

TECHNICAL SPECIFICATIONS

SUPPLY, INSTALLATION, TESTING & COMMISSIONING OF 380 KVA DG SET

LOCATION: IRMRA-Sricity (Andhra Pradesh)

CAPACITY – 380 KVA/304KW

1. DESIGN REQUIREMENTS

The diesel engine should be water cooled, cylinders in line 4stroke, turbo charged with after cooler for generating set application rated at 1500 RPM under NTP conditions of BS: 5514/ISO 3046 with an overload of 10% for one hour in every 12-hour continuous hours of operation. The DG sets shall be latest model and shall be capable to run Round the clock on emergencies.

2.1. Scope

- i) This specification covers the requirements of Design, Assembly, Testing, Supply and Commissioning of LT diesel Generator set and exhaust piping as per CPCB norms.
- ii) Generator set shall have **prime power rating** based on power factor of 0.8 lagging.
- iii) Generator shall be capable to withstand the over speed requirements specified in Table 15 of IEC 60064.1
- iv) Generator shall be capable of withstanding a current equal to 1.5 times of rated current for a period of not less than 30 sec. Thereby comply to IEC 60034.1.
- v) Generator shall be supplied with weather proof acoustic canopy / enclosure as per CPCB norms

The Engine shall be Complete with the following accessories:

- a. Radiator with blower fan (or heat exchanger)
- b. Turbo charger, pulse tuned exhaust manifold
- c. Corrosion inhibitor coolant/liquid coolant
- d. Paper element filters – fuel, lube oil and by-pass
- e. Flywheel housing and fly wheel to suit Single bearing alternator
- f. Electronic governing system with P T fuel pump
- g. Stainless steel flexible connection coupling
- h. Dry type air cleaners and vacuum indicator
- i. Residential silencer
- j. Plate type lube oil cooler
- k. Electric starter
- l. Battery charging alternator
- m. Holding down bolts for anti-vibration pads as required for combination base plate
- n. Dry type replaceable paper element air cleaner with restriction indicator
- o. Flexible coupling for engine and alternator
- p. Integrated Digital Electronic Isochronous governor with digital speed and voltage control. Integrated Electronic Control Panel (displaying the following Engine parameters):
 - a. Battery Voltage monitoring
 - b. Coolant Water Temperature
 - c. Lubricating Oil Pressure
 - d. Engine Speed

- e. Engine Hours
- f. V/Hz Control for better block loading.

The Gen set controller should have following features:

- a. Inbuilt feature for synchronizing utility bus.
- b. Programmable fault thresholds
- c. Master first start sensor for providing interlock to prevent multiple sets simultaneously closing on dead bus
- d. Inbuilt Auto synchronizing Auto Load sharing
- e. Mod bus output of both engine and Alternator parameters.
- f. Safety Control : high water temperature (hwt)
(Trip & Indication) : low lube oil pressure (l lop)
: Over speed stop : Failed to start (over crank) Shutdown
- g. Fuel monitoring device Digital fuel flow meter compatible BMS (Building management system) integration. Make Kent/fluid dyne.
- h. Acoustic enclosure as per Pollution Control Board Norms and NAL approved.

The acoustic enclosure for the DG sets generally comprise/incorporate following:

1. The structure/ profile including canopy shall be made out of good quality 16SWG CRCA sheet steel on both side.
2. The roof, side valves integrate partition and doors shall be of sandwich design made out of superior quality CRCA sheet steel.
3. The acoustic enclosure shall be natural cooled and shall maintain temperature difference with air ambient of 7-10° c. if necessary articulated ventilation may also be considered. The average sound level, when measured at 1mtr distance from all four sides shall be less than 75 DB as per CPCBB-II norms.
4. The sound absorption material shall be selected from either mineral wool/non-igniting foam of eleven thickness and density to meet the performance.
5. The acoustic enclosure shall be of modular construction to permit easy assembly and dismantling and shall design for easy access to the serviceable parts of the DG sets.
6. Base frame shall be fabricated either in ISMC channel (only formed sections for base plates not accepted) the base frame is rugged in construction and designed for mounting the engine and alternator closed coupled with cross embers mounted on anti vibration mounting. The base from shall have provision for mounting of acoustic enclose.
7. The enclosure construction shall provide sufficient access (lockable door with common key) for maintenance work.
8. The control board shall be suitably mounted inside the enclosure and the enclosure door is provided with panel viewing made from glass/ acrylic and sealed with neoprene rubber gasket. Separate door shall be provided with locking arrangement to access the control panel independently from outside the acoustic enclosure.
9. The DG sets enclosure shall be complete with

