankcase oil level	A	-
xiv)	Charging alternator failure	A	-

After shut down, the set shall lockout and it shall not be possible to start it unless manually reset after the cause of fault has been removed.

4.4.3 **Batteries & Battery Charger**

The batteries provided with the D.G. Set shall be of sufficient capacity to perform all required functions.

Battery charger shall be static type and shall provide for both trickle and boost charging of the batteries when the engine is not in operation. The charger shall be of suitable capacity to fully recharge the completely discharged batteries within four hours at boost charge.

4.4.4 **Controls**

Following Controls shall be provided as a minimum:

- i) Auto- Manual-Test-Stop key with LED indicator
- ii) Lamp test key
- iii) Alarm acknowledge key
- iv) Status indicators (1 red shutdown, 1 amber warning)
- v) Lock down emergency stop push button.

4.5 **Auto Load Sharing and AMF Panel (Inbuilt)**

Tile Synchronizing, Load Sharing and AMF panel shall incorporate automatic changeover system, which shall be designed for the following functions:

- i. To start D. G. set immediately when the main supply fails and synchronize them.
- ii. To start the set and synchronize whenever the main supply voltage drops to 360 volts or rise to 440 volts. The setting voltages shall be adjustable within - 5% and +5% respectively for the lower and upper ranges.
- iii. To make two successive attempts, in case the set fails to start in the first attempt.
- iv. Initiate the Automatic Transfer Switch (ATS) closing the Generator Air Circuit Breaker while the Supply Air Circuit is already made open. The ATS shall transfer the load to the Generators. The system shall provide for immediate transfer of load to the generator, after the rated speed/frequency and voltage have been achieved.
- v. The system shall transfer the load from the generator to main supply wherever the voltage returns +5% and persists for at least 3 minutes.
- vi. The system shall be self-resetting after each cycle of operation.
- vii. A four-position selector switch shall be provided for selecting the operation mode i.e. Test-Manual-Automatic-Stop/Maintenance mode to facilitate the following operation:-
 - i) Automatic (As described above).
 - ii) **MANUAL**
Manual starting of the set and load transfer from transformer to generator and vice versa.
 - iii) **TEST**
Testing the changeover operation when so desired, and also for starting and running the set without interrupting the normal operation. In case of failure of main supply during testing, the set shall automatically revert to automatic mode of operation.

iv) Stop/ Maintenance

Provision shall be made to isolate the system for troubleshooting and maintenance without interruption of mains power supply. The set shall not be capable of starting in this condition.

- viii. Two normally open and two normally close potential free contacts rated for 3 Amps at 230V AC shall be provided, which shall operate when the set is started with the operation mode selector switch in auto or manual position. The contacts shall be wired up to the terminal block in panel.

All necessary control and instruments including the synchronizing device, power factor meters, voltmeters percentage adjustable Load Sharing etc. shall be provided with the Synchronizing, Load Sharing and AMF Panel.

5.0 PRE – SUPPLY INSPECTION & TESTING:

Complete tests at full load and 10% overload shall be carried out at the manufacturer's works to determine the performance and operating characteristics of the generator to determine whether or not the guaranties have been met, unless otherwise specified. All the routine tests shall be carried out in accordance with the standards and shall be witnessed by the representatives of the purchaser. Manufacturer test certificate with manual in triplicate shall be supplied by the vendor.

5.1 INSTALLATIONS & TESTING

The Diesel generator set and associated equipment with accessories shall be installed at location shown on the drawing. The Contractor shall ensure execution, coordination with the civil works for providing any openings, holes, etc. to avoid any breakage to completed works. The Contractor will arrange all allied civil works for complete execution of the job at his own cost and to the satisfaction of Engineer. The Contractor shall provide foundation bolts and grout them in cement concrete floor using non-shrinkable material with the approval of Engineer.

All installation materials for physically installing the Diesel generator set and associated equipment, such as bolts, nuts, washers, supporting steel, etc., shall be provided and installed by the Contractor. The generator shall be installed upright and in level and shall be firmly and rigidly bolted to the steel frame skid with vibration isolators.

The Diesel generator set shall be completely erected as per manufacturer's instructions and as approved by the Engineer. Loose parts dispatched by the manufacturer shall be installed and connected as per assembly drawing provided by the manufacturer. Any safety locking of meter, relays, etc., provided by the manufacturer for safe transport shall be released only after the generator/ control panel is erected in position.

The incoming and outgoing cables shall be connected as recommended by cable manufacturer. The cable armor shall be connected effectively to ground.

The Diesel generator and associated equipment body shall be connected to earth as per instructions given in Section "Earthing" of these Specifications. The Diesel generator set shall be tested on full load for at least 08 hours and commissioned in the presence of the Engineer/ representative of client. The tests to be carried out are described in article "Testing" of General Specifications for Electrical Works.

The tank shall be installed in accordance with best engineering practice/international codes, the approved shop drawings, applicable code requirements and manufacturer's instructions.

The piping shall be hydrostatically shop tested as required by ASME code, section VIII, DIV-I and will be dried immediately after the test.

No separate payment is admissible for testing and commissioning of low voltage D. G. Set, associated equipment and piping and is deemed to have been included in the BOQ rates of the Low voltage D. G. sets and fuel system.

6.0 MEASUREMENT AND PAYMENT

6.1 General

The Contractor's bid amount against each item of Bill of Quantities as given below shall include supply, installation, testing, commissioning and for all work specified herein and/or as shown on the Tender Drawing/B.O.Q. related to the item.

6.2 Diesel Generator Set

6.2.1 Measurement

Measurement shall be made for the Diesel Generator Set including Fuel Day Tank, Control/Instrument Panel, Gravity Louvers, Control Wiring to Control/Instrument Panel of other generator, MCO Panel with required Interlocking, L.T Switchboard etc. acceptably supplied and installed by the Contractor as a complete job.

6.2.2 Payment

Payment shall be made for the number of jobs measured as provided above at the Contract unit price each for supplying installing, testing, commissioning and completion of the Diesel Generator Set, including its reinforced concrete foundation, Fuel Day tank, Gravity Louvers matching with radiator, Control/ Instrument Panels and accessories, control wiring between D. G. Set and Control/ Instrument Panel, ATS Panel with required interlocking, L. T. Switching fixing arrangements, all testing arrangements, etc.

6.3 Fuel System

6.3.1 Measurement

Measurement shall be made for Fuel System comprising surface Fuel Storage Tank of capacity mentioned in BOA/ drawings including pumps all accessories and piping acceptably supplied and installed by the Contractor as a complete Job.

6.3.2 Payments

Payment shall be made for the number of jobs measured, as provided above at the Contract unit price each and shall constitute full compensation for supplying, installing, testing and commissioning of surface fuel storage tank with excavation, with related civil work, reinforced concrete foundation/ structure (including reinforcement) and fixing/ supporting structure and all other accessories complete with all type of valves, fuel transfer pumps (both electric and manual) float switches control/ power wiring, control panel for automatic operation of the pumps, for each generator fuel piping network with required filters for each generator as per Specifications and required for normal operations of D. G. Set.

6.4 SPARE PARTS

6.4.1 Measurement

Measurement shall be made for the spare parts of Diesel Generator Set as listed in Schedule in Tender Documents, acceptably supplied by the Contractor as a complete lot.

6.4.2 Payment

Payments will be made for the complete job of spare parts as provided above at Contract unit price and shall constitute full compensation for supplying, tagging, packing of spare parts including wooden/ steel storage boxes as required.

