Supplying, Installation, Testing and Commissioning of 380 kVA DG Set at Hostel 18,17 & proposed Hostel 19 at IIT Bombay.

TENDER NOTICE NO: IITB/Dean IPS/H-18/17/19/DG/01/2019-20 dated 25.04.2019

PART-II
(to be submitted in Envelope II-Volume II)

TECHNICAL SPECIFICATIONS

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Indian Institute of Technology Bombay
Office of the Dean (IPS)

Volume II

NIT No.: IITB/Dean IPS/H-18/17/19/DG/01/2019-20 dated 25.04.2019

NAME OF WORK: Supplying, installation, testing and commissioning of 380 kVA DG Set at Hostel 18,17 & proposed 19 at IIT Bombay

GENERAL SPECIFICATIONS
DIESEL OPERATED GENERATOR SET

1. **SCOPE**

The scope of this section consists of but not necessarily limited to the following:

a. The contractor shall supply, deliver to site, hoisting into position, install, test and commission the standby power generating set together with the necessary controls and switchboards as specified and indicated in the Drawings and BOQ and all necessary for safe operation which may or may not be available in drawing and BOQ. It shall be provided without any additional cost to complete the system.
b. Provide manufacturer's factory representative's services, including coordination, start-up and testing supervision at site.
c. Testing (factory and field), start-up supervision, training and providing necessary documentation and tools for operation.
d. Carry out performance test run at site.

2. **SUBMISSION**

For bidding

The bidder shall submit offer with the following documents:-

- Technical Data Sheet duly filled in and signed and stamped.

- Catalogues of major items, highlighting the offered models.
- Overall GA drawing with Diesel oil tank details, residential silencer, exhaust piping details (as applicable).
- Structural support drawings.
- To submit operation logic.
- Supporting structure details of pipe lines, chimney and accoustic enclosures etc.
- Every page of tender documents duly signed and stamped.
- EMD as stipulated.

For approval before construction/erection

The Contractor shall submit the following documents.

a) For all the supplies, the contractor shall submit the following documents in 2 sets for approval.

- General arrangement drawings, with all dimensions, showing space-requirements, weights (for transport and service conditions), requirements of civil works/foundation, fixing and mounting facilities, connection devices, etc.
- Electrical drawings, showing power and control single line and functional/control multi line diagrams, terminal blocks, components list with make, type, quantity, etc.
- Design drawing of residential silencer, AMF control drawings as applicable.
- Quality assurance plan and bar-chart showing manufacturing schedule.

The contractor shall incorporate all comments and submit revised drawings in stipulated times in all drawings are finally approved for manufacturing by IIT Bombay.
The contractor shall submit the following documents, reflecting the true final as built situation, in 3 sets, and one soft copy in pen drive.

a) The drawings including wiring diagrams as revised and "as built".
b) Inspection and preliminary testing certificates and reports and shipping release.
c) Test certificates of KWh meters from Government approved Lab or Electric Supply Co.
d) Guarantee certificate.
e) Instruction & maintenance manuals, catalogue etc.
f) Any other certificates/report as called for by the Client/Project Manager/Consultant.

3. PRODUCT

CAPACITY: 380kVA, Diesel Generator set
Actual power output shall be as shown in drawings and in schedule of quantities.

3.1 Diesel Engine

The diesel shall be of the 4 stroke cycle, prime rated continuous, multi-cylinder direct injection, compression ignition type operating at a speed of 1500 rpm and shall be silent, vibration free while in operation and comply Center I State Pollution Control Board and shall conform to BS:649/5514.

The engine shall be complete with radiator cooled type engine, fan, lubricating oil pump, lubrication oil pressure gauge, lubrication oil temperature gauge, jacket water temperature gauge (or microprocessor built-in display), tachometer, digital or electronic type governor, integrated hours-run recorder, over-speed trip and all other necessary auxiliaries.

The brake horse power of the engine with all attached accessories as specified shall not be less than that which is required by the full load rating of the alternator at site operating conditions taking into consideration losses, plus a reserve factor of at least 10%.