- * Arrangement for power cable connection for supply to load.
- * Residential /Hospital exhaust silencer as per pollution control board norms.
- * Suction louvers

- * Discharge louvers- openable and lockable doors with air tight neoprene rubber gasket
- * Interior lighting arrangements-1single phase MCB, DB, FLUROCENT type, INDUSTRIAL type, LIGHTFITTING complete with internal wiring, external electronic ballast, etc.
- * The lifting arrangement.

The DG sets shall have acoustic enclosure specially designed to meet stringent MOEF/CPCB norms. The sound level shall be 75 dBA @ 1 mtr at 75% Load under field conditions.

The insulation material used shall meet IS 8183 specifications.

The enclosure shall be coated with UV resistant powder coating so as to wish stand extreme environment.

Generator set technical data:

Supply, installation, testing and commissioning of 380kVA Diesel Generating Set. Conforming to BS: 5514. Prime Power Rating min of 487 BHP in accordance with ISO: 8528. DG set shall be capable of 10% overload for 1 hour in every 12 hours of operation. The set will comprise Diesel Engine, Alternator, acoustic enclosure, common MS base frame, ant vibration mountings etc. with all required accessories.

2.2. DG panel:

- The DG panel shall be fabricated in one shipping section. Panel shall be IP52 enclosure and fabricated with CRCS sheet as follows
 - a) Structure body and back door-2mm thick
 - b) Component mounting plate and front door-2.0mm thick.
 - c) Gland plate -3.0mm thick
 - d) Suitable MS Angle reinforcement shall be provided where required.
- The panel shall be power coated with Siemens grey colour shade inside and outside. The fabricated panel shall be treated with seven tank process. Base channel shall be painted with black colour.
- The Panel shall be wired with PVC insulated copper wire of 660/1100V grade.
- Each component shall be provided with identification tag.
- Each lamp, push button, switch etc., shall be provided with suitable inscription plate on the face of the panel.
- All interconnecting flexible wire shall be provided with ferrules as marked in the schematic drawing at both end.
- Antirust hardware shall be provided.
- Panel board shall be provided with suitable size earth bus bar.

The DG panel shall comprise following

1. 800A MCCB, 4 pole with microprocessor control. Make : Schneider/GE/ABB/L&T
2. LED Indication lamp for 3 phases indication, trip indication, loads on DG, DG running, DG ON, DG OFF etc., Make : Schneider/siemens
3. Multi-function meter Accuracy class-1, Make: Schneider
4. MCB's ('C' curve) for control circuit Make : Schneider/Siemens
5. Digital Meters to show DC Amps, voltage Make: Schneider
6. Counter Type Analog Energy meter Make: Schneider/ L&T
7. Suitable Protection and metering CTs of cast resin type shall be provided Make: KALPA/ABB
8. Earth leakage relay Make: Parkdevys/ Woodward
9. Set of TPN 800A Aluminum bus bar 0.7A/sqmm duly insulated with heat resistant sleeves.

2.3. ALTERNATOR:

“STAMFORD”/Leroy Sommer Make standard designs double bearing. Alternator, suitably rated at 304KW/380KVA at 0.8 PF(lag), 415 Volts, 3 Phase, 4wires,50 cycles, 1500 RPM, screen protected, revolving field, separate excited with PMG and self-regulated, with brushless excitation, with AVR Regulation +/- 0.5 % of rated voltage from no load to full load. Insulation Class “H”. , IP: 23 Enclosure shall be provided. The alternator to conform to BS: 5000/IS: 4722.

Suitable adaptor box shall be supplied for facilitating termination of power/control cables for the alternator.

The alternator shall be provided with thermistor winding for protection against overheating.

2.4. BASE FRAME:

Sturdy, fabricated, welded construction, channel iron Base Frame for mounting the above Engine and Alternator. The AVM pads shall be provided. Base frame with drain plug, air vent, inlet and outlet connection, level indicator and provision for cleaning

2.5. FUEL TANK:

1000 Liters capacity fuel tank with mounting brackets, complete with level indicator, fuel inlet and outlet, air vent, drain plug, inlet arrangement for direct filling and set of 2 mtr long, fuel hoses. The fuel tank shall be calibrated and shall be marked in 50 liters interval.

2.6. BATTERY:

Set of 2/4 nos, 12 volts, 180 AH pulse battery with charger rating 10 A - 1 set. Fully charged maintenance free batteries.

2.7. FUEL/EXHAUST PIPING

Exhaust piping shall be of suitable size MS “B” class pipe along with flexible pipe 0.5 mtr long including painting and supplying & fixing 50 mm thick mineral wool insulation of 48 kg per cubic meter density on all sides of exhaust pipe and silencer with chicken wire mesh wrapping and aluminum cladding with aluminum sheet of 24 SWG, complete as required and as per specification from the DG sets manifold which is also supplied is to be connected to the exhaust piping and extended further with additional pipe if required, beyond DG room and terminated on the MS stack. The suitable silencer shall be fitted in this piping.

Free standing MS stack shall be provided. The stack shall be MS “B” class pipe and the height up to which it should provided shall conform to Pollution Control Board requirements but not less than 18 M height.. The MS stack shall be provided with MS cowl, stiffeners if required, gusset plates, flanges Lighting arresters etc., the exhaust and the MS stack pipe material shall be pretreated to remove rust particles, dust, dirt etc., and a coat of primer followed by two coats of heat resistance paint shall be applied. The MS support material shall be applied with enamel paint after surface pretreatment.

2.8. EARTHING SYSTEM

The scope of earthing including Earth Stations and earthing conductor for the DG sets neutral and body earthing system. The earth stations shall be complete with suitable earth pits and earth strips as per IS 3043. The complete earthing should be done as per the statutory requirement of electrical inspectorate.

The details of earth pits, earthing conductors are as below.

Sl. No.	Equipment to be earthed	Type of earthing	Qty	Earthing conductor from earth station to equipment/panel
1	380KVA DG sets neutral earthing	50 mm Copper bonded Earth Electrode	2 Nos	25 x 5 mm copper strips
2	380 KVA DG sets Body	50 mm GI bonded Earth Electrode	2 Nos	25 x 5 mm GI strips

Note: Earth chamber 450 *450*300 mm size with CI cover shall be Provided for all earthing.

2.8.1. General Specification of earthing:

- Earth pit center shall be at a minimum distance of 2m from nearest building, unless otherwise advised. The minimum distance of 5M shall be maintained between centers of 2 earth pits. These 2 earth stations shall be interconnected with suitable earthing conductor.
- The earth station must be interconnected with GI/CU earthing conductor.
- Earthing system used for DG neutral must be independent of the other general body earthing and the pits shall be interconnected with suitable earthing conductor.
- All cable glands must be connected to the earthing system using suitable copper strips for the gland earthing. These gland- earthing conductors must be connected to the main earth bus/general earthing using copper wire of sufficient length.

Detail technical specification of Fabrication, Supply, installation, field wiring, testing and commissioning of AMF (Auto Mains Failure) Panel suitable for 380 KVA DG.

System Operation:

The above-mentioned AMF Panel should be functional for following operation.

1. Auto Mode:

A line voltage monitor shall monitor the supply voltage on each phase. When Mains supply voltage fails completely or falls below set value (variable between 80 to 95% of normal value) on any phase, the monitor module should initiate start-up of DG. To avoid initiation due to momentarily disturbance, a time delay adjustment between 0 to 5 min should be incorporated in start -up initiation. A three attempt starting facility should be provided with 15 sec intervals. If at the end of third attempt, the engine does not start it should lock out of start and a master timer should be provided for this function. If the alternator does not build up voltage after the first or second start as may be the case, further starting attempt will not be made until the starting facility is reset.

Once the alternator built up voltage, the alternator circuit breaker shall close connecting the load to the alternator. The load is now supplied by the alternator. When the mains supply is restored and it is healthy as sensed by the line voltage monitor setting, both for under voltage and unbalance, the system shall be monitor by control circuitry with time delay for the load to be transferred automatically to mains supply.