Starting
Starting system of the standby generator shall be of a heavy-duty electric motor complete with a 24 V.D.C. (2X12V) heavy-duty battery of 300 AH or as recommended by the manufacturer. The electric motor shall be capable of cranking the engine to achieve the

rated speed in less than 10 seconds from the initiation of the starting process. The electric start battery shall be of adequate capacity for 6 successive starts. Time delay relays shall be incorporated to provide a rest period of 1-5 seconds (adjustable) before each successive start and a time lag period of 19-100 seconds (adjustable) before the system lock out due to failure of the 3rd start to crank up the engine.

The generator set shall be provided with a micro-processor based control system which is manufactured to provide automatic starting, monitoring, and control functions for the generator set. Interface to BMS system according to point schedule on drawings shall be provided.
The control system shall include an engine governor control, which shall function to provide steady state frequency regulation. The governor control shall include adjustments for gain, damping, and a ramping function to control engine speed and limit exhaust smoke while the unit is starting. The governor control shall be suitable for use in paralleling applications without component changes.

Speed Regulation
The governor shall be capable of regulating the speed of the engine within the limits approximately 10% of the rated speed and maximum voltage dip of 10% within 4 seconds due to a sudden application of 0 to 60% of full load in first step and 60 to 100% of full load in next step or removal of total full load. The steady load speed shall vary within the limits of approximately 0.1% of the rated speed.

Cooling
The engine cooling system shall be of radiator type system to cool the engine as well as the body to minimize heat radiated into the surrounding area. The cooling circuit shall exchange heat through a heat exchanger capable to remove the heat generated under continuous full load operation. The cooling system shall include the Radiator, fan, pump etc. OEM shall specify the water quality standard of Radiator.

Lubricator
The lubricating system shall be by a positive displacement oil pump providing a positive forces feed to all lubricating points.

Exhaust System
Adequate sized piping and fittings shall be installed to carry the engine exhaust discharge into the atmosphere at a height as indicated in the drawings & as per the requirement of Center/State Pollution Control Board or Pollution Control Committee as the case may be.

M.S- epoxy painted structural support and vibration arrestors for D.G. set chimney to specify along with drawing for statutory clearance.

Mufflers shall be installed to reduce the engine exhaust noise at the outlet of muffler to noise level as permitted at site as per CPCB requirements. Flexible connection shall be provided between the engine and the fixed piping.

Fuel Piping and Fuel Tank Installation
The complete system shall include engineering, supply, installation, testing and commissioning of tank for storage of fuel, pumps, piping, valves and control system.

Engine instrument panel
An instrument panel mounted on the engine shall be provided and shall comprise the following flush-mounted instruments and gauges:-

- Cooling water inlet and outlet temperature
- Lubricating oil pressure gauge
- Lubricating oil temperature gauge
- Tachometer positive driven
- Hour counter with hour totalizer

Protection Devices
Warning indication and automatic shut-down shall be provided for the following:-

- Low oil pressure shutdown and alarm
- High coolant temperature alarm
- High coolant temperature shutdown
- Fail to crank shutdown
- Over cranking shutdown
- Over speed shutdown
- Low & high DC voltage alarm
- Low battery alarm
- Low fuel-day tank alarm
- High and Low AC voltage shutdown
- Under frequency shutdown
- Over current and alarm and shutdown
- Short circuit shutdown
- Earth fault alarm
- Overload alarm
- Emergency stop
- Failure indication lights and alarm for all fault conditions shall be provided on control panel for restoring the operation to normal

The starting circuit shall be disconnected in the event of any of the above shutdowns.

3.2 **Alternator**
The alternator shall be brush less synchronous drip proof, self-ventilated and screen protected and directly coupled on to the diesel engine by flexible coupling

and shall be of double bearing construction, continuously rated for site operating conditions and conform to BS 5000 (para99) or IS 4722.

The full load output voltage shall be 415 volts, 3 phase, 4 wire, 50 Hz at 0.8 power factor with neutral solidly earth with the frequency maintained at 50 Hertz at all time under any load condition including transient overload due to motor starting etc.

The rotor shall consist of the main alternator field poles the brushless exciter and its rectifier module, all bolted on a common alternator shaft. The rotor shall be mechanically and electrically balance up to 135% of the rated speed. The insulation of the alternator shall be non-hygroscopic, class "F" & "H".

The rectifier module of the exciter shall be impregnated with epoxy resin and shall be capable of withstanding without damage or deterioration of the thermal, centrifugal and other stresses that is experienced during normal or short circuit conditions. Rectifiers shall be of silicon type.

The voltage build up shall be of self-excitation using the residual voltage of the alternator through a solid-state voltage regular. The voltage regulator shall be capable of maintaining the voltage regulation to 1% independent of power factor, heating and 5% of speed variation. The voltage output of the alternator shall also be capable of manual adjustable to 5% of the rated voltage.

The response of the voltage regulator shall be less than 10 millisecond. The voltage dip shall not exceed 10% when a rated continuous load is supplied to 0 to 60% of full load in first step and 60 to 100% of full load in next step and the correction time shall not exceed 200 millisecond. When the rated load is withdrawn, the voltage overshoot shall not exceed 20%.

The automatic voltage regulator and the exciter shall be manufactured to withstand 50% overload at a constant terminal voltage.

An Auxiliary winding regulated excitation principle (AREP) shall be included to provide a reliable source of excitation power for optimum motor starting and short circuit performance. The AREP and controls shall be capable of sustaining and regulating current supplied to a single phase or three phase fault at approximately 300% of motor current for not more than 10 seconds.

Excitation System

a) The alternator shall be provided with a complete rotating diode type brushless excitation system, capable of supplying the excitation current of the generator under all conditions of output from no load to full load and capable of maintaining voltage of the generator constant at one particular value.

b) The exciter shall have class 'F' insulation.
c) The excitation system shall comprise a shaft driven AC exciter with rotating rectifiers. The rectifiers shall have in-built protection for over voltage.
d) The exciter shall be fast response type and shall be designed to have a low time constant to minimize voltage transients under severe load changes. The excitation voltage response ratio shall be at least 0.8.
e) The rated current of the main exciter shall be at least 10% more than the alternator rated exciter current and it shall have 40% overload capability for 10 seconds.
f) No external supply shall be required during starting and normal running of the alternator.

Automatic Voltage Regulator

a) An automatic high speed, dead band type voltage regulator shall be provided, complete with all accessories. The regulation system shall be provided with equipment for automatic and manual control.
b) The regulator shall regulate the output voltage from generator current and potential signals. Series compounding transformer shall be provided to enable maintaining adequate terminal voltage in the event of terminal faults. Alternatively excitation system shall be provided with arrangement for field forcing. Contractor shall coordinate suitability of protection relays for generator with the operational characteristics of automatic voltage regulator, especially in short circuit conditions.
c) Voltage regulation and steady state modulation shall be within 1% of the line voltage.
d) Necessary equipment for field suppression and surge protection shall be provided.
e) The response time of exciter and the generator shall be properly matched to avoid hunting.
f) AVR system shall be provided with equipment for automatic and remote operation/control.
g) Necessary equipment shall be furnished for the following.
    - To prevent automatic rise offield voltage in case of failure of potential supply.
    - To initiate transfer from automatic to manual control of excitation on fuse failure on the generator potential signal.

Mounting Arrangement

The engine and the alternator shall be coupled by means of flexible coupling and both shall be mounted on the same base frame to ensure perfect alignment of the engine and the alternator with rigid construction to ensure minimum vibration. The base frame shall be provided with lifting facilities and pre-drilled foundation holes for permanent installation on pre-prepared concrete foundation.

3.3 Interface with Building Automation System

All necessary hardwares/softwares to integrate the Generator microprocessor panel to BAS system shall be provided free of cost by generator manufacturer/supplier.

For the integration of Microprocessor Panel of the generator with the Building Automation. System, an Interface Control Document shall be developed by BAS Contractor. It shall be responsibility of Generator Contractor to provide following minimum to BAS Contractor for preparing the interface.

a. Hardware Protocol of Microprocessor panel.
b. Software Protocol of Microprocessor panel.
c. Communication structure relating to collection of message/event information.
d. Description of the formatted packets/blocks of data which construct controller commands/responses.
e. Written permission to BAS contractor to develop the interface without any financial implication.