The panel shall start the set in the event of fault condition of under voltage, over voltage, phase reversal, high frequency, neutral snapping, short circuit etc. On the mains side. If the above fault conditions being arises if the load is being fed from DG set, then panel should start to cut off the load from the DG with audible alarm and DG should run on no load.

2. Manual Mode:

In manual mode it shall start the DG set by operator on pressing the start push button. Three attempt facilities shall be operative for the start-up function. Alternator circuit breaker closing and trip operations shall be from operator only by pressing the appropriate button on panel and close shall be feasible only after alternator has built up full voltage.

3. Test mode:

When under the test mode, pressing of test button should complete the start-up sequence simulation and engine should start. Engine should build up voltage but DG should not take load by closing alternator circuit breaker when the load is on the mains, monitoring performance for voltage/frequency etc. shall be feasible without supply to load. If during test mode the power fails, the load shall automatically transfer on DG Set. Brining the mode to Auto position shall shutdown the set provided main supply is ON. If the main supply is not available at that time, the alternator shall take the load.

I. Features:

- Auto Start & Auto Stop the Gen set when Mains fails & restores respectively.
- Cranking standard - three cranking attempts with 15 sec intervals.
- Auto / Manual mode selector available, automatically changes lines from Mains and Gen Line and vice versa.
- Test mode operation
- Low/high Voltage Protection, Reverse Phase Protection.
- Provision of battery charger

INSTALLATION, EXECUTION & COMMISSIONING OF DG SETS

1. Erection of D.G. Set along with its accessories, control panel from its stored place on to the foundation is in the scope of erection. All necessary lifting tools, tackles, support frame for transport, necessary packing for D.G. Set shifting to be arranged by the supplier.
2. The fuel oil tanks shall be installed at the necessary elevation as suggested by the engineers In-Charges and necessary piping between the D.G. Stand the tank shall be carried out. The scope of erection shall include the supply of required inter connecting pipes, valves fittings, support frame work/MS support for fuel tank, cable etc.,
3. The scope of erection shall include the supply of required inter connecting pipes, valves fittings, support frame work/MS support for fuel tank, cable etc.
4. The battery supplied along with D.G. Set shall be installed along with necessary stand as required.
5. The bidder of DG set shall install necessary exhaust pipe/chimney to take out the gases beyond D.G. Room and terminate the same with a cowl. The height above the nearest building roof level shall confirm to Maharashtra State Pollution Control Board/Electrical Inspectorate requirements. The pipe size shall be 8" "B" class pipe. The exhaust pipe shall be insulated with the mineral wool secured with chicken wire mesh and cladded with 22 SWG Aluminum sheet up to the cowl. Support system for exhaust pipe shall be provided with the heat resistant aluminum paint is included in scope of execution. The structure support to the exhaust pipe

shall also be painted with aluminum paint. The pipe size mentioned is indicative, the suppliers shall supply suitable size exhaust pipe.

6. The necessary inter connecting cable supplied with the D.G. Set has to be terminated along with necessary cable glands (crimping type of lugs to be used)
7. The neutral of the D.G. Set shall be double earthed with 50X6mm copper strips. The body of the DG. Set has to be double earthed with 50X6 mm GI strips. The necessary earth pits and earth strips are included in scope of supply. Earth chambers of 450 mm x 450 mm by 300mm shall be constructed and chamber covers are to be provided. All the earth chambers are to be marked.
8. The energy meter provided in the DG panel shall be recalibrated through the approved calibration agency before commissioning the unit.
9. The successful tenderer shall prepare the required layout electrical single line drawing and obtain necessary Electrical Inspectorate approval for the commissioning of the 380 KVA D.G. Set for relevant licenses Statutory fee paid (if any) shall be reimbursed against documentary evidence. Obtaining approval from state electrical board and Pollution Control Board for installation of D.G. set is also included in the scope of erection. In case installation needs to be re-inspected will be at the cost & expense of bidder.
10. The supplier shall arrange the visit of the electrical inspectorate for inspecting the installation.
11. Alignment of alternator and D.G. Set to be checked and rectified prior to operation of the DG. Set.
12. Anti - vibration pads required for the D.G. Set shall be provided by the supplier.
13. The following safety equipment's shall be provided and the same are to be installed as directed by our engineer – In-charge.