3.4 **Acoustic Treatment**

The DG SET shall be provided with it's own outdoor duty type acoustic enclosure duly tested and approved for 75 DBA measured at 1.0m from enclosure as per norms of central/local pollution control board.

3.5 **Execution**

Testing and commissioning

All the necessary comprehensive tests shall be performed to the approval and satisfaction of the Engineer In-charge /site representative at the completion of installation. Before the commencement of acceptance testing, the installation shall be in a state of practical completion and shall have completed all of the preliminary testing and adjusted the equipment to its proper running order.

Upon completion of all above tests, four(4) sets of the test results shall be submitted for the approval of Engineer In Charge /site representative. All test reports submitted shall be endorsed by all parties witnessing the test including the contractor's and manufacturer's Qualified Personnel.

The Contractor shall provide at his own cost all materials, including electric power, instrument test set, fuel, lubricants and other consumable required for the tests and adjustments of the equipment and for carrying out the acceptance tests and any re-tests that may be necessitated by failure of the installation or by any other causes within his control.

The Contractor shall ensure that the fuel supplied for use in acceptance tests is part of a batch for which certified test data is available. Two copies of the test certificate shall be supplied to the Project Manager/Owners site representative prior to the commencement of tests.

During the testing period the Contractor shall appoint a qualified personal to carry out the checking and testing the testing instrument (equipment which are to be used for the test) including accurately calibrated test equipment for checking the accuracy of gauges and instruments forming part of or supplied with the installation.

Prior to commencement of testing a detailed list of the equipment shall be submitted to the Project Manager/Owners site representative for his approval and no item on the list shall be removed from the site without his consent until the completion of testing.

Water supply and Electric supply for installation work will be provided at one point free of cost.

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List of approved makes for Equipment & Materials

Sr No.	Details of Materials/Equipment	Manufacturer's Name
1	Diesel operated Engine	Caterpillar
		Cummins India
		Kirloskar Oil Engines
		MTU Friedrichshaten
		Perkins
		Volvo Penta
2	Alternator	Caterpillar
		Kohler (Marathon)
		Leroy Somer
		Mitsubishi
		Perkins
		Stamford
		Crompton
3	System Integrator (OEM) for DG sets-authorized by Engine Manufacturer	DG Power Electric (for Kirloskar/Perkins)
		Gmmco (For Caterpillar)
		Jaksons (for Cummins)
		Powerica (for Cummins)
		Sterling & Wilson (for Perkins & MTU)
		Sudhir Genser (For Cummins)
		Vibro Power (For Perkins & MTU)
		Goel Power
4	AMF Panel	Accusonic (Pune)
		Antia Electricals
		Indochem Industries
		Powerica
		Popular Switchgear
		Scoot Engineering

		Sterling & Wilson
		Zenith Engineering
		Arrow Engineering
		Aback
		Devta Electrical Goel power
5	Moulded Case Circuit Breaker (MCCB)	ABB
		Larsen & Toubro
		Schneider Electric
		Siemens
		Legrand
6	Miniature Circuit Breakers (MCB)/Residual Current Circuit Breakers (RCCB)	ABB
		Hager
		Legrand
		Schneider Electric
		Siemens
		Indo-Asian (Optipro)
7	Power/Aux. Contactor	ABB
		Larsen & Toubro
		Schneider Electric
		Siemens
8	Change over Switch	Elcon
		Socomac
		Larsen & Toubro
		Schneider Electric
9	Control Transformer/Potential Transformers	Automatic Electric
		Gilbert & Maxwell
		Indcoil
		Matrix
		Kappa
		Pragati
10	Current Transformer (Epoxy Cast Resin)	Automatic Electric
		Gilbert & Maxwell
		Indcoil
		Matrix
		Kappa
		Pragati
11	Protection Relay	
	Numeric Type	ABB
		Areva
		Larsen & Toubro

		Prok Devices Pvt. Ltd.
		Schneider (SEPAM)
		Siemens
		Woodword
12	.Electromagenetic	ABB
		Areva
		Larsen & Toubro
13	Indicating Lamps LED type and Push Button	Atos
		Larsen & Toubro
		Schneider Electric
		Siemens
		Vaishno
		Pushtron
		Teknik
14	Overload relays with built in Single Phase preventer	ABB
		Larsen & Toubro
		Schneider Electric
		Siemens
15	a. Electronic Digital Meters (A/V/PF/Hz/KW/KWH) with LED/Display dual energy Meter/Static Meter	Automatic Electric
		EI Measure
		L&T
		Matrix
		Rishabh
		Schneider Electric (Conzerve)
		Secure
		Socomac
		SATEC
	b.Electro Magnetic Meters	Automatic Electric
		Rishabh (L&T)
16	Static Power Meter & Logger (SPML) with Rs.485 Port	CMS
		EI Measure
		IME
		ICD
		Larsen & Tourbo
		Nippen
		Schneider Electric (Conzerve)
18	FRLS PVC sheathed XLPE insulated aluminium/copper conductor armoured MV Cables upto 1100 V Grade	Finolex
		KEI
		Havells
		Polycab

		RR Kabel
20	Cable Glands Double Compression with earthing links	Baliga Lighting
		Comet
		Cosmos
		ELMEX
21	PVC insulated Copper Conductor Stranded Flexible Wires (FRLS)	Finolex
		Havells
		Vinay
		Anchor
		RR Kabel
22	Metallic/GI Conduit (ISI approved)	AKG
		BEC
		Vimco
		Vaishno
23	PVC Conduit & Accessories (ISI approved)	AKG
		BEC
		D Plast
		Diamond
		Duraline
		Polycab
		Precision
24	Timer	ABB
		Larsen & Toubro
		Legrand
		Schneider Electric
		Siemens
25	Sealed Maintenance Free Batteries	Amar Raja
		Exide
		Global (Rocket)
		Hitachi
		Shinkobe
26	Battery Charger	Amar Raja
		Exide
		Global (Rocket)
		Hitachi
		Shinkobe
		Caldyne

		Chhabi Electricals
		Volstat

Signature of Tenderer

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TECHNICAL DATA SHEET FOR 380 KVA GENERATOR SET
(to be filled in by bidder & submitted with the bid in Envelope 1)

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Sr. No	Description	Specifications	Remarks
1	Generator KVA Rating / Model No.		
2	Make		
3	Model No.		
A	**Engine**		
4	BHP Output		
5	Cooling		
6	Aspiration		
7	No. of Cylinders		
8	RPM		
9	Compression ratio		
10	Displacement (ltrs.)		
11	Fuel oil		
12	Fuel consumption at 50% load		
13	Fuel consumption at 75% load		
14	Fuel consumption at full load		
15	Capacity of fuel tank (litres)		
16	Governor		
17	Starting system		
18	Lub oil specification		

19	Lub oil sump capacity		
20	Lub oil consumption (ltrs. Per hour)		
21	Coolant capacity (Engine + Radiator)		
22	Lub oil change period (hrs.)		
23	Emission compliance		
24	Battery rating		
B	**Alternator**		
25	Make and Model No		
26	Type		
27	Voltage		
28	Frequency		
29	Phase		
30	Rated current		
31	Rated current		
32	Power factor		
33	Enclosure		
34	Voltage regulation		
35	Class of Insulation		
C	**Control Panel**		
36	Make		
37	Type		
38	Overall dimensions (L x B x H)		
39	Finish		
40	Sheet metal size		
41	Make and type of contactors / circuit breakers		

42	Make and type of instruments		
43	Make and type of switch fuse units		
D	**Generator set**		
44	Noise level		
45	Overall dimensions of the DG set		
46	Overall canopy dimension		
47	Approx. Total weight (Dry)		
48	Type of coupling/bearing details		
	AMF Panel		
49	Ingress Protection	IP 56	Yes/No
50	Thickness of CRCA steel used	2mm	Yes/No
51	Base channel	3mm	Yes/No
52	Multifunction Meter	Make & Model	

SIGNATURE & SEAL OF TENDERER