- | | |
|--|----------|
| a. Fire extinguishers –CO2 type 5 kg | – 2 nos. |
| b. Fire buckets 4 no's with metallic stand | – 1 set. |
| c. Rubbers mat 1.6 mtr X 1 X12 mm thick | – 4 nos. |
| d. Electrical shock Treatment chart with frame | – 1 no. |
| e. Danger board standard size | – 1 no. |
| f. Earthing indication boards for all earth pits | – 1 lot. |
| g. First Aid kit | – 1 no. |

Self-supported MS Stack shall be provided including Structure and the height of the MS Stack shall conform to Pollution Control Board requirement.. The MS Stack shall be fabricated in sections and connected with flanges by providing suitable gusset plates etc., the stack and all supports shall be treated, suitable primer shall be applied and followed by two coats of heat resistance paint.

Note:-

Party shall provide the following details

- i) Consumption of fuel at various load conditions.1/4 load, 1/2 load, ¾ load and 100% load.
- ii) Units generated per liter of fuel consumption
- iii) Consumption of lubricant per hour

iv) List of Approved Makes:

PARTS	APPROVED MAKES
MCCB	Schneider/L&T/GE/Legrand/ Havells
Contactora	Schneider /Siemens/ABB /L&T/ Legrand
Digital indicating meters	Schneider /Krycard/HP
Indicating led lamps	Schneide/C&S /Idel /
Selector switch	ABB/Schneider
Earth leakage relay	Woodward/equivalent
Current transformer	Kalpa/ABB
Surge protection device	Bussmann/Schneider electric/ABB
Power cables-	Havells / Gloster / CC
Control cable	Havells / Finolex/ polycab
Generator controller	As per the manufacturer standard
Engine make	Cummins/ caterpillar/ Kirloskar/ Mahindra
Alternator make	Stamford/ Leroy Some/ CG/ Kirloskar

(v) The party shall provide necessary drawing for DG sets chimney, control panel etc., required for installation and to facilitate necessary civil foundation/trenches.

(vi) The scope of works includes taking approval from all relevant statutory bodies, preparation of Drawings in accordance to the stipulations laid by the statutory bodies.

2. GENERAL REQUIREMENT**➤ Inspection:**

The assembled DG sets shall be inspected at the works of supplier at our discretion. In case of over dimension assemblies, the same may be permitted for transportation on knocked down conditions, otherwise the set should be displaced in assembled conditions only.

Inspection and testing at site the following checks and tests will be carried out at site after installation.

- (a) Physical verification of components.
- (b) Visual examination for defects, transit damages etc,
- (c) Checks for assembly, alignment, fuel, lubricating oil, water and air circuits.
- (d) Checks for power cabling control wiring and earth connections including terminations.
- (e) Winding resistance and insulation resistance measurement for alternator winding.
- (f) Insulation resistance measurement for power and control circuits.
- (g) High voltage test for power circuit (2.5 kv for one minute) and control circuit (2 kv).
- (h) Load test and recording the following.
 - (i) Voltage regulation and response time for sudden application and sudden withdrawal of 25%, 50%, 75% and 100% Load.
 - (ii) Speed regulation and response time for sudden application and sudden withdrawal of 25%, 50%, 75% and 100% Load.
 - (iii) Fuel consumption at 25%, 50%, 75% and 100% Load.
 1. Engine parameters like speed, water temperature, lube oil pressure.
 2. Electrical parameters like frequency, voltage and current.
 3. Leak test for fuel tank.

➤ **Manuals & Drawings:**

Three sets of DG sets layout drawing, enclosure drawing schematic, piping, cabling drawing, GA of panel showing arrangement of various devices on panel, foundation details ,etc. shall be supplied for approval, immediately after receipt of your purchase order for approval. Two sets of operation and maintenance manuals, spares parts details/drawing, GA and control wiring drawings for engine and alternator shall be supplied along with the equipment.

➤ **Training:**

During testing and commissioning of the set, the supplier shall provide necessary training to the operators on operation and maintenance of the set. The supplier shall demonstrate the performance of the set as detailed in the specification for one shift of 8 hours for a minimum period of THREE days necessary log sheets are to be maintained for the performance period and shall be jointly signed by the representative of supplier and the project authority/client. In case of no performance of any of the component/parts of the system the entire performance test shall be re-done. Supply shall also include first fill of lube oil required for carrying out all the tests at site.

BILL OF MATERIAL:

Sr No.	Item Description	Qty	Unit
1	Supply, Installation, Testing and Commissioning of 304 kW / 380 kVA, SILENT Diesel Generating Set with CPCB II approved acoustic enclosure comprising of: Radiator Cooled, Diesel engine developing suitable BHP at 1500 RPM, complete with standard accessories, coupled to Alternator rated at 304 kW / 380 kVA at 415 Volts, mounted on Channel Iron Base Frame complete with Fuel Tank with Manual Control Panel and 2 number 12 V Batteries.	1	No
2	Supply, Installation, Testing and Commissioning of 380 KVA Automatic Mains Failure Panel (AMF).	1	No
3	EXHAUST PIPE SUPPORT		
3.1	Supply & installation of MS Support for exhaust pipe and turbo charger with 1 coat of red oxide & enamel paint.	1500	Kgs
4	EXHAUST PIPES		
A	Supply & installation of 8"Exhaust pipe of MS ERW 'B' class with proper insulation and Al. cladding.	06	Mtrs
B	Insulation for above pipe with 50 mm thickness with 120kg/m3 density of rock wool wrapped with 14/16 SWG aluminum sheet cladding	06	Mtrs
C	8" MS Long Bends	4	Nos
D	50 mm thickness with 120kg/m3 density of rock wool wrapped with 14/16 SWG aluminum sheet cladding insulation for Silencer works	1	Job
E	Lightning arrester (BIS Grade) & Aviation Lamp with Earthing System	1	No

5	Power Cabling (XLPE Aluminum Armored Cable) 650/1100V, Grade conforming to IS-7098(part-1)1988.		
A	3R - 3.5 C X 300 Sq mm Al. armored power cable from Generator to DG panel 25Mtr X 02 runs	50	Mtrs
B	End termination for the above with suitable AL. lugs & Single compression gland.	04	No
6	Control Cabling (Copper Multistrand Armored Cable) 650/1100V, Grade conforming to IS-7098(part-1)1988.		
A	2C X2.5 sq mm (From External supply of power to enclosure Lighting).	25	Mtrs
B	End termination kit suitable for the above cable with copper lugs and single compression gland	02	No
C	2C X4 sq mm (For Battery Charger).	30	Mtrs
D	End termination kit suitable for the above cable with copper lugs and single compression gland	4	Nos
E	4C x 2.5 sq mm (For Bus supply & Master first start)	30	Mtrs
F	End termination kit suitable for the above cable with copper lugs and single compression gland	4	Nos
7	Earthing		
A	Supply and installation of Body Earth station – 50 mm, 2 meter long Copper Bonded earth electrode with compound complete shall be provided including excavation, civil work, construction of chamber & Supply of chamber cover.	2	Nos
B	Supply and installation of Neutral Earth station - 50 mm, 2 meter long GI Bonded earth electrode with compound complete shall be provided including excavation, civil work, and construction of chamber & Supply of chamber cover.	2	Nos
C	25 x 5 GI. strip for body earthing	20	Mtrs
D	25 x 5 CU. strip for neutral Earthing	20	Mtrs
E	GI Earthing for lightning arrester	1	Nos
8	MISCELLENOUS ITEMS		
A	Fire extinguishers –CO2 type 5 kg	2	Nos
B	Fire buckets 4 no's with metallic stand	1	Set
C	Rubbers mat 1.6 mtr X 1 X12 mm thick	4	Nos
D	Electrical shock Treatment chart with frame	1	No
E	Danger board of standard size	1	No
F	Earthing indication boards for all earth pits	1	No
G	First Aid kit box	1	No

Note :

-DG set price should be inclusive of Transportation, Loading, Unloading, shifting, positioning, installation, commissioning of DG SET & Standard control panel charges.

-Total charges also inclusive of Electrical Inspectorate Approval Charges, Exhaust pipes/Earthing installation, cable laying etc.

- Price bid should be submitted considering above technical specifications & Bill of Materials.

- Shortlisted bidder should have **Authorized Service Centre** within the radius of 100Km from IRMRA-Sricity (AP